The following activities are ways to adapt the lesson from STEMming Up Gardening by Florida Agriculture in the Classroom: [www.faitc.org](http://www.faitc.org) Chapter 3: Learn About Decomposition by Creating Compost. <https://faitc.org/wp-content/uploads/2018/03/Learn-About-Decomposition-by-Creating-Compost.pdf> This lesson was written for 6-8

Here are some connections to Nature of Science for 6-12

Grades 6-12

Nature of Science:

1) Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.

* After having students observe types of soil and discussing how soil is made have students plan an investigation to turn sand into soil by adding organic material such as leaves, grass, and other plant matter. Have them predict how long it will take for the plant matter to decompose and become humus.
* Compare the decomposition of different materials such as a banana peel, a piece of paper, and a plastic spoon.

2) Infer based on observation.

* Create a T chart of observations and inferences.
* What can you see happening inside the compost bottle?

3) Recognize that scientists use models to help understand and explain how things work.

* The compost bottle is a model of what happens on a forest floor. What can we learn about decomposition on a forest floor by watching our compost bottle?

4) Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

• Have students predict what will happen when the compost is left in the bottle for 12 weeks. Draw and describe. Discuss- we can learn what will really happen by observing the compost bottle carefully. Explain that when we observe carefully, we look carefully and pay close attention to any changes we notice. We record what we learn in our science notebooks.

• Observe the compost bottle weekly. Draw and describe – teacher write student’s descriptions- on a chart or poster.

5) Long Term Investigation: After having students observe types of soil and discussing how soil is made have students plan an investigation to turn sand into soil by adding organic material such as leaves, grass, and other plant matter. Have them predict how long it will take for the plant matter to decompose and become humus.

And these activities adapt it for K-5.

**Kindergarten**

**SC.K.P.9.1** Recognize that the shape of materials such as paper and clay can be changed by cutting, tearing, crumpling, smashing, or rolling.

* Students draw or make rubbings of grass and leaves. Students then tear leaves and grass into small pieces to fit into the compost bottle. Have them redraw/make rubbing of torn leaves and grass before putting them in the bottle.
* Have students observe a fruit or vegetable that was left over from lunch and headed for the trash. Discuss how it can be changed by cutting. Students draw whole fruit and a prediction of what it will look like cut. Teacher cuts the fruit into small pieces and students redraw.

SC.K.N.1.5 Recognize that learning can come from careful observation.

* Have students predict what will happen when the compost is left in the bottle for 12 weeks. Draw and describe – teacher write student’s descriptions- on a chart or poster. Discuss- we can learn what will really happen by observing the compost bottle carefully. Explain that when we observe carefully, we look carefully and pay close attention to any changes we notice. We record what we learn.
* Observe the compost bottle weekly. Draw and describe – teacher write student’s descriptions on a chart or poster.

SC.K.N.1.3 Keep records as appropriate -- such as pictorial records -- of investigations conducted.

* Keeping records of weekly observations. Emphasis that scientists make careful observations and record what they see.

1st Grade

SC.1.E.6.1 Recognize that water, rocks, soil, and living organisms are found on Earth's surface.

* Have students compare types of soil such as sand, humus, garden soil, the soil outside. Record and describe the differences.
* Weigh samples of the dry soils. Poke small holes in the bottom of cups and pour an equal amount of water into each cup. Let it drain for several hours. Reweigh the soil to find out which type retained the most moisture. (Original weight – weight when wet = weight of retained water) Plants need water – which type of soil is best at retaining moisture?
* Give students samples of sand and humus. Explain that humus is made of plant material that has broken down or decayed. Humus is made of material that was once living. Sand is tiny rocks. It is made of materials that were never living. The dirt/soil outside is a mixture of sand and humus and is good for plants to grow in. When we compost we are making humus.
* When compost has turned to humus take it outside to a garden or planting area and put it on the soil. Have students compare the color and texture of the new humus to the existing soil.

SC.1.E.6.3 Recognize that some things in the world around us happen fast and some happen slowly.

* Making of rich soil that is good for farming is a very slow process. Soil is considered a nonrenewable resource because soil that we use up or that erodes cannot be replaced in a human’s lifetime. Decomposition of plant materials is a slow change.

SC.1.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

* After having students observe types of soil and discussing how soil is made have students plan an investigation to turn sand into soil by adding organic material such as leaves, grass, and other plant matter. Have them predict how long it will take for the plant matter to decompose and become humus.

SC.1.N.1.3 Keep records as appropriate - such as pictorial and written records - of investigations conducted.

• Have students predict what will happen when the compost is left in the bottle for 12 weeks. Draw and describe. Discuss- we can learn what will really happen by observing the compost bottle carefully. Explain that when we observe carefully, we look carefully and pay close attention to any changes we notice. We record what we learn in our science notebooks.

• Observe the compost bottle weekly. Draw and describe – teacher write student’s descriptions- on a chart or poster.

2nd Grade

SC.2.E.6.1 Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.

* Have students observe sand using hand lenses, and if possible, a microscope. Ask students to draw one grain of sand enlarged to a size bigger than a quarter. Ask students to describe how a grain of sand looks. Ask students compare a grain of sand to a small rock. How are they different? How are they alike? Is a grain of sand a tiny rock? (yes it is)

SC.2.E.6.2 Describe how small pieces of rock and dead plant and animal parts can be the basis of soil and explain the process by which soil is formed.

