Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science
Unit 2 Sample Lesson "Matter Cycles through Decomposition: What's the Breakdown?"
Matter and Energy in Organisms and Ecosystems
December 2022

The SIPS Grade 5 Science Unit 2 Sample Lesson "Matter Cycles through Decomposition: What's the Breakdown?", Matter and Energy in Organisms and Ecosystems was developed with funding from the U.S. Department of Education under the Competitive Grants for State Assessments Program, CFDA 84.368A. The contents of this paper do not represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

Science Grade 5
Unit 2: Matter and Energy in Organisms and Ecosystems
Sample Lesson: Matter Cycles through Decomposition: What's the Breakdown?
Suggested Time to Complete: 60 minutes

Purpose & Use Statement: *This sample lesson was developed for state and local administrators and teacher leaders (e.g. curriculum directors, instructional facilitators, professional learning specialists) to (1) illustrate an example of an instructional lesson developed using a principled design approach, and (2) support accompanying process documentation about how to use the SIPS unit as an instructional framework to intentionally design high-quality lessons in an aligned curriculum, instruction, and assessment system. This sample lesson should be evaluated and refined, as necessary, to align appropriately with a standards-based curriculum, instruction, and assessment system prior to its use. Additionally, teachers should refine this lesson to meet the local, cultural, and individual needs of students.*

Desired Results

Overview of the Learning Goals

In this lesson, "Matter Cycles through Decomposition: What's the Breakdown?", students engage with Big Idea 3 (Interdependent Relationships in Ecosystems) and figure out what happens to plants and animals when they die.

Students engage in an argument from evidence and analyze data about the role and importance of decomposers. Students draw on information from multiple sources to write a Claim, Evidence, and Reasoning (C-E-R) argument that explains the role and importance of decomposers and then add that evidence to their explanatory model.

Connections to Prior Learning (K-5)

DCI: PS3.D, LS1.C, LS2.A, & LS2.B

- Energy can be "produced, "used," or "released" by converting stored energy.
- Plants are living organisms.
- Plants need water and light to live and grow.
- Animals obtain food they need from plants or other animals.
- Living things need water, air, and resources from the land, and they live in places that have the things they need.

SEP: Engaging in Argument from Evidence

- Students develop a beginning understanding that arguments must be supported by evidence, evidence in support (or in contradiction) of an argument can be evaluated, and evidence can be relevant or irrelevant to the specific claim/question.
- Students continue developing their argumentation skills and abilities by constructing arguments, supporting those arguments with evidence, and forming an argument to critique an explanation or model.

SEP: Analyzing and Interpreting Data

- Students begin to analyze data in K–2 that builds on prior experiences and progress to collecting, recording, and sharing observations.
- In grades 3-5, students represent data in tables and/or various graphical displays to reveal patterns that indicate relationships. They analyze data to refine a problem statement or the design of a proposed object, tool, or process.

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CCC: Cause & Effect

- Students understand that events can be described in terms of cause(s) and effect(s) and have some experience identifying causes and/or effects.
- In grades K-2, students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.
- During grades 3, 4, and 5, students become adept at identifying/testing causes and effects and become aware that events can be correlated but not causally related.

Key Vocabulary

Students build conceptual meaning with and use key tier II and tier III vocabulary terms as they make sense of phenomena and phenomena-based design problems. This is not an exhaustive list of terms and should be reviewed and modified by educators, as appropriate.

- Producers
- Consumers
- Decomposers
- Decomposition
- Ecosystem
- Microbes
- Scientific argument

Targeted Stage 1 Learning Goals

Acquisition Goals (AG)

A20. Analyze and interpret data to make sense of the process of decomposition of matter, using logical reasoning.
A21. Use data to evaluate claims about the role of decomposers in breaking down matter.

Common Core State Standards (CCSS):

RI.5.7
RI.5.9

Enduring Understandings (EU)/ Essential Questions (EQ):

EU1/EQ1	EU2/EQ2

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
☒ Analyze & Interpret Data	☒ LS2.A Interdependent Relationships in Ecosystems (5-LS2-1)	☒ Cause & Effect
☐ Ask Questions	☒ LS2.B Cycles of Matter and Energy Transfer in Ecosystems (5-LS2-1)	☐ Energy & Matter
☐ Construct Explanations		☐ Patterns
☐ Define Problems		☐ Scale, Proportion, & Quantity
☐ Design Solutions		☐ Stability & Change
☐ Develop & Use Models		☐ Structure & Function
☒ Engage in Argument from Evidence (5-LS1-1)		☐ Systems & System Models
☐ Mathematics & Computational Thinking		
☐ Obtain, Evaluate, & Communicate Information		
☐ Plan & Carry Out Investigations		

