ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 9: Landfill or Compost?

MINI-LESSON

Learners use the Kiddle search engine to find answers to their inquiry questions.

SCIENCE INQUIRY CIRCLES

Teams find additional information to complete their diagrams.

GUIDED SCIENCE INVESTIGATIONS

Teams consider the differences between two methods of garbage disposal: landfills and composting.

ABBREVIATED STANDARDS

- ELA and Reading TEKS: 5.13(C)
- CCSS: RI.5.7
- NGSS: 5-LS2-1
- TEKS: 5.1(A)(D)(E), 5.3(B), 5.5(B)(E)(F) (G), 5.11, 5.12(A)(B)(C)

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Day 9: Landfill or Compost?

Literacy Strategy: Searching online using a search engine

Science Concept: The ways in which humans dispose of waste can have positive and negative impacts.

Science and Literacy Connection: Scientists read online as they expand their knowledge about a topic they are investigating. Being able to quickly and efficiently find the information they need online is important.

Mini-Lesson (15 minutes)

OVERVIEW

Yesterday learners began planning how they would create diagrams to represent matter cycling and energy transfer in the food-disposal methods they are investigating. Teams took note of areas of confusion and new questions they had. Today learners will use a search engine (e.g., Google) to find answers to their questions.

Scientists often use search engines to find more information. Search engines can help scientists find out what other scientists have to say about a topic. Search engines can show us resources that are helpful for answering our questions, but they can also show us web pages that are unrelated or not helpful. Scientists and other internet users have to sort through lots of search results to find what they were looking for.

NOTES: This lesson uses Kiddle (https://www.kiddle.co/), a safe-search engine designed by Google, with all results vetted by editors. If you have another safe-search engine that your learners are already familiar with, you might model today's strategy using your preferred search engine instead.

Complex literacy strategies appropriate for upper elementary readers often include subroutines. Today's complex literacy strategy (searching online) is made up of subroutines learners may have learned or used before, such as *skimming and scanning*, a subroutine often used when searching online. If your learners need support with this subroutine, an optional additional mini-lesson on skimming and scanning can be found in the supporting files for Day 9.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Searching Online" 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 are going to learn how to search for information online. Searching online is using an online search engine to find information about a topic. The search engine we will use today is called Kiddle.*

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

1. *I search for information online when I have a specific question I want to answer or I want to know more about a topic.*
2. *When I search online, I don't click on every result or read every word on the page. Instead, I think about key words related to what I want to know then I skim and scan the search results, looking for words like my key words. This helps me decide when to stop and read more closely.*

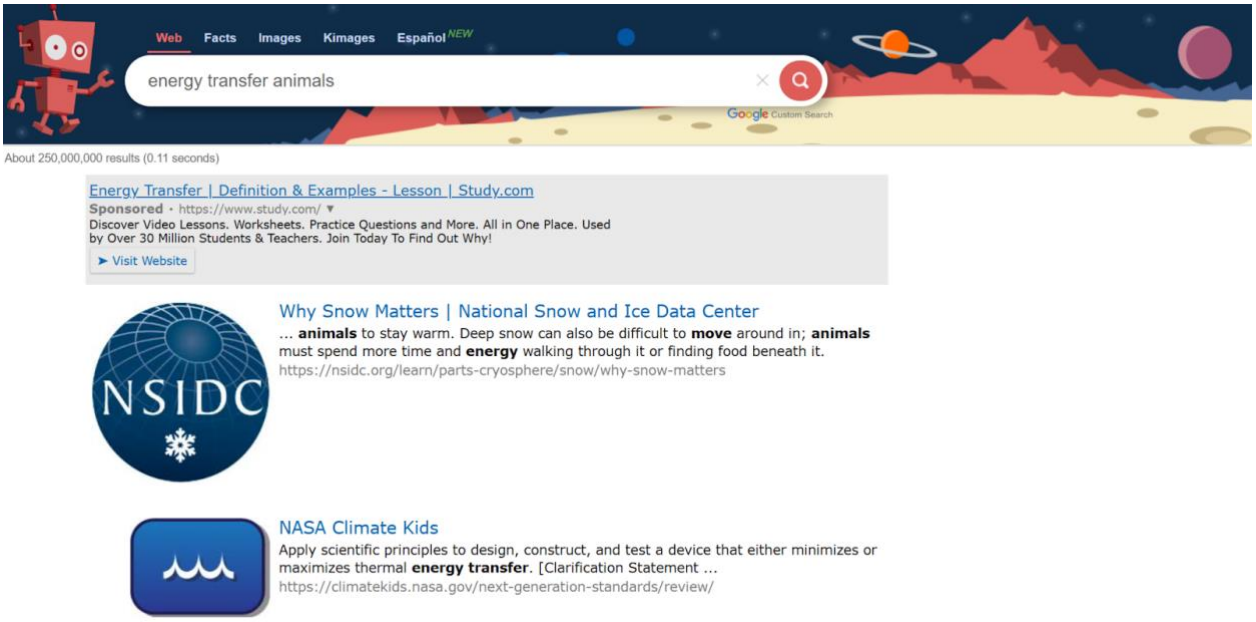
Tell how to use the strategy (procedural knowledge)

