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From Garbage to Garden

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Composting Lesson Plan

Devised by Genevieve Criss, Marilyn Laistner & Kim Parlatore

Grade Level: 10th

Subject / Content area: Interdisciplinary Science (Physical Setting & Living Environment)

Unit of Study: Human Impact on the Earth

Lesson Title: Composting

CHALLENGE QUESTION for the learning segment: How can I design a highly efficient compost pile?

Content Standard(s): NYS Content Standards

NYS Science Learning Standards (Physical Setting):

Key Idea 3: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

- Elementary –
 - observe and describe properties of materials using appropriate tools
- Intermediate –
 - observe and describe properties of materials, such as density, conductivity, and solubility

NYS Science Learning Standards (Living Environment):

Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life.

- Commencement –
 - explain the basic biochemical processes in living organisms and their importance in maintaining dynamic equilibrium

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment.

- Elementary --
 - identify ways in which humans have changed their environment and the effects of those changes
- Commencement --
 - describe the range of interrelationships of humans with the living and nonliving environment
 - explain the impact of technological development and growth in the human population on the living and nonliving environment
 - explain how individual choices and societal actions can contribute to improving the environment

NYS Mathematics Standards:

A.CN.5

Understand how quantitative models connect to various physical models and representations

A.PS.8

Determine information required to solve a problem, choose methods for obtaining the information, and define parameters for acceptable solutions

A.PS.9

Interpret solutions within the given constraints of a problem

A.PS.10

Evaluate the relative efficiency of different representations and solution methods of a problem

A.R.1

Use physical objects, diagrams, charts, tables, graphs, symbols, equations, or objects created using technology as representations of mathematical concepts

Learning Objectives associated with the content standards:

1. I can explain what composting is and why it is important to me.
2. I can describe and explain what factors effect composting and how they affect composting.
 - a. I can calculate the ideal Carbon to Nitrogen ratio for composting materials from a given molecular formula.
 - b. I can calculate the ideal moisture percentage for composting materials from the dry and wet weight.
 - c. I can calculate the overall average of a compost pile's Carbon:Nitrogen ratio, moisture content and particle size.
 - d. I can explain and hypothesize the relationships between Carbon:Nitrogen ratio, moisture content, particle size, temperature, pH and rate in a compost pile.
 - e. I can calculate and graph an approximation of the rate of decomposition from the data collected from the composting simulation.

Instructional Strategies and Learning Tasks that support diverse student needs. (Include what you and students will be doing.):

Teacher: Educational hook, direct instruction, guided inquiry

Students: Group reports, exploratory inquiry

Differentiation and planned universal supports:

- Use multiple modes of engagement (educational hook in direct instruction, exploration time with the simulation).
- In direct instruction, use multiple modes of representation (visual, oral and written representation).
- In discussion, encourage use of multiple modes of expression (mathematical, conceptual, etc.)

Language Function students will develop. Additional language demands and language supports:

Describe, Observe, Compare, Contrast, Infer, Analyze, Explain, Speculate, Hypothesize

Type of Student Assessments and what is being assessed:

- **Informal Assessment:** Composting Simulation Laboratory (CSL)
- **Formal Assessment:** Composting Simulation Worksheet (CSW)
- **Modifications to the Assessments:** Calculator for CSW, work in pairs for CSL

Evaluation Criteria:

For CSL: Students have unlimited trials, they must have at least one simulation fully decompose.

For CSW: Mastery is demonstrated at the 85% correct level.

Relevant theories and/or research best practices:

Computational Modeling/Simulations, Guided Inquiry, 3E Learning Model

Lesson Timeline:

1. Introduce the topic to the students with the Powerpoint Presentation that explains what composting is and what factors effect composting and how, but not to what degree (the students must determine the degree).
2. Provide Individual Preparatory Worksheet to each student. Allow time for students to calculate Carbon to Nitrogen Ratios and moisture content.
3. Introduce the computer simulation and allow time for students to run multiple simulations.
4. Students will choose the best (most efficient/fastest) simulation and finish the individual worksheet with that data.
5. Have students form groups of four and provide students with Collaborative Worksheet. Allow time for students compare data, and make hypothesis about what, how and to what extent factor affects decomposition.
6. Have student groups present their hypothesis to the class in a small report.