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Formative Assessment Opportunities

Monitoring	Success Criteria	Possible Instructional Adjustments
• Small group conferences and discussion • Teacher questioning • Cause & Effect Graphic Organizer (see page 12)	Students can: • Make observations (effect) to produce data in determining the role (cause) and importance of decomposers • Use data (effect) to answer questions related to the role (cause) and importance of decomposers • Use observations and/or data (effect) to generate a conclusion about the role (cause) and importance of decomposers	The teacher can: • Provide additional scaffolds and supports and modes for responding to the task, such as visual tools and cues, examples, prompts, and sentence starters • Provide opportunities for class discussion and/or think-aloud for students • Ask in-the-moment questions as students are making their observations • Provide opportunities for peer and teacher conferencing and feedback
• Claim, Evidence, Reasoning Graphic Organizer • Student presentations and group discussion of C-E-R feedback • Student conferences • Teacher questioning	Students can: • Identify a claim related to the role and importance of decomposers in an ecosystem or the process of decomposition • Identify the evidence or data from their investigation and/or research to support their claim • Evaluate the evidence to determine whether it is sufficient and relevant to support the claim • Reason to connect the relevant and appropriate evidence to support the claim	The teacher can: • Model how to write a sample C-E-R response with a familiar, relatable topic • Revisit and discuss criteria (a CER checklist; see "Materials & Set-Up") for providing a strong claim, evidence, and reasoning • Provide peer review opportunities to provide and receive feedback from classmates

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Instructional Plan

Lesson Overview

In this lesson, students will **Explore** and **Explain** to investigate decomposers' role in breaking down food through a fruit's lifecycle.

- **Explore:** Students work in small groups to collaboratively write their predictions about what they think will happen to a fruit if left untouched for several weeks.
- **Explain:** Students use data from a video and a timelapse of a decomposing fruit to complete a Claim, Evidence, Reasoning Graphic Organizer to form an argument about the role and importance of decomposers.

Materials & Set-Up

- Images of a ripe banana, strawberry, or blueberries
- Poster paper and marker
- Copies of a Cause & Effect Graphic Organizer; one per student (see page 12)
- Copies of a Claim, Evidence, Reasoning Graphic Organizer; one per student
- Claim, Evidence, Reasoning development checklist
- Video: Decomposers and Scavengers
- Timelapses of Decomposing Fruit
  - Blueberry Decomposition
  - Strawberry Decomposition
  - Cantaloupe Decomposition
  - Orange Decomposition
  - Banana Decomposition
  - Papaya Decomposition

Anchor or Investigative Phenomenon: Decomposition of Organic Matter

Decomposers, such as bacteria and fungi, break down dead plants, animals, and waste matter and recycle nutrients back into the ecosystem.

Driving Question: What causes the fruit that is left untouched to change over time?

	Teacher Does	Students Do
Engage ☑ Introduce object, event, phenomenon, problem, or question ☑ Build background knowledge ☑ Facilitate connections		
Explore ☑ Explore object, event, phenomenon, problem, or question ☑ Guided exploration with hands-on activities	To inspire interest in the investigation and to capitalize on student curiosity, the teacher shares the images of the ripe banana, strawberries, or blueberries and asks students to collaborate with a partner to write their predictions about what	Students work in partners to write predictions, or what they know, about what happens to the fruit over the course of several weeks. Students share their predictions with the class.

	would happen to some fruit over time if left untouched in an orchard. The teacher encourages students to add specific details about what they think will happen. How will the fruit change over time? Will the fruit look different? How will it look different? What causes some fruit to look different? Once students have made their predictions, the teacher asks them to share their responses with the class and lists what students share on a poster titled, "What Happens to some fruit over time"? As students share, the teacher asks probing questions related to the decomposition process and makes note of any alternate conceptions or misunderstandings (e.g., the fruit becomes harmful to the environment as it decays) related to the role and importance of decomposers. The teacher shares the video "Decomposers and Scavengers" which students watch as a whole group. While watching the video the teacher pauses the video and allows students to take notes and turn and talk to peers about what they learned. After watching the video, the teacher engages students in a discussion.	As a class, students watch the PBS video, "Decomposers and Scavengers." This video highlights how large scavengers, small scavengers, and decomposers work together to break down organic matter. As students watch the video they should record notes about the decomposers and scavengers they see and the role they play in the ecosystem. Students discuss how decomposers play an important role in the decomposition process at pause points throughout the video. Students then revisit, refine, and add to their predictions about what will happen to a fruit left untouched for several weeks. Add to the list of students' predictions.
Explain ☑ Explain understanding of concepts and processes ☑ Introduce new concepts and skills to seek conceptual clarity	Next, the teacher shows images or a timelapse of a fruit left untouched over several weeks up to the final stage when it is fully decomposed. The teacher provides a Cause & Effect Graphic Organizer (see page 12) for students to record observations to support their CER.	Students analyze and interpret the data provided by the teacher and from the "Decomposers and Scavengers" video by recording their observations in a Cause & Effect Graphic Organizer (see page 12). This can be done in small groups, pairs etc.