1. *First, I ask myself what I want to know. If I have multiple questions, I choose just one question to focus on for now. I can type my question directly in the search bar OR I can type in a few key words related to my question (the words are called "search terms").*
2. *When the search results pop up on the page, I skim and scan the results. Skimming and scanning means reading quickly through the results and stopping when I see a key word related to my question.*
3. *I stop on a result that includes words like my key words, and I read the title and sample text more closely to decide if the web page might help me answer my question.*
4. *If the result seems related, I open the web page.*
5. *With the web page open, I skim and scan again, looking for information related to my question. I stop and read closely when I reach a part of the page that includes words like my keywords.*
6. *When I find information that helps me answer my question, I write this new information on my Inquiry Chart and take note of the title, the publisher, the date, and the URL.*

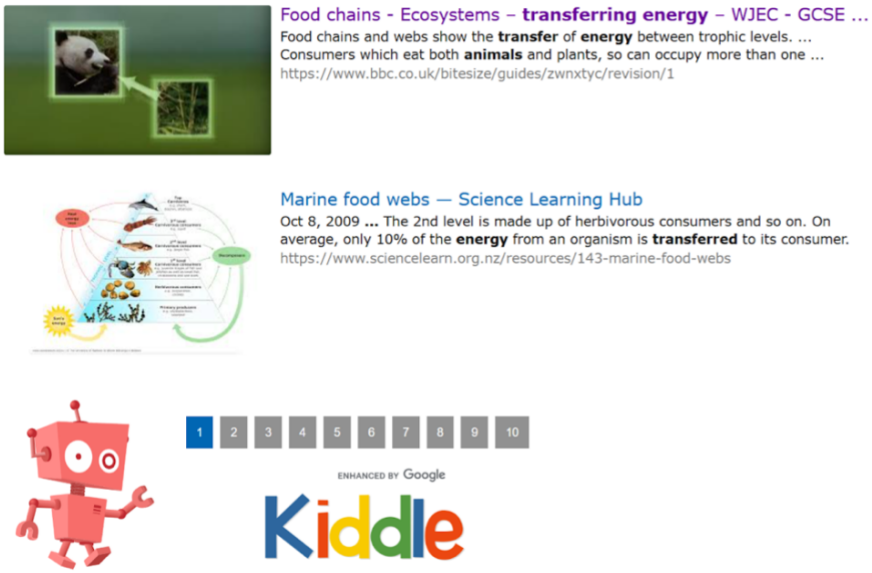
Model the Strategy

1. *First, I ask myself what I want to know. I have been thinking about how animals get energy by consuming plants. I know there is energy stored in the plant being eaten, but I'm not sure what happens once the animal eats the plant. Where does the energy go? I navigate to Kiddle by typing* "kiddle.co" *into the URL window at the top of my internet browser window. Then, I type "energy transfer animals" in the search bar.*
2. *My search results pop up on the screen. When I look at the page, I notice the first result appears in grey. This first result says, "sponsored." This means that a business or company is paying for this result to appear at the top of the screen. These results are usually trying to sell me something. I don't click on them. Instead, I look at the results below.*
3. *I know that not every result will help me answer my question, so I think about my question in my mind as I read the first result. The first result is titled, "Why Snow Matters" from the National Snow and Ice Data Center. I don't think that reading about snow is going to help me answer my question about what happens after an animal eats a plant. This tells me that some of the results*

are unrelated to my question. I skim and scan the titles of the top search results. I am looking for results with words like plants, animals, energy, and transfer.



