ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 10: What Is Vermicomposting?

MINI-LESSON

Teacher introduces the "Synthesizing" anchor chart and models how to write synthesis statements.

SCIENCE INQUIRY CIRCLES

Teams write synthesis statements for each question on their Inquiry Charts.

GUIDED SCIENCE INVESTIGATIONS

Teams are introduced to the process of vermicomposting and compare it to other methods for managing waste.

ABBREVIATED STANDARDS

- ELA and Reading TEKS: 5.13(E)
- CCSS: RI.5.9
- NGSS: 5-LS2-1
- TEKS: 5.1(A)(D)(E), 5.3(B), 5.5(E)(G), 5.11, 5.12(A)(B)(C)

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Day 10: What Is Vermicomposting?

Literacy Strategy: Synthesizing information across multiple texts

Science Concept: Worms can be used to enhance the decomposition of organic waste.

Science and Literacy Connection: Scientists synthesize what they have read by other scientists with what they already know and put that information together in a new way.

Mini-Lesson (15 minutes)

OVERVIEW

Scientists synthesize information about the world every day. Before they conduct their own investigations, scientists read lots of texts other scientists have written about their own work. Scientists synthesize what they read with what they already know and put that information together in a new way. *Synthesis* means making something new by putting things together. Today, you will model how to write a synthesis statement using a model inquiry question and information about the bottle system from the science investigation.

NOTES:

You are encouraged to create the "Synthesizing" anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. Post it for easy reference when completed and remind learners to refer to the anchor charts during inquiry circles.

Earlier in this unit, learners hear about *intratextual synthesis*. This is synthesizing, or putting together multiple, different pieces of information within a single text (e.g., synthesizing words and visual representations). This lesson focuses on *intertextual synthesis,* or putting together pieces of information across multiple texts. But we will just call this *synthesizing*.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Synthesizing" anchor chart as a model
- model Inquiry Chart

PROCEDURE

The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Tell what the strategy is (declarative knowledge)

1. *Today we will practice synthesizing our evidence from multiple sources. We will combine information from all of our sources and create our own, new information. This is different from restating what other scientists have written. When I write a synthesis statement, I combine evidence from multiple sources with my own knowledge and state the information in a new way.*

Tell when and why to use the strategy (conditional knowledge)

1. *I write synthesis statements because other scientists expect me to show that I have read scientific writing about my topic and that I can combine that information in my own words. I also synthesize my resources because it helps me construct a deeper and broader meaning about my topic. As a strategic reader and writer, I synthesize to make sense of lots of information. I write a synthesis statement when I want to combine information from different books, online resources, experts, and videos.*

Tell how to use the strategy (procedural knowledge)

1. *The first thing I do is look at one of my Inquiry Chart questions and think about the important information from each source that helps to answer this question.*
2. *I compare and contrast the important information from each of the sources to make sure all of my information fits together in a way that makes sense. If the information across sources is similar, I often do not need to do anything. If my sources contradict or disagree with each other, I need to stop and try to evaluate the claims or statements the authors are making.*
3. *Now, I need to think about what I know about this important information and if I can add something from my own knowledge that the authors didn't mention directly. I will be careful to include only my knowledge that is factual and that matches what I have read in the writing of other scientists. I will not include opinions or information that I have heard someone in my life say. If what I know agrees with what other scientists say, I can include it in my synthesis statement.*
4. *Finally, I write a synthesis statement that combines evidence from my sources and my own factual knowledge.*

You might present the following as a model synthesis statement as part of this mini-lesson:
(Explain that their synthesis statements will focus on the method of food disposal they have been investigating; their synthesis statements should also include information related to the cycling of matter and transfer of energy in their chosen food-disposal method.)

