



Grade: 5

Subjects: Dance and Science

How Matter and Energy Transfer in an Ecosystem

<p>Lesson Overview</p>	<p>Students create a visual arts poster showing how matter and energy transfer in a food chain in order to more effectively understand the basics of this concept. Then the students work in small groups to choreograph a dance to show how energy transfers from the sun, directly to producers, to consumers, to decomposers, and then back to producers to start the cycle again. Through dance this cycle of energy transfer is illustrated with body movements to deepen students' comprehension of the process, and teamwork and problem-solving skills are fostered.</p>		
<p>How the Arts Improve this Lesson</p>	<p>By choreographing a dance based on their visual arts model of a food chain, students will be able to model this content with movement and deepen their understanding of how energy transfers from one organism to another. Traditional methods of paper and pencil are challenging for some students. Integrating kinesthetic body movements helps all students understand, and the traditional learner also excels by this method. All users utilize muscle memory and access different parts of the brain to fully comprehend how matter and energy transfer in an ecosystem. Furthermore, students practice collaborating as a team to achieve a shared goal, an experience that can highlight students' personal strengths and allow them to shine and gain confidence.</p>		
<p>Assessment of Student Learning</p>	<p>Massachusetts Learning Standards</p>	<p>Evidence</p>	<p>Collection Strategy</p>
	<p>Grades 5-6. Dance. Performing. 6. Convey meaning through the presentation of artistic work. Formally present a short</p>	<p>Students work in small groups to choreograph a dance with at least two dance terms intentionally included to represent the transfer</p>	<p>Teacher observes the dance and video, and listens to students' explanations to assess</p>

	<p>movement work to an audience. 5-6.D.P.06</p>	<p>of matter and energy in an ecosystem.</p> <p>Students perform the dance and explain their choreographic elements and choices.</p>	<p>understanding, and uses the grading rubric to evaluate.</p>
	<p>Grade 5. Life Science. Ecosystems: Interactions, Energy, and Dynamics. Develop a model to describe the movement of matter among producers, consumers, decomposers, and the air, water, and soil in the environment to (a) show that plants produce sugars and plant materials, (b) show that animals can eat plants and/or other animals for food, and (c) show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. 5-LS2-1.</p>	<p>Students create a labeled visual arts poster of a food chain that contains: sun, producer, consumer, secondary consumer, decomposer.</p> <p>Students create a choreographed dance to illustrate the food chain: plants producing sugars, animals eating plants and/or other animals for food, and fungi and/or bacteria breaking down dead organisms to recycle some materials back to the air and soil.</p>	<p>Teacher collects food chain posters to review for accuracy with grading rubric.</p> <p>Teacher observes the dance and video, and listens to students' explanations to assess understanding, and uses the grading rubric to evaluate.</p>
<p>Essential Questions</p>	<p>Where do choreographers get ideas for dances?</p> <p>What influences choice-making in creating choreography?</p> <p>How is energy cyclical?</p>		

	How do scientists recognize the changes in organisms?	
Enduring Understandings	<p>Scientists and dancers model content and skills in different ways but can achieve the same goal.</p> <p>Dancers create movements which express ideas and emotions.</p> <p>The same concept can be demonstrated in a variety of ways.</p> <p>Scientists examine cause and effect to see relationships between organisms, and compare organisms to make sense of our world.</p> <p>Scientists analyze and recognize how organisms change over time.</p>	
Materials and Needs	<ul style="list-style-type: none"> ● images of the following: bacteria, sun, plant with green leaves, herbivore, carnivore, mushroom, potato with leaves, sandy soil, loam soil ● drawing paper or poster board ● art supplies such as crayons, markers, colored pencils, paint, paintbrushes, magazines, glue ● chart paper ● video camera or other recording device ● space to move around and perform in 	
Advancing Vocabulary	<ul style="list-style-type: none"> ● carbon dioxide ● choreography ● consumer ● cycle 	<ul style="list-style-type: none"> ● dance ● decomposer ● elements of dance (body, energy, action, space, time) ● photosynthesis ● producer
Support & Accommodations	<ul style="list-style-type: none"> ● Instead of displaying all images in the front of the room, smaller images can be made for groups so that students can refer to them in an up-close manner. 	