4. *I continue reading the titles of the search results. If the title doesn't give me enough information, I read the smaller text that appears under the title. The smaller text is a preview—a small part of the text that appears on the web page. This can help me decide if the website is related to my question.*
5. *I stop on a result titled "Food Chains - Ecosystems - transferring energy."*



This time I see a few key words that seem related to my question. I see the words "food chains" and "ecosystems," and I know both of these are related to animals eating plants. I also see the words "transferring energy," and this seems related to my question. I keep reading the smaller text to be sure. I see the words "transfer of energy," "consumers," "animals," and "plants." This seems like a resource that can help me answer my question!

6. *Once I open the page, I skim and scan the page, looking for key words related to my question (plants, animals, energy, transfer). I stop at the first paragraph and read that plants use light energy from the sun to create glucose. When animals eat plants, they eat the glucose in the plant. Then the animal uses the glucose for respiration, a process that releases the energy stored in the glucose. Then the animal can use that energy to do life processes.*
7. *I write this new information on my Inquiry Chart and take note of the web page title ("Food Chains"), the publisher (BBC Bitesize), the date the page was updated (2024), and the URL (https://www.bbc.co.uk/bitesize/guides/zwnxtyc/revision/1).*

Science Inquiry Circles (30 minutes)

OVERVIEW

Yesterday learners began planning and creating a diagram to represent how matter is cycled and energy is transferred within the food-disposal method they are investigating. As they began their work, they likely noticed they do not have all the information needed to complete their models and took note of the information they still need. Finding additional information in the focus of today's mini-lesson and work in inquiry circles.

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- sticky notes listing areas of confusion and/or new questions written yesterday
- paper for creating diagrams, or previously started drafts of diagrams
- drawing materials

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. *Yesterday you began planning and creating a diagram to represent how matter is cycled and energy is transferred within the food-disposal method you are investigating, but you probably figured out that you needed more information. Today you will work in your teams to search online for more information.*

During Inquiry Circles (20 minutes)

1. Redistribute each team's sticky notes from yesterday or have Equipment Directors retrieve their sticky notes from where they were stored.
2. *Take a moment in your team to revisit your areas of confusion or questions from yesterday. Remember, we are looking for specific information to include in our diagrams.* (Review the list with learners). *Based on this list, is there anything else you need to find out to complete your diagram? If your team has any new questions, the Lead Scientist will write them on a sticky note.*
    - Consumer: Who or what is getting energy from the energy source?
    - Energy Source: Organic matter or matter that contains stored energy
    - Matter Transfer from the Energy Source to the Consumer
    - Matter Transfer from the Consumer to the Environment
    - Energy Transfer from the Energy Source to the Consumer
    - Energy Transfer from the Consumer to the Environment
    - Waste That Can Be Used by Other Living Things
3. Learners will need to organize their findings as they search. Teachers may choose to have learners add a column to their Inquiry Chart for each new question and record additional sources as they have previously recorded their sources—in the leftmost column on the Inquiry Chart. Because learners may accumulate many new questions and sources in a single day, there might be another way you want teams to record their findings from today's web search. Make sure to clearly explain and explicitly model how you would like learners to keep track of their findings.
4. *Today we are going to use our strategy for searching online* (refer to the "Searching Online" anchor chart). *The Lead Scientist will guide the search process for the day by picking question(s) to search, one at a time. The Data Scientist will record on the team Inquiry Chart all source information and the answers to your additional inquiry questions.*
5. All additional questions should be answered today. How teachers choose to organize this time may depend on the availability of internet-equipped devices. If devices are available for every learner, teams might divide up questions and search independently. If devices are limited, teams might divide up questions and search in pairs or use one shared device per team to conduct searches together, one by one.
6. *Remember to type "kiddle.co" into the URL window. When you see the robot on the Kiddle home screen, you can then type your search terms or questions in the search bar. Everyone should help search and find the answers to your questions online.*
7. *My role is to help guide the inquiry circles, but I expect you to work as a science team to solve your problems together.*
8. While teams are working, walk around the room to facilitate as needed. Learners may need support when applying their strategy from today's mini-lesson. You can remind learners to look for related keywords and read the titles and preview text before clicking on a search result to determine if the result is going to help them answer their questions.
9. If learners finish their searching early, they can begin or continue creating their diagram.

