

Composting 101- It's the Microbes

Target Grade Level: 1-4

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1. CONTRIBUTOR'S NAME: JEFF PIOTROWSKI

2. NAME OF INQUIRY: COMPOSTING 101: IT'S THE MICROBES

3. GOALS AND OBJECTIVES:

a. Inquiry Questions: What is composting and what causes decomposition?

b. Ecological Theme(s): Nutrient cycling

c. General Goal: To understand the process of decomposition

d. Specific Objectives:

Academic: Students learn about decay, its importance in ecosystems, and the microbes responsible.

Experimental: Students set up a long term experiment with different treatments, replicates, and controls

Procedural/technical: Student use hand lenses and microscopes to observe the decomposition process

Social: The students set up the experiment in pairs and discuss the decomposition process as a group

Communication: The students are asked to predict what material will decompose faster given the treatments, their prediction are drawings and written descriptions

e. Grade Level: First through fourth

f. Duration/Time Required: 6 hours over 8 weeks

→ Prep time- 1 hour

→ Implementing Exercise During Class- 2 hours (four 30 minute sessions)

→ Assessment- 30 minutes

4. ECOLOGICAL AND SCIENCE CONTEXT:

Background (for Teachers and students):

Everybody knows compost is good for the garden, but not everybody knows why. This exercise demonstrates how compost is made and discusses what benefits compost actually provides. Compost is beneficial to plants because it is rich in nutrients that the plants can readily take up. Additionally compost adds porosity to soil, providing more soil air and water retention. Compost is made through the decomposition of plant litter (leaves, twigs, roots). The litter is converted into composted soil by a suite of bacteria and fungi. Compost bins often have very high internal temperatures because of the energy given off by the bacteria during decomposition. Sometimes you can see steam rising from compost when you turn the pile. Different organisms break down litter differently. Fungi are better than bacteria at degrading tough woody material. Worms often aid the decomposition process. Plant based kitchen wastes can be recycled through composting to reduce waste in landfills and provide one's garden with a nutrient rich soil amendment.

5. MOTIVATION AND INCENTIVE FOR LEARNING:

Students at these grade levels love playing with dirt. Composting seems somewhat magical to them as leaves turn into soil. The little gardeners in the classes are particularly interested

6. VOCABULARY:

Soil: The top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter and the organisms within.

litter: The surface layer of the forest floor which is not in an advanced stage of decomposition, usually consisting of freshly fallen leaves, needles, twigs, stems, bark, and fruits.

soil organic matter: The organic fraction of the soil exclusive of undecayed plant and animal residues.

compost: Organic residues, or a mixture of organic residues and soil, that have been mixed, piled, and moistened, with or without addition of fertilizer and lime, and generally allowed to undergo thermophilic decomposition until the original organic materials have been substantially altered or decomposed.

Decomposition: Breakdown or decay of organic materials.

Soil microbes: Assemblages of bacteria and fungi that live in the soil and break down organic materials

Bacteria- Microscopic single cell organisms that live in nearly all environments on earth. Bacteria may be beneficial (through composting) or harmful (through disease)

Fungi- Microscopic organism that may grow as multicellular filaments or single cells. These organisms excrete enzymes that break down organic material and provide food for themselves.

7. SAFETY INFORMATION: NONE

8. MATERIALS LIST (including any handouts or transparency masters):

Ziploc bags
Fresh compost from a compost bin
Heat killed compost
Shredded leaves
Small twigs
Pine needles

9. METHODS/PROCEDURE FOR STUDENTS:

a. Pre-investigation work: The teacher should gather materials for the investigation and have them ready in class. The teacher should lead a discussion on litter, decay, decomposition, and their causes. The teacher should introduce bacteria and fungi to the students.

b. Investigation work:

This investigation is best conducted outside. The students should be divided in groups of two. Each team receives three Ziploc bags. Into each bag have them place a small handful of leaves and a few small twigs. Into one bag place 1 cup of fresh compost, into

another place 1 cup of heat killed compost, and the remaining bag should have just leaves. Have the students poke holes into the Ziploc bags and then close them. At this point have the students draw and write their predictions for how the bag contents will change in appearance over the next weeks.

After the set up, keep the bags in a dark environment over the next 8 weeks. Every two weeks the students should take out the bags, observe, and draw the contents. The students can use microscopes to observe any fungal or bacterial growth. Every week they should discuss the changes and if their predictions are being met.

10. ASSESSMENT:

Assessment is conducted through the drawings and written predictions and through the discussion over the course of the experiment.

11. EXTENSION IDEAS:

The different compost types could be used in soil mixtures to grow plants. This inquiry could test how the different composted materials affect plant growth.

12. SCALABILITY

This exercise could be easily scaled up. The decomposition rates of different litter types could be measured. High school student could measure changes in available nitrogen, pH, color, and weight of the bags.

13. REFERENCES:

<http://www.soils.org/ssagloss/>

14. LIST OF EXPERTS AND CONSULTANTS

http://www.howtocompost.org/cat_education.asp

<http://ltpwww.gsfc.nasa.gov/globe/>

15. EVALUATION/REFLECTION BY FELLOWS AND TEACHERS OF HOW IT WENT:

This was a long experiment that worked exactly as expected. The students could see how fungi grew in the bags containing compost and more rapidly broke down the litter. One problem was a few flies set up residence in the compost containing bags after a few weeks. The kids eventually used this homemade compost in other inquiries on soil composition and the benefits of soil organic matter.