

GARBAGE-EATING WONDER WORMS – Lesson 1

Hands-on observations and experiments with red wiggler worms are used to teach students about decomposition, recycling, and reducing waste.

OBJECTIVES

- Introduce students to the concept of composting kitchen wastes in a worm bin.
- Give examples of the important roles worms play in the environment.
- Observe worms and worm behavior using magnifiers.
- Perform simple experiments to test whether worms prefer light or dark -and- wet or dry.
- Create a classroom composting worm bin. (Compost created by the worms will be examined in a follow-up lesson.)
- Conduct simple experiments to test worm preferences for various foods and observe the process of composting.

MATERIALS

- Red wiggler worms
- Materials for creating a worm bin:
 - shredded newspaper (black ink)
 - water in spray bottles
 - dry, shredded leaves (avoid oak leaves)
 - chopped vegetable leftovers such as lettuce (no fruit, eggs or nuts)·
- a third item for student predictions about which will decompose first - the worksheet calls for a stick, but you may select another item
- Large worm composting bin with air holes
- Small plastic "investigation" bins with holes for ventilation (these are optional: use small bins if you are leaving bins in the classroom for a short period of time)
- Large white sheets of laminated paper or bowls for worm observations (1 sheet or bowl for every two students)
- Light/dark and wet/dry experiment boxes

PREPARATION

- Read all of the background information, familiarize yourself with worm composting. [It may not be possible to discuss everything written in this lesson – the idea is to target the important concepts and vocabulary, and to maximize time making and discussing observations.](#)

INTRODUCTION

- Begin with students seated at their desks.
- Review the following discussion points about worms to develop an age-appropriate introduction to worms and composting for the class.
- Explain your expectations for student behavior when you pass out the worms for observation.

1. Introduce Recycling - Trash sort. Ask students if they are familiar with recycling paper (point out a blue paper recycling bin), and then ask them if they think that food can go in a recycling bin.

Concepts to review

- This lesson is about recycling food. Ask if anyone knows how food can be recycled. How can you make new food from old food?
- It may sound gross, but it's actually really cool! Talk about how food can be broken down into compost, and compost can be used in gardens to grow plants.
- Ask if anyone has ever heard of composting. Composting is a big word that means changing natural materials (like food, fallen leaves and mowed grass) into soil. (Note: Compost is organic matter which is a component of soil or can be added to soil as an amendment; an average soil sample is composed of 45 percent minerals, 25 percent water, 25 percent air, and 5 percent organic matter.)
- Are the leaves that fall from trees in autumn still on the ground in the spring? Most are not. So what happened to them? Fungi, worms, woodlice (rolly pollies) and bacteria eat the leaves. When they eat leaves, they are breaking them down into organic material that is an important component of soil. This happens to anything that dies outside. This is why we don't find big piles of dead things...which is really good! Compost can be rich in nutrients that help new plants grow.
- Composting to make healthier soil for our school or home gardens can be done in many ways. One way is to build an outdoor compost bin and to add the materials to the bin. If it is done the right way, the bin will attract soil creatures to help break down the natural materials. Another way is to build a special home for worms, called a "worm composting bin." You keep worms in the bin - usually inside your house or classroom. You feed them stuff from your kitchen ("food wastes") that would otherwise be thrown in the trash.
- By letting worms eat our unwanted leftovers, we are reducing waste. *Ask, how does this reduce waste?* Talk with students about how composting reduces the amount of trash your home or school sends to the incinerator. Also, less waste means fewer bags are needed to hold trash and less energy is needed to take the bags to the incinerator.

Activity (Optional): Have the kids sort the trash/compost/recycling into the appropriate piles.

2. Introduce the red wiggler worms

· Ask questions to get the students thinking about how worms differ from other animals (show photos of the animals as you talk about them).

· How do you know it is not a bird? A worm does not have wings or feathers.

· How do you know it is not a dog or a cat? A worm does not have fur and four legs.

· How do you know it is not a fish? It does not live in the water or have fins.

· You may want to just focus on how a worm is different from a snake since they have some physical similarities, but are unrelated animals.