After Inquiry Circles (5 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share the information they found by searching online. The Lab Director will lead the discussion about today's results. What has the team learned? What problems did the team encounter? How did*

the team resolve those problems? Did the team use a reading strategy? Which one and how did it help? What new questions does the team have?

2. After you have allowed the teams to gather their thoughts, have the Data Scientists share with the class. Try to encourage teams to share a variety of things—you do not want just facts about food waste, just reading strategies, or just cooperative learning strategies.
3. After all learners have shared, thank them for their hard work, and point out any practices of scientists you observed. If you saw an outstanding example of using a reading strategy or collaborative work, explicitly point it out. If you notice any problems in the teams during the lessons, take a moment to point them out, and explain your expectations for all future inquiry circles. Collect all Inquiry Charts or have learners put them in their normal classroom place for ongoing work so they can easily access them.

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners consider the differences between two methods of garbage disposal: landfills and composting.

GUIDING QUESTIONS

What happens to garbage in a landfill? What happens to garbage when you compost? How is matter cycled and energy transferred by these methods of garbage disposal?

BACKGROUND INFORMATION FOR THE TEACHER

In the previous lessons, learners explored the role of microorganisms in decomposition and how the components of a soil ecosystem cycle matter and transfer energy. In the coming days, learners will observe different approaches to disposing of household garbage and consider how decomposition cycles matter and transfers energy in the process of household garbage disposal. By comparing different methods of garbage disposal, learners can apply new knowledge to the question of how best to cycle matter and transfer energy from food 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 or move them in a way that disturbs the layering.

MATERIALS

Each team member needs:

- Investigation Journal
- pencil
- colored pencils or crayons

Each team needs:

- 1 Disposal Chart

- 1 set of Garbage Disposal Strips

Teacher needs:

- Disposal Chart
- "Garbage Disposal Strips" page
- "Landfill vs. Composting" slideshow
- "Landfill" image
- small resealable plastic bags

SETUP

- Make copies of the Disposal Chart (1 per team).
- Make copies of the "Garbage Disposal Strips" page (1 set per team).
- Cut out and mix up a "Garbage Disposal Strips" page for each team. Place the strips in a plastic bag along with 1 copy of the Disposal Chart.
- Prepare to project the "Landfill" image.
- Prepare to project the "Landfill vs Composting" slideshow after the activity.

PROCEDURE

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

Engage

1. *Where does your trash go after the garbage trucks pick it up?* Accept responses. Explain that where your garbage goes depends on your waste service provider and local or state regulations. Sometimes garbage goes to a processing facility that sorts out items that are recyclable and can be composted or used in waste-to-energy facilities. The remainder of the trash will go to landfills. However, if there is no processing facility, it goes straight to a landfill.
2. Project the "Landfill" image. Ask learners to describe what they see.
3. *What do you think happens to all of this garbage? Is it decomposed? If so, how?* Accept responses and listen for any mention of decomposers breaking down organic matter.
4. Tell learners there are other methods for disposing of garbage. *Have you heard of any other means of disposal besides placing waste in the trash?* Accept responses and say that today they will compare two different methods of disposal.

Explore

1. Instruct the Equipment Directors collect a bag containing the Disposal Chart and Garbage Disposal Strips for their team.
2. Have teams take out the Disposal Chart. Explain that the "Landfill" and "Compost" headings represent two different methods for disposing of garbage. The strips in the bag describe what happens when garbage is disposed using these methods.
3. Explain that their job is to sort the strips and place them under the method that best fits the descriptions. Ask if they have any questions. Remind them to work as a team to make decisions.
4. Let teams know they have 5–8 minutes to sort the cards. (Time at teacher's discretion.)
5. As learners work, walk among them to listen to their ideas as they sort the cards. Make no corrections at this time.

