

Schoolyard Investigation plan for Heritage Elementary, Macon, GA

Title: Worm Watchers: worm diet

Grade: 1-5

Duration: Two days/6-8 hours



Lesson Goals:

The goals of this study are to introduce students to worms and the important role they play in nature. The class will learn to build a worm bin. This bin will be used to conduct activities and set up a scientific investigation. The students will work in groups of three. Each student will keep a journal and record data in a log book. They will perform experiments and draw their own conclusions. Investigation includes an outdoor compost pile and a vermicomposting bin inside the classroom or lab.

Georgia Performance Standards covered in this investigation:

First Grade: S1CS1, S1CS3, S1CS5, S1CS6, S1CS7

Second Grade: S2CS1, S2CS3, S2CS5b, S2CS6, S2CS7

Third Grade: S3CS1, S3CS3, S3CS5, S3CS8

Fourth Grade: S4CS1, S4CS3, S4CS4, S4CS5, S4CS7, S4CS8

Fifth Grade: S5CS1, S5CS3, S5CS5, S5CS6, S5CS7

Materials:

Each Group of three needs:

- (1) Thermometer
- (2) Log book
- (3) Graph paper
- (4) Hand lens
- (5) Trowel
- (6) Set of 5 worksheets :
 - a. Warming up to worms
 - b. Set up Record sheet
 - c. Feeding Record sheet
 - d. Worm population count
 - e. Red worm observation

Classroom supplies for lab experiments:

- (1) Paper towels
- (2) Ruler
- (3) Jar of water

- (4) 1 sheet of black construction paper
- (5) 1 large plastic (butter) container with lid
- (6) Food scale to weigh food waste
- (7) Assortment of vegetable and fruit peels
- (8) A working vermicomposting bin (see section II b. for instructions)

II. Engaging the Students, “The Hook”

The instructor will lead the students to an outdoor compost pile.

Ask the following questions:

1. What do you see here?
2. What is the purpose of this pile of soil?
3. How does this pile break down wastes?
4. What do you think is living in this soil?
5. What do you think they eat?
6. How much do you think they eat?

Student Questions:

1. Do worms have eyes?
2. Where are their eyes? Mouth?
3. How does a worm move?
4. How do worms eat?
5. How do they feel?

Comparative question: What decomposes food wastes faster, garden compost or a vermicomposting ?

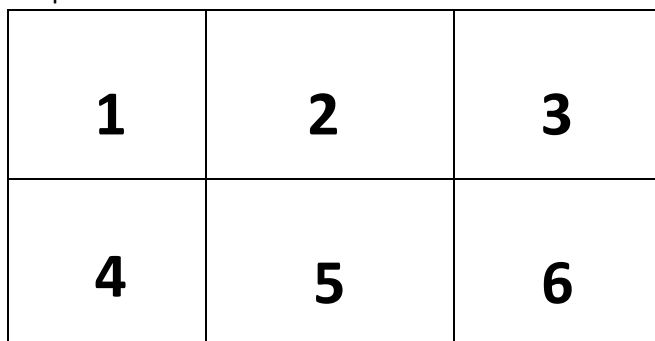
Hypothesis: A classroom vermicomposting bin will decompose food waste at a faster rate than the outdoor compost pile.

II. Experiment Design

Day One: Pre-Investigation

- A. Ask the students ‘What is vermicomposting?’
Let students brainstorm and share their ideas then give them the definition. ‘Vermi’ is Latin for worm. Vermicomposting is a system that uses red worms to process (eat) kitchen waste, resulting in worm castings that are rich in nutrients and can be used as fertilizer for plants. Worm poop is called “castings” and is an excellent soil amendment.
Ask students to write down their questions and about vermicomposting in their journals.
- B. Show a completed working worm bin to the students. Check resources and ‘The Worm Guide’ for instructions on how to build a vermicomposting bin for your classroom.
Explain how the bin was set up, step by step.
 1. Select a solid colored plastic 12 gallon tub w/lid, approximately 21”Lx15”Wx12”H, but less than 18” deep
 2. Drill small ¼” holes in the top and the bottom of the bin for air circulation (8-10 holes on the top and the bottom)