○ Snakes have scales and worms have soft bodies made up of segments.

○ Snakes have eyes and a big mouth (compared to a worm). Worms do not have eyes, but can sense light and dark.

○ Most snakes lay eggs. Worms keep eggs inside a “cocoon.” This leads to the discussion about how the clitellum develops eggs inside and the worm wiggles out of it; at this point it is then called a cocoon that contains 4-6 eggs. The eggs hatch inside the cocoon.

○ Snakes have bones (including a backbone) and worms do not have bones. Worms are invertebrates. This is a major reason why worms and snakes are not closely related.

○ Snakes have lungs. Worms breathe through their skin.

○ Snakes have one heart and worms can have up to 5 hearts.

○ If a worm loses its tail it can grow it back. Snakes can't do that. (Some people think that worms can be cut in half and that both halves can remain alive. This is not true; only the tail may be able to regenerate.)

· Red wigglers are a type of worm, but they are a bit different from earthworms you may find around your home. If you dig a hole and find worms, you are probably finding European night crawlers. These worms live deep in the soil and come to the surface at night to eat bits of leaves and other dead things.

· Red wigglers don't like to live in soil. Instead, they prefer to live in rotting [vegetation](#), [compost](#) and [manure](#). They really like to eat some of the food we throw away! Because of this they can do a special job for people. They turn food waste into compost that can be used in gardens. They are **nature's recyclers**.

3. Take a few minutes to set up the red wiggler “behavior experiments.”

1. **Do the worms like to be in the light or the dark?** Place a worm in between the light and dark sections of the experiment box. Lightly dampen the box before showing it to the students.

- **Ask students for their predictions about what the worms will prefer.**

1. **Do the worms prefer to be moist or dry?** Place a worm in between the wet and dry sections of the experiment box.

- Ask students for their predictions about what the worms will prefer.

Set the behavior experiment boxes aside and come back to them at the end of the lesson.

4. Begin setting up a worm composting bin.

· Each class will add materials to the worm bin that you create for the school. The bin will be kept by the naturalist or at ANS. (The bin can be kept at schools if a teacher shows a strong interest in its proper care).

· Show the ANS GreenKids worm composting bin to the students. Point out the ventilation holes. Tell the students you use a dark bin that doesn't let light in.

· The materials the worms live in are called "bedding" materials. A few types of bedding materials are:

- Shredded newspapers. We use newsprint with regular black ink (no colors) or soy inks (colored soy inks can be used in a worm bin).

- Partially decomposed leaves - dry leaves that can be shredded easily

- Soil - one or two handfuls with initial bedding that comes with the worms

· Have students add either a handful of shredded newsprint, broken up dried leaves, chopped vegetable leftovers (lettuce is a good choice) or water (use a spray bottle).

· You can add a handful of worms to the bin now or wait until after the lesson and have the students add the worms they have observed. (Keep enough worms for observations!)

· Review what the red wiggler worms are good at composting.

- Vegetable "wastes" from food preparation: potato peels, carrot peels, cucumber peels, onion skins, outer leaves of lettuce and cabbage, celery ends. It is best to cut the vegetable wastes into small pieces.

- "Plate scrapings" or uneaten food - pasta, vegetables, potatoes, grains, bread (these foods should not have been prepared with sauces or butter)

- Coffee grounds (not too much at one time)

- Tea leaves (including the used tea bags, which should be torn open)

- Students may suggest different types of **fruit** or **meat**. Worms will eat fruit and meat, but we don't add these to an indoor worm compost bin because they attract fruit flies and can cause the bin to smell bad. Remember, **foods to avoid include fruit and meat**.

HANDS-ON ACTIVITY: WORM INVESTIGATIONS (minimum 20 minutes)

· Students will work at their tables or desks to observe (that means carefully look at) the red wigglers. Tell them you will come around and place some red wigglers on the tables (on placemats or in bowls). Provide 1 placemat or bowl for every two students.

· In addition to worms, there will be the material that they live in as well as compost that they've made.