* Have students compare types of soil such as sand, humus, garden soil, the soil outside. Record and describe the differences.
* Give students samples of sand and humus. Investigate that humus is made of plant material that has broken down or decayed. Humus is made of material that was once living. Sand is tiny rocks. It is made of materials that were never living. The dirt/soil outside is a mixture of sand and humus and is good for plants to grow in. When we compost we are making humus.
* When compost has turned to humus take it outside to a garden or planting area and put it on the soil. Have students compare the color and texture of the new humus to the existing soil.

SC.2.E.6.3 Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.

* Weigh samples of the dry soils. Poke small holes in the bottom of cups and pour an equal amount of water into each cup. Let it drain for several hours. Reweigh the soil to find out which type retained the most moisture. (Original weight – weight when wet = weight of retained water) Plants need water – which type of soil is best at retaining moisture?

SC.2.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.

* After having students observe types of soil and discussing how soil is made have students plan an investigation to turn sand into soil by adding organic material such as leaves, grass, and other plant matter. Have them predict how long it will take for the plant matter to decompose and become humus.
* Compare the decomposition of different materials such as a banana peel, a piece of paper, and a plastic spoon.

3rd Grade

SC.3.N.1.1

Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

* Long Term Investigation: After having students observe types of soil and discussing how soil is made have students plan an investigation to turn sand into soil by adding organic material such as leaves, grass, and other plant matter. Have them predict how long it will take for the plant matter to decompose and become humus.
* Compare the decomposition of different materials such as a banana peel, a piece of paper, and a plastic spoon.

SC.3.N.1.3 Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

• Have students predict what will happen when the compost is left in the bottle for 12 weeks. Draw and describe. Discuss- we can learn what will really happen by observing the compost bottle carefully. Explain that when we observe carefully, we look carefully and pay close attention to any changes we notice. We record what we learn in our science notebooks.

• Observe the compost bottle weekly. Draw and describe – teacher write student’s descriptions- on a chart or poster.

SC.3.P.8.2 Measure and compare the mass and volume of solids and liquids.

* Have students weigh and record the weight of each object or substance they add to the bottle. How can you find the weight of 20ml of water? Which units are measures of weight and which are measures of volume?

SC.3.N.1.6 Infer based on observation.

* Create a T chart of observations and inferences.
* What can you see happening inside the compost bottle?

SC.3.N.3.2 Recognize that scientists use models to help understand and explain how things work.

* The compost bottle is a model of what happens on a forest floor. What can we learn about decomposition on a forest floor by watching our compost bottle?

SC.3.N.3.3 Recognize that all models are approximations of natural phenomena; as such, they do not perfectly account for all observations.

4th Grade

SC.4.P.8.3 Explore the Law of Conservation of Mass by demonstrating that the mass of a whole object is always the same as the sum of the masses of its parts.

* Show a couple minutes of the video: Fruit and Vegetable Decomposition – time lapse video

<https://www.youtube.com/watch?v=c0En-_BVbGc>

* Do not poke a hole in the top or add an Earthworm to a second compost bottle or group of compost bottles. Put the lid on the bottle and tape it shut.
* Ask students to predict what will happen to the mass/weight of the bottle when the contents decompose.
* Weight the bottle and record the weight each week. Use the data collected after the contents have decomposed to show evidence of what happens to the mass.

SC.4.E.6.3 Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.

* Investigate/ research – Is soil renewable or nonrenewable?

SC.4.L.17.2 Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.

Decomposers video <https://rmpbs.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/>

* Compare a compost bottle with a worm to one without a worm. How does the addition of the worm affect the decomposition of the matter in the bottle?

SC.4.N.1.1 Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

* Set up an investigation - How does the addition of the worm affect the decomposition of the matter in the bottle?

SC.4.N.1.8 Recognize that science involves creativity in designing experiments.

* What other ways can you create a compost bin?

5th Grade

SC.5.E.7.1 Create a model to explain the parts of the water cycle. Water can be a gas, a liquid, or a solid and can go back and forth from one state to another.

* Observe and record how the moisture in the compost bottle evaporates and precipitates. Explain how this models the water cycle on Earth.

SC.5.N.1.6 Recognize and explain the difference between personal opinion/interpretation and verified observation.

* Create a T chart of observations and inferences.
* What can you see happening inside the compost bottle?
* What do you infer is causing the changes?

SC.5.P.9.1 Investigate and describe that many physical and chemical changes are affected by temperature.

* Place a thermometer in the compost bottle in a way that it can be read from outside the bottle. Compare it weekly to the temperature outside the bottle. Research: What is causing the temperature to increase inside the bottle?
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Additional compost resources for teachers:

Backyard Composting. (2009). US Environmental Protection Agency. <http://www2.epa.gov/recycle/composting-home>

Brite DelValle, T., (2011). Make compost with worms. UF/IFAS Extension. <http://duval.ifas.ufl.edu/documents/CompostingwithWorms.3.26.11_000.pdf>

Composting for teachers and students. <https://www.compostfoundation.org/ICAW/ICAW-for-Teachers>

Florida’s online composting center. (2012) UF/IFAS Extension. <http://sarasota.ifas.ufl.edu/compost-info/>

Park Brown, S., (2007). Compost tips for the home gardener. UF/IFAS Extension.

 <http://edis.ifas.ufl.edu/ep323>

The Story of Compost video- <https://www.youtube.com/watch?v=bqDQD8cvO5Y>

UF/IFAS Extension- Composting

<https://sfyl.ifas.ufl.edu/sarasota/natural-resources/waste-reduction/composting/>

Grow to Learn Gardening Guide – compost safety page 47 –

<http://sfyl.ifas.ufl.edu/sarasota-docs/hortres/GrowtoLearnSchoolGardeningGuide.pdf>