1. *My question is, What happens to the organic matter in newspaper and egg yolk when microorganisms consume it? I found that*
    - *Newspaper and egg yolk are examples of organic matter, or matter that contains stored energy. Organic matter comes from plants and animals, and the energy stored in plant and animal matter can be used by consumers like animals and microorganisms.*
    - *Microorganisms consume organic matter to get energy stored in the matter.*
    - *The matter that was in the newspaper and the egg yolk becomes part of the microorganism as it grows in size.*
    - *Microorganisms also reproduce, and the matter that was once part of the newspaper and egg yolk becomes part of the microorganism's offspring.*
    - *Microorganisms release some of the matter back into the environment by producing waste, such as gas bubbles.*

- *The energy that was stored in the newspaper and egg yolk is used by the microorganism to perform its life processes, such as moving around, growing, and reproducing.*
- *Some of that energy is released into the environment in the form of heat.*

Model synthesis statement:
Microorganisms consume organic matter, such as newspaper and egg yolk, to get energy stored in the matter. Microorganisms use this energy to perform life processes, and matter is recycled as it becomes part of the microorganism or its offspring. Matter and energy that is not used by the microorganism are released into the microorganism's environment.

Science Inquiry Circles (30 minutes)

OVERVIEW

Teams will write synthesis statements for each inquiry question on their Inquiry Charts. You may need to make adjustments for teams still working to complete their Inquiry Charts.

MATERIALS

Each team member needs:

- Investigation Journal
- pencil

Each team needs:

- team Inquiry Chart

PROCEDURE

The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Before Inquiry Circles (5 minutes)

1. *It is time to get into our inquiry circles. You will be with the same team as yesterday, but we will rotate the science roles.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their team).
2. *We have answered all (or most) of our Inquiry Chart questions. Today we will write our synthesis statements, so we need to be sure we have completed the Inquiry Chart.* (Make adjustments for teams that have not yet completed their Inquiry Charts.)
3. *Now, inquiry circle teams will work together on their synthesis statements.*

During Inquiry Circles (20 minutes)

1. *When all questions are answered on your Inquiry Chart, your team will work together to write a synthesis statement for each one of your inquiry questions.*
2. *When writing your synthesis statements, remember to synthesize all the information in the column under each question. You probably have information from multiple sources as well as some information from your own knowledge.*
3. *As you work to write your synthesis statements, remember the synthesis statement from our mini-lesson today.* (Refer to the written statement.)

4. *Choose one inquiry question at a time and write a synthesis statement as a team.* (You might also give teams the option to divide up the inquiry questions and have each team member write one synthesis statement. Facilitate in a way that works best for your learners.)
5. *Write your synthesis statements in the Day 10 page of your Investigation Journals.*
6. *Do not forget to use the anchor charts to help guide your thinking.* (Refer to the posted anchor charts.)
7. *I will help guide the inquiry circles, but I expect you to work as a team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

After Inquiry Circles (5 minutes)

1. *As we conclude our inquiry circles for today, each team's Lab Director will lead the discussion about today's results. Was the team able to synthesize the questions on their inquiry chart? What problems did the team encounter? How did the team resolve those problems?* (After you have allowed the teams to gather their thoughts, have the Data Scientists share with the class.)
2. *The Data Scientists will now share with the entire class one of their team's synthesis statements.* (Encourage teams to share how they developed their synthesis statements. If you saw a great example in action, encourage that team to share with the entire class.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners are introduced to the process of vermicomposting and compare it to other methods for managing waste.

GUIDING QUESTIONS

What is vermicomposting? How is it different from traditional composting?

BACKGROUND INFORMATION FOR THE TEACHER

Vermicomposting is a process that uses worms to break down organic waste more quickly than traditional composting. In North American, red wigglers (*Eisinea fetida*) are used most often for vermicomposting.

Composting worms are detritivores, meaning they break down and consume organic matter, which is then excreted as worm castings. Worm castings contain many microorganisms that continue to decompose organic matter; they also have a many more nutrients than traditional compost, making them a valuable fertilizer for enriching soil.

Today, learners will be introduced to vermicomposting and will then compare and organize what they know about methods for managing waste.

DAILY OBSERVATIONS

Teams will make daily observations of their bottles and record information in their Investigation Journals. Observations can be made at any time of the day.

SAFETY

- Remind learners not to shake the bottles during observations or move them in a way that disturbs the layering.