· **Give specific instructions about touching the worms.** We can touch the worms using one touching finger (ask students to put up their pointer finger). Do not pick up the worms because it is not good for them. The bodies of worms must always be moist. If you pick them up, your skin removes water from the worms' bodies and this can make them sick.

· Is it safe to touch the worm? Of course! Worms do not have teeth and their mouths are very small. They can only take very small bits of food into their mouths. Worms do not have eyes so they can't even see you. Should we touch the worms gently? Yes! They do not have any bones and their bodies are very soft. Be very gentle.

· Scientists do not say "eeeewwwww!" Give examples of scientist-like reactions, such as "that is very interesting" or "hmmmm."

· Stay at your seats throughout the activity.

· **Talk about things to observe** (this will depend on the grade level)

- Long worms
- Short worms
- Fat worms
- Baby worms (these are very small and might be white or light pink and look like a piece of thread)
- Worm egg sacks (look like small brown balloons – also called cocoons)
- What does a worm do when you touch it?
- What the worms are living in (which is also what they eat)

· **Give a hand lens demonstration.** Before students begin observing the worms, review how to use a hand lens. Tell students that they are going to learn how to use a hand lens, which is a special tool to make small things look bigger. They will learn by viewing their thumbs. Ask students to place one hand in a thumb up position with their fist on the table. Ask students to hold the hand lens up to their eye and look at their thumb. Is it blurry? Yes! Hold the hand lens right on their thumb – does it look any bigger? No! Somewhere between your eye and your thumb is a place that will make your thumb seem bigger. Show how to move the lens back and forth to find that spot. Walk around to make sure students understand. Reminder: students must use a finger to touch worms or to move the material they are living in. Do not use the hand lens like it is a spoon!

· **Introduce the worksheet.** Review the worksheet BEFORE handing out the worms. Show first graders an example of a completed worksheet.

- **Drawing** – direct students to make drawings during their worm observations.
- **Composting Prediction** – after making observations, have students predict what they think worms will eat first.
- **Behavior Experiments** - check the behavior experiments and record the results.
- **“I Wonder” Questions** – give students a few minutes to write their questions. Move around the room and discuss their questions as a group after completing the observation activity.
- **Collect the worms!** After making observations and completing the worksheets, students can add their worms to the compost bin.

ASSESSMENT

After students have had an opportunity to observe the worms, complete their worksheets and ask questions, have them sit on the carpet while you quickly clean up. Then finish with a wrap-up discussion. Share predictions about what will happen to the compost bin and don't forget to reveal the results of the light/dark and wet/dry experiments!

OPTIONAL EXTENSION: EXPERIMENTS WITH WORMS

- Use smaller plastic “investigation” bins with ventilation holes. Use at least three per experiment. You could have each table or group set up one bin.
- Have students count out 20 large worms per bin.
- Put the 20 worms and equal amounts of peat moss in each bin (add enough peat moss to fill up one-third to one-half of the bin).
- Add one handful of lettuce (or other food you are testing) to the top of each bin. Do not mix in. (See experiment ideas below.)
- Spray enough water into the bins so they are moist. Use the same amount of water for each bin.
- Leave the bins alone for two to four weeks, checking them occasionally (once a week) to make sure they are moist. Add water as needed! If you add water, make sure you add the same amount to each bin. Do not disturb the worms or bury the food. This should be a very low maintenance experiment.
- Have students will observe changes in the bins after the pre-determined amount of time.
- Test other ideas:
 - Vary the number of worms per bin
 - Vary the foods per bin – observe and record which type of food disappears faster
 - Put bins in different locations (light versus dark)
 - Ask the students for their ideas – make it fun!

Lesson Development

Use the PowerPoint to go over the outer anatomy of the earthworm and the functions of each part, including:

Outer Anatomy of the Earthworm

1. **Anus**—where waste is excreted from the worm
2. **Segments**—the areas of the worm's outer body that bend and stretch and aid in movement
3. **Setae**—stiff hairs on the exterior of the worm that serve as feelers or sensory aides
4. **Clitellum**—located near the front of the worm; the worm's genitalia is located here
5. **Mouth**—where the worm ingests food