	The teacher asks the students to write a claim that they will support based on how decomposers affect the fruit over time. The teacher provides students with a Claim, Evidence, Reasoning (CER) Graphic Organizer that supports the development of an evidence-based argument. (Note: If students have not had prior experience with CER or have not previously used the Claim, Evidence, Reasoning Graphic Organizer, the teacher may need to structure the activity as a guided or shared learning experience or offer additional scaffolds and supports (See "Differentiation Strategies and Resources"). Finally, as students work in their small groups to add to their explanatory models, the teacher should walk around the room and ask students probing questions to check understanding and encourage students to use evidence to support their modifications. Potential questions could be: What decomposers/scavengers do you think will be part of the owl ecosystem? Where do the decomposers/scavengers get their matter and energy in the owl ecosystem? What evidence do you have to support that? What happens to decomposers/scavengers in the ecosystem? (For example: students may add earthworms as a decomposer and should also include shrews as a predator of earthworms.)	Students independently write a Claims, Evidence, Reasoning argument supported by their scientific observations, data, and research. Students make a claim about the role of decomposers in what they observe happening to the fruit over time. Students defend their claim with evidence from the pictures/timelapse and video.  Students use evidence from their investigation and additional research and their reasoning to explain how the evidence supports their claim. Finally, students revisit their owl/predator explanatory models in their small groups. They should add information and details related to the role of decomposers in the ecosystem.

	CCSS ELA Connections: 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 (RI.5.7); Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably (RI.5.9)

Elaborate

☑ Build on or extend understanding and skill

☑ Apply concepts in new or related contexts

Evaluate

☑ Self-assess knowledge, skills, and abilities

☑ Evaluate student development and lesson effectiveness

Closing

As a class, the teacher asks students to share their CER arguments. The teacher facilitates a discussion to build a whole class consensus argument based on students' individual arguments.

As a class, the teacher revisits the decomposition predictions poster (see "Explore" section of the lesson) to review and add to what students know about decomposition and decomposers. The teacher asks students to think about and discuss why decomposers are an important part of the ecosystem. The teacher uses guiding questions such as, "What would the world be like without decomposers?" The class revisits the driving questions board for the unit and students discuss what they have figured out through their research and observations. Students share their findings and also raise additional questions.

Differentiation Strategies and Resources

"Universal Design for Learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (CAST, 2022). Taking time to reflect on prior instruction when planning for accessible, differentiated, and culturally responsive instruction for diverse learners and culturally diverse classrooms serves to identify ways to improve future instructional practices. The UDL Guidelines provide a framework for this reflection. The guidelines include three principles as ways to focus on variety and flexibility in instructional practices:

 Multiple Means of Engagement

 Multiple Means of Representation

 Multiple Means of Action & Expression

By examining instruction and instructional materials through the lens of each of these principles, teachers can identify and thus reduce or remove barriers to diverse learners.

Learning Opportunities	UDL Principle	Example Differentiation Strategies & Resources
Explore		
Students make predictions about fruit decomposition.		Personalize and contextualize to learners' experiences • Ask questions and/or make statements that enable students to consider their everyday observations or experiences related to the explored topics)
		Optimize individual choice and autonomy • Give learners a variety of fruits from which they can make their predictions
		Supply or activate background knowledge • Show a short video, objects, or photographs to remind students the characteristics of living and nonliving things
		Vary the ways for students to respond to questions or a task • Provide sentence starters, a writing template, or an expanded word bank • Provide a variety of ways in which students can "write" to make predictions (e.g., traditional form of writing, with sentence starters, using pictures, etc.)
		Minimize threats and distractions

Students identify and share key ideas from video(s).		• Provide variations in the pace and intensity of work, include independent and group work, and involve all learners in class discussions
		Support planning and strategy skills • Model and think aloud about how to take notes from the video or other texts
		Provide options for accessing instructional activities and materials • Ensure access is available for students who have a hearing impairment or visual impairment, who are blind, deaf, or deaf/blind (e.g., include audio description for video content, closed captions for video content, alternative text for graphics, preferential seating, an American Sign Language (ASL) interpreter, screen reader, enlarged text, etc.) • Allow for differences in rate, timing, speed, and range of motion (e.g., Allow enough time for all students to process the question and formulate their responses; Allow enough time for all students to move from one activity to the next, or to perform a task.)
Explain		
Students identify evidence and reason from their data analysis and the video to support a claim.		Vary the ways for students to respond to questions or a task • Allow students to use a variety of ways to create and share their C-E-R argument (e.g., drawing, pictures, objects, multimedia) • Provide a variety of ways in which students can "write" to respond to questions (e.g., traditional form of writing, with sentence starters, using pictures, etc.)