<p>Inspired by Universal Design for Learning</p>	<ul style="list-style-type: none"> • Students, especially those with fine motor delays, can use images of producers, consumers, and decomposers from magazines or printed copies, instead of drawing all elements in their food chain poster. • Explain that dance moves can include non-locomotor movements (movements that don't travel across a room) to support students with mobility issues. • Vocabulary terms and definitions can be typed and glued into notebooks for students who struggle with taking notes.
<p>Lesson Plan Progression Details</p>	<p>Hook:</p> <ul style="list-style-type: none"> • Show an image of bacteria. Write on the board: How are matter and energy transferred within ecosystems? Ask: "What do you think this is an image of?" Give students an opportunity to share their ideas before revealing that it is bacteria. Ask: "Why do you think bacteria is important to ecosystems?" Have students write claims in their science journals, supported by evidence if possible, and then share with the class. (DOK 2- students predict and infer. DOK 3- students make claims and justify reasoning with examples and/or evidence) <p>Turn and talk:</p> <ul style="list-style-type: none"> • Display images of a sun, a plant, an herbivore, a carnivore, and a decomposer (bacteria, worms, or mushrooms). Say: "Turn and talk to your partner about how these organisms could be related." Walk around and listen to students' discussions. Have volunteers share what they discussed. Guide students to understand that matter and energy transfer from one organism to another when they "eat" or "consume" another organism. (DOK 2- students explain relationships) <p>Instruct, brainstorm, and question:</p> <ul style="list-style-type: none"> • Display only the image of the producer (plant). Ask: "How do you think producers, which are plants, get their energy if they don't have mouths to eat? Turn and talk to your partner and discuss the parts of a plant. What are the structures? What are the functions of each structure?" Have volunteers share what they discussed. Guide students to understand that the leaves of the plant absorb energy from the sun, water, and carbon dioxide to produce their own sugars (food) and release oxygen into the air in a process called photosynthesis. Plants are called producers because they produce their own food. On chart paper, have students brainstorm a list of producers. Guide students to observe that all of the

plants have some form of green leaf, even potatoes (show image). **(DOK 1- students remember, generate a list of producers. DOK 2- students explain the structures and functions of a plant)**

- On chart paper, have students brainstorm a list of consumers that eat producers. Say: “These are called primary consumers because they eat producers.” On another chart paper, have students brainstorm a list of consumers that eat other consumers. Ask: “What do you think these consumers are called? (They are secondary consumers.)” If you want to, or have time, you can continue with another chart paper and make a list of tertiary consumers that eat the secondary consumers. You can also discuss the “top of the food chain.” **(DOK 1- students generate lists)**
- Display the image of a mushroom. Ask: “Is this a plant or producer? How do you know? Why is this not a plant or producer? What do you think mushrooms are? How do they fit in the food chain or help matter and energy transfer from one organism to another? What do you think happens to producers and consumers after they die?” Have volunteers share their thoughts. Guide students to understand that all organisms decompose, or break down, after they die. Decomposers help organisms break down matter and turn the matter into nutrients or compost in the soil. They also release carbon dioxide in the air and in the water. Ask: “Why is this helpful to the ecosystem? Which part of the food chain do decomposers help the most directly? What would happen if there were no decomposers?” Show images of sandy soil and loam. Ask: “Which type of soil has more decomposers and how do you know? (The dark decayed matter does.)” What will happen if there are more decomposers? (More plants or producers can grow.)” Guide students to understand that decomposers are natural recyclers and help continue the energy transfer cycle. On chart paper, have students brainstorm a list of decomposers. **(DOK 1- students generate lists. DOK 2- students infer and draw conclusions. DOK 3- students use evidence and reasoning to explain claims)**

Make a Model:

- Ask students: “What is a model?” After the discussion, have students write in their science journals that a scientific model is a conceptual, mathematical, or physical representation of a real-world phenomenon, and it usually shows how something works. Tell students that they are going to create a physical model of a food chain on paper (poster board) and then work in groups to create a conceptual model of a food chain using dance/creative movement. Both will be shared with the class, so they will need to be

prepared to explain their artistic choices using specific dance and science vocabulary. Consider sharing an example of a visual model of a food chain to support understanding.