Explain

1. When ready, ask the Data Scientist from each team to share one description they placed under "Landfill." *What made you think it belonged there?*
2. After each response, ask the other teams for a "thumbs up" if they agree or a "thumbs down" if they disagree. If they disagree, have them explain why. Listen to their reasoning, but do not make corrections yet.
3. Continue in this manner with both the landfill and compost descriptions until all have been discussed.
4. Then, validate and discuss their work as you project the "Landfill vs. Composting" slideshow.
5. **Project slide 2**. Explain that a landfill is a system of garbage disposal in which the waste is buried between layers of earth in a cell or hole. In years past, landfills were open pits that allowed more oxygen, heat, and moisture to provide a good environment for decomposition. However, it also created so much heat that fires sometimes erupted. Add that, in a landfill, there are many different types of garbage and materials that take a very long time to decompose, if they decompose at all.
6. Alternatively, composting is a managed, aerobic decomposition of organic materials by microorganisms. This process decomposes brown and green organic matter. Brown organic matter provides carbon from sources such as paper, dried leaves and yard waste, and twigs. Green organic matter provides nitrogen from fresh grass clippings, food scraps, and vegetable waste. Like landfills, compost piles generate a lot of heat and can also ignite, which is why compost piles need to be turned regularly.
7. **Project slide 3**. In recent years, it was believed that burying garbage in layers in a dry, closed pit was better for the environment, but that idea has been challenged by newer technologies that suggest a wet, controlled environment is better for decomposition. *Why would a wet environment be important?* The right amount of clean water is important for the survival of microorganisms, primarily bacteria and fungi, that decompose waste. What we consider waste can be a food source for many types of bacteria and fungi.
8. However, in a landfill, leachate—a liquid that results from rainfall seeping from and through waste—is contaminated by chemicals and heavy metals from garbage. This leachate is not good for decomposition or the environment. Add that leachate can also be a problem in composting if not managed properly.
9. Continue by affirming that composting is preferable to using landfills for all the reasons identified in the charts. It accelerates the decay and breakdown of organic matter. In contrast, food waste in a landfill is piled together, where it rots and produces methane gas, rendering nutrients unrecoverable. Composting, through the action of beneficial bacteria, recycles organic matter, enriching the soil with nutrients that support plant growth and nourish producers like plants.
10. **Project slide 4.** Explain that while methane and carbon dioxide are gases that can be harmful to the environment, they can also be beneficial if managed properly, as described in the slide.
11. **Project slide 5.** Let learners know that there are programs in place to monitor former landfills to ensure these landfills meet the safety and design requirements of a community. Add that compost is an important factor in organic and biological farming and gardening due to the richness and quality of the soil produced by organic decomposition.
12. **Project slide 6**. End by discussing the difference between the large land areas required for landfills and the flexibility of composting, which can be done on scales ranging from small household projects to larger community efforts.

Elaborate

1. *So which of these methods of garbage disposal do you think is more efficient for cycling matter and transferring energy?* Accept responses. Explain that, in both methods, decomposition of matter occurs through the action of bacteria and other microorganisms (consumers), though the process takes much longer in a landfill due to the anaerobic conditions created by layers of buried garbage.
2. Explain that in landfills, energy is primarily released as heat and methane gas during decomposition. In composting, energy is also released as heat and transferred through organic matter in the form of carbon and carbon dioxide gas back into the soil where it can be used by producers and in turn consumers. It is also released as heat and as carbon dioxide gas.

Evaluate

1. Ask learners to read the statement on the bottom of the Day 9 page in their Investigation Journals ("A proposal has been made to create a new landfill in your community.") Have them pair up and write a short argument **for and against** the landfill.

Science Language

- A **landfill** is a system of garbage disposal in which the waste is buried between layers of earth in a cell or hole. Decomposition is generally anaerobic.
- **Composting** is a managed, aerobic decomposition of organic materials by microorganisms.
- **Leachate** is a liquid that results from rainfall seeping from and through waste.

Expanded Standards

English Language Arts and Reading TEKS

5.13(C) identify and gather relevant information from a variety of sources.

CCSS

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

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(B)** identify and investigate cause and effect relationships to explain scientific phenomena or analyze problems; **(E)** investigate how energy flows and matter cycles through systems and how matter is conserved; (**F)** explain the relationship between structure and function of objects, organisms and systems; **(G)** explain how factors and 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.