3. Screw small wood blocks 2" from each corner of the bottom of the bin. These 'feet' are used to prop the bin up to allow for drainage and ventilation.
 4. Place a tray of aluminum pan under the bin to collect "worm tea".
 5. Add bedding material for the worms. Use shredded office paper, newspaper or cardboard. Newspaper can be torn into one-inch strips by the students if time allows. Fill the bin $\frac{3}{4}$ full.
 6. Add water to the bin. Start with 2 cups of water. Stir the bedding until it is all wet. Use your hands to 'fluff' the bedding to allow air circulation.
 7. Add worms.
 - a. You will need about 1 pound about 1000 red worms or red wigglers to start your bin. The scientific name is *Eisenia foetida*. Make sure that you are buying only this worm.
 - b. A red worm's goal is to eat decomposing matter. They will eat up to their own weight each day. They don't need a large area to live and they don't bury down deep like the night crawler worms.
 - c. You can purchase red worms at your local bait shop, get them from a friends bin or order them on line (see resources).
 - d. Place the worms on the top of the bedding and watch them burrow down away from the light.
 - e. Observe the worms for a few days or a week before feeding them.
 8. Feed your worms.
 - a. Collect vegetable and fruit peels, coffee grounds with the filter, ground egg shells, beans, grains, leaves, lawn clippings and a little gritty soil. The soil and egg shells help the worms grind bits of food with their gizzards. Worms do not have teeth.
 - b. When adding food to the bin, place it under the bedding. Be careful not to put too many citrus peels in at the same time. They contain a toxic chemical called D-limonene that is released as the peel breaks down.
 - c. DO NOT add meat, bones, dairy or oily foods to your bin. Worms will eat these but they will cause a strong odor and attract rats and mice.
- C. Have students draw a diagram of the worm bin from an over head view, in their journals. Draw the bin into six sections or quadrants. Draw this example on the board along with a list of items that can and cannot be placed in the bin. Have the students to also draw pictures of these items. Place masking tape at the top edge of the bin above each section. Number the sections 1-6 following the diagram example.



- D. Assign sections 1-6 to groups of three or four students. Have each group choose what type of food they want to put in the worm bin. Example: Group 1 will pick shredded carrots and place it under the newspaper bedding in section #1. Make sure that each group is recording what time, place, date and what kind of food was placed in the bin.

Day 2: The Compost Pile

- A. Take students to a compost pile on the school grounds. Each group will need a trowel, a butter dish, and a soil thermometer. Explain how the compost was built:
1. The compost itself can be made in a number of ways. The simple method, which produces usable compost in about 3 to 6 months, is to mix waste with a little soil and turning the compost with a garden fork every couple of weeks.
 2. If you want to achieve faster results, layer your compost with alternate layers of waste and soil. Layers of waste should be no more than 4 to 6 inches (15 cm) deep with the coarsest material on the bottom. Alternate layers between green leafy material, dry leaves and twigs. Grass clippings and prunings should be placed in layers not more than 2 to 4 inches (5 cm to 10 cm) thick.
 3. Each layer of waste should be moistened and then covered with a loose layer of soil. Adding some manure or blood and bone, a handful of lime dolomite or a commercial compost starter should increase the speed of the process. Be careful to avoid compacting the layers. Air needs to be able to circulate freely for composting to take place.
 4. Repeat this layering until the compost heap has reached a height of about 5 feet (1.5 m). Ensure the compost doesn't become soggy or dry out and turn it every 5 days. This method produced rich compost in about 6 weeks. Not turning your compost regularly simply means that it will be longer before it is usable.
- B. Divide the compost pile into 6 sections. You can use flagging, white marking paint or just draw a line with a stick. Explain how to use a thermometer and how to take the soil temperature.
1. Instruct each group to take the temperature of the soil in their section and record the data in the log book.
 2. Then each student will take turns searching for worms. Collect 5 or less in the butter tubs. Give them a time limit of 5-10 minutes.
 3. The students are also encouraged to record any other organisms found in the soil.
- C. Classroom/Lab
- a. Each group observes the worms on a damp paper towel. Write observations in your journal.
 - b. Send a captain from each group to get one worm from the vermicomposting bin.
 - c. Compare the similarities and differences in the two worms.
 - d. Explain that the worms in the compost pile are different from the worms in the bin.