Resources

- Stem Teaching Tools #66: Why you should stop pre-teaching science vocabulary and focus on students developing conceptual meaning first
  [https://stemteachingtools.org/brief/66]
- Stem Teaching Tool #17: Beyond the Written C-E-R: Supporting Classroom Argumentative Talk about Investigations
  [https://stemteachingtools.org/brief/17]
- Mapping Vocabulary onto Student Sensemaking (Haverly, C., Hossein, B., & Richards, J., 2021)
  [https://www.nsta.org/science-and-children/science-and-children-novemberdecember-2021/mapping-vocabulary-student-sense]
- Effective Strategies for Teaching Science Vocabulary (Carter, S.J., UNC)
  [https://edcount.app.box.com/file/999662360871]

- Using Literature in the Science Classroom (McGinnis, P, 2020)
  [https://www.nsta.org/science-scope/science-scope-novemberdecember-2020/using-literature-science-classroom]
- Why Are Decomposers Important? [Lesson]
  [https://lab.betterlesson.com/lesson/631751/why-are-decomposers-important?from=search]

Core Text Connections

- Next Generation Science Standards Interactive Read Alouds
  [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.kbs.msu.edu/wp-content/uploads/2017/02/NGSS-Interactive-Read-Alouds.pdf]
- A Handful of Dirt
  [https://www.amazon.com/Handful-Dirt-Raymond-Bial/dp/0802786987/ref=sr_1_1?crid=3MKH78BASE56Y&keywords=a+handful+of+dirt+by+raymond+bial&qid=1665413715&sprefix=a+handful+of+dirt%2Caps%2C103&sr=8-1]
- Leaf Litter Critters
  [https://amzn.to/2jtUS7m]
- Compost Critters
  [http://www.amazon.com/gp/product/0525447636/ref=as_li_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=0525447636&linkCode=as2&tag=growitsciblo-20&linkId=R4B3IBTKRMFM4GSR]
- Rotten!: Decomposition
  [https://www.amazon.com/Rotters-Decomposition-Raintree-Fusion-Science/dp/1410919404/ref=sr_1_1?crid=W4YBWGPG2VS6&keywords=rotters%21+Decomposition&qid=1665413199&sprefix=rotters+decomposition%2Caps%2C93&sr=8-1]
- Rotten!: Vultures, Beetles, Slime, and Nature's Other Decomposers
  [https://www.amazon.com/Rotten-Vultures-Beetles-Natures-Decomposers/dp/1328841650/ref=sr_1_1?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412507&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-1]
- Decomposers (Food Chains)
  [https://www.amazon.com/Decomposers-Food-Chains-Megan-Lappi/dp/1616907126/ref=sr_1_3?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-3]
- Producers, Consumers, and Decomposers
  [https://www.amazon.com/Producers-Consumers-Decomposers-Spotlight-Ecology/dp/1499426194/ref=sr_1_5?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-5]
- Insects as Decomposers

[https://www.amazon.com/Insects-as-Decomposers-Lyn-Sirota/dp/1681916940/ref=sr_1_6?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-6

- Decomposers

  [https://www.amazon.com/Decomposers-Science-Kaleidoscope-Greg-Roza/dp/1435829816/ref=sr_1_8?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-8]

- Composting: Nature's Recyclers [Audiobook]

  [https://www.amazon.com/Audible-Composting-Natures-Recyclers/dp/B09WSVT4GM/ref=sr_1_9?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-9]

- Death Eaters: Meet Nature's Scavengers [Audiobook]

  [https://www.amazon.com/Death-Eaters-Meet-Natures-Scavengers/dp/B08GVHP1KJ/ref=sr_1_11?crid=26YMCNHXTGTHT&keywords=decomposers+books&qid=1665412613&qu=eyJxc2MiOiIwLjAwIiwicXNhIjoiMC4wMCIsInFzcCI6IjAuMDAifQ%3D%3D&sprefix=decomposers+books%2Caps%2C101&sr=8-11]

Cause & Effect Graphic Organizer
Observing Decomposing Fruit

Name _____ Date: _____

Describe the Phenomenon

_____

_____

Observation Write or draw a picture of the **effect.** What do you observe is happening to the fruit?	**Inference** Write or draw a picture of what you think **caused** this to happen. How do you know?