MATERIALS

Each team member needs:

- Investigation Journal
- pencil
- colored pencils or crayons
- 1 copy of "Worm Notes" page

Each team needs:

- 1 copy of the "Managing Waste" chart

Teacher needs:

- "Worm Notes" page
- "Managing Waste" chart
- "Vermicomposting: How Worms Can Reduce Our Waste" video (TedEd):
- "Go Green with Worms" video (NC State Extension):

SETUP

- Make copies of the "Worm Notes" page (1 per team member).
- Make copies of "Managing Waste" chart (1 per team).
- Prepare to project the "Vermicomposting" and "Go Green with Worms" videos.

PROCEDURE

The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Engage

1. Begin by reminding learners of the work they did in the previous class when they compared two systems of garbage disposal: landfills and composting.
2. Ask, *What is one thing both systems have in common?* Accept responses. If no one mentions it, tell them one similarity is "time." Both systems take a long time for the decomposition of waste to occur, though composting organic waste generally takes less time than decomposition in landfills.
3. Explain that today they will explore another way of decomposing organic waste that takes less time than landfills.

Explore

1. Project the "Vermicomposting" video first, followed by the "Go Green with Worms" video (together, the videos take about 8 minutes to view). After the video, randomly select learners to answer the question, *Why do you think vermicomposting takes less time than traditional composting?*
2. Accept their ideas, then have the Equipment Directors distribute the "Worm Notes" page to each of their team members. Explain that the "Worm Notes" highlight key points and important facts about vermicomposting. Allow 2–3 minutes for learners to review them.

3. Next, distribute the "Managing Waste" chart (1 per team). Tell the class it is time to begin organizing what they have learned about the decomposition of waste disposal. Read over the headings on the "Managing Waste" chart together so that learners understand what information they will need to include.
4. Instruct them to work as a team to summarize any information gathered from previous lessons. Note that tomorrow, they will explore incineration and will add that information to the chart.
5. Ask if there are any questions and l let them know they have about 15 minutes to complete their work.
6. As teams work, move among them, listening to their discussions and offering guidance on how to summarize their information.

Explain

1. When time is up, ask teams to partner up with another team to share and discuss their work. Explain that this gives them an opportunity to consider other ideas and justify their own. Allow about 5 minutes for sharing.
2. Circulate among the teams as they discuss their work with each other, offering guidance as needed.

Elaborate

1. Wrap up the team discussions and ask if there was any information they summarized on the chart that the teams disagreed with. If there is, have them share their differing views and allow other teams to weigh in before you offer clarifications if needed.

Evaluate

1. Give teams 2 minutes to create and write an 8-word "headline" together about the most important thing they discovered today. This can be written on the Day 10 page in their Investigation Journals.

Science Language

- **Worm castings** are the waste material (poop) produced by worms**.**
- **Vermicomposting** is a process that relies on worms to decompose organic waste. **Vermicompost** is the rich, dark material left after worms break down organic waste.

Expanded Standards

English Language Arts and Reading TEKS

5.13(E) demonstrate understanding of information gathered.

CCSS

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

NGSS

5-LS2-1 A system can be described in terms of its components and their interactions.

Science TEKS

5.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; **(D)** use tools, including calculators, microscopes, hand lenses, metric rulers, Celsius thermometers, prisms, concave and convex lenses, laser pointers, mirrors, digital scales, balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, notebooks, timing devices, materials for building circuits, materials to support observations of habitats or organisms such as terrariums and aquariums, and materials to support digital data collection such as computers, tablets, and cameras to observe, measure, test, and analyze information; **(E)** collect observations and measurements as evidence; **5.3(B)** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; **5.5(E)** investigate how energy flows and matter cycles through systems and how matter is conserved; **(G)** explain how factors or conditions impact stability and change in objects, organisms, and systems; **5.11** The student understands how natural resources are important and can be managed. The student is expected to design and explain solutions such as conservation, recycling, or proper disposal to minimize environmental impact of the use of natural resources. **5.12(A)** observe and describe how a variety of organisms survive by interacting with biotic and abiotic factors in a healthy ecosystem; **(B)** predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web; **(C)** describe a healthy ecosystem and how human activities can be beneficial or harmful to an ecosystem.