Day 3-Lab Experiments

Lab Stations: Set up

1. Place the sample station cards, one at each station (area) of your choice.
2. Put a damp paper towel and a worm from the bin at each station.
3. Station # Worm in a tray that is half covered with black paper.
4. Station #2, Butter dish filled with at least 25 worms.
5. Station #3, Feather or a leaf.
6. Station #4, Paper plate, water, pipette.

Warm up activity

- A. Give each group the worksheet 'Warming up to worms', 'Red Worm Observation and 'Feeding Record Sheet' and a red worm on a damp paper towel.
- B. Tell students to observe their worm and complete the worksheets as a team.
- C. Ask a captain from each group to take the temperature of the vermicomposting bin in their designated area and record the data on the feeding record sheet.
- D. Show students how to weigh the food scraps with the scale.
- E. Tell each group to vote on which food to compost. They may choose to use two different foods. Ask them to choose someone in their group to weigh the food and someone to record the data. Use the feeding record sheet.
- F. Have each group choose someone to bury the food about an inch under the bedding, in the correct section or quadrant.
- G. Make sure each group is recording everything correctly on the feeding chart.

Lab Station Activity

Before rotating through each station, ask the students to predict what the answer of each question might be, before conducting the experiments. Remind them to record everything in the log books or worksheets.

Station #1

Does a worm sense light? Do worms have eyes? Remove the black paper from the tray and place it on the other end. Does the worm move toward the dark cover of the paper?

Station #2

What is the average length of a worm? Straighten out the worm and measure it with a ruler. Measure 10 worms and calculate the average length.

Station #3

Can a worm feel? Using a feather or a leaf, touch the worm and observe its reaction.

Station #4

Do worms like water? Place a drop of water on a paper plate and place a worm near the drop.

Predictions: If equal food wastes are placed in an indoor vermicomposting bin and in an outdoor compost pile, then the food in the vermicomposting bin will be decomposed faster.

Analysis and Communication

1. At the conclusion of this investigation, in seven days each group will share their findings.
2. Record all of the data from each group on the board.
3. Discuss the results as a class. Answer questions.
4. Write a conclusion as a class.
5. Take notes of any other ideas for investigations with worms.

Extension: Do seeds germinate and grow better in worm castings from a vermicomposting bin or a yard waste compost pile?

Resources:

1. Vermicomposting book: Worms eat my Garbage by Mary Appelhof
2. The book, Recycle with earthworms: Red Wiggler Connection by Shelley Grossman and Toby Weitzel, Master Composters
3. Guide to building and maintaining a vermicomposting bin:
< <http://www.ciwmb.ca.gov/Schools/curriculum/Worms/> >
4. Video on collecting/harvesting castings www.youtube.com/watch?v=PJq21pyENFU
5. Website discusses earthworm biology and construction of a worm bin www.vermicoast.com
6. *Indoor vermicomposting kit \$30.00* www.roomtosqworm.com/kits.htm
7. *Purchase worms* <http://www.unclejimswormfarm.com/>
8. *On-line Vermicomposting game* <http://www.ciwmb.ca.gov/vermi/game/menu.html>
9. *The adventures of Vermi the Worm* <http://www.ciwmb.ca.gov/vermi/>
10. *Step by step details for vermicomposting* www.cityfarmer.org/wormcomp61.html

Budget

ITEM	COST
(1) Thermometer	10.00 each
(2) Log book (Composition)	1.50 each
(3) Graph paper	2.00 per pack
(4) Hand lens	4.00 each
(5) Trowel	3.50 each
(9) Paper towels	1.00 per roll
(10) Ruler	1.00 each
(11) Jar of water	.50
(12) 1 sheet of black paper	3.50 per pack
(13) 1 butter container with lid	Collect/recycle
(14) Food scale to weigh food	14.00 each
(15) Assortment of vegetable and fruit peels	Collect/recycle
(16) A working vermicomposting bin	Worms 25.00 per pound Plastic bin 7.00