- Pass out the poster board paper for the food chain posters. Students use the art supplies to illustrate and label all parts in any food chain they desire, but they must include the sun, a producer, a consumer, a secondary consumer, and a decomposer. All elements must be in the correct order to show the flow of the cycle. Encourage students to ask for help if needed, and to support and discuss with classmates while working, if needed. Have students share their posters with the class using science vocabulary. **(DOK 4- students self monitor and use what they have learned about food chains to design their own visual representation of one. DOK 2- students explain their choices to the class)**

Learn Dance Vocabulary:

- Ask students, “What do you already know about dance?” Record responses. Teach dance vocabulary. Display each vocabulary word on chart paper, write the definition, model an example or have a student model an example, and then have students practice the movement(s). Teach students that there are five main elements of dance: body, energy, action, space, and time. An easy way to remember this is by using the acronym BEAST. Teach the vocabulary terms of *repetition* and *unison*. Practice all five elements BEAST, and repetition and unison in a variety of ways. **(DOK 1- students use and define dance terms. DOK 2- students practice a skill)**
 - **Body-** the human form is made up of body parts (head, arms, legs, etc.) that can take different shapes.
 - **Energy-** relates to the quality of movement, like smooth, sustained, sharp, sudden, or heavy, for example.
 - **Action-** relates to actions that the body can make, like those in place (twisting or bending, for example), or those made by traveling (running, leaping, or rolling, for example).
 - **Space-** includes space around the room and space around the body, and how the dancing body moves through the space(s).
 - **Time-** relates to duration, speed, and timing relationships, like before and after.
 - **Repetition-** a choreographic device where a movement or phrase is intentionally repeated.
 - **Unison-** a choreographic device where a group of dancers intentionally do the same movement at the same time.

Create a Choreographed Dance:

- Divide the students into groups of about four students. Each student should bring their food chain model poster with them as they convene in groups. Say: “As a group, you will choreograph a dance by planning out a sequence of moves to model how matter and energy transfer in an ecosystem. Show plants producing sugars from the sun, animals eating plants and/or other animals for food, and fungi and/or bacteria breaking down dead organisms to recycle some materials back to the air and soil. You may use the posters you made to inspire you, or come up with a completely new idea. You need to choose at least two dance terms to incorporate intentionally into your dance, and you must choreograph some kind of transition in between each part of your food chain so the segments flow together smoothly. For example, you might want to use repetition and move in unison.” Give students examples of transitions. Give students time to choreograph their dance. Remind students that they’ll need to be prepared to explain their dance to the class, and should plan to take turns as a group when explaining so all group member’s voices are heard. **(DOK 4- students self monitor, collaborate, create, problem-solve, and translate knowledge of a food chain from a visual into kinesthetic dance movements)**

Perform:

- Each group performs their dance for the rest of the class, who serves as the audience. Have the audience explain which food chain they think the group is trying to portray and why. Ask them to identify at least two dance elements (BEAST) that they observed and explain how the elements were connected to the food chain. For example, a student might say they observed the student portraying the sun by stretching body limbs out like rays of sun. Stretching can connect to the element of action. The performing group then explains their food chain to the class and how they represented it through their artistic choices. The group then performs the dance a second time. Record the dance using a recording device. **(DOK 3- students critique and respond to the dances).**

Journal and Reflect:

- After all the groups have performed twice, have students self-critique their dance by writing in their journals. Ask students to respond to these questions: What was your group’s food chain? Was the food chain clear to the audience, and why do you think this? How successful was your group in incorporating chosen dance elements into the choreography? Why? If you could change and improve your dance,

	<p>what would you do differently and why? (DOK 3- self evaluate and analyze)</p> <p>Revise:</p> <ul style="list-style-type: none"> • Give students time to work in their groups to incorporate new changes into their choreography, based on their written reflections. Show the video recording of the original dance and then have each group perform their new dance. Have the group explain their changes, if any, or state why they chose not to change anything. (DOK 3- students use self-critiques and audience-critiques to revise). <p>Wrap-Up Discussion:</p> <ul style="list-style-type: none"> • Ask: “How do matter and energy transfer in an ecosystem? How did the models and strategies we explored help you learn and remember, and why?” (DOK 3- students assess what they have learned with examples and evidence)
<p>Resources</p>	<p><i>Bacteria.</i> (n.d.). Getty images. Retrieved December 30, 2020, from https://www.gettyimages.com/photos/bacteria?phrase=bacteria&sort=mostpopular</p> <p><i>Dance.</i> (n.d.). The Kennedy Center. Retrieved December 30, 2020, from https://www.kennedy-center.org/education/resources-for-educators/classroom-resources/collections/collections/dance/</p> <p><i>Dance elements.</i> (n.d.). Printable worksheets. Retrieved December 30, 2020 from https://printableworksheets.in/worksheet/dance-vocabulary</p> <p><i>Mushrooms growing.</i> (n.d.). Getty images. Retrieved December 30, 2020, from https://www.gettyimages.com/photos/mushrooms-growing?phrase=mushrooms%20growing&sort=mostpopular</p> <p><i>Potato with leaves.</i> (n.d.). Getty images. Retrieved December 30, 2020, from https://www.gettyimages.com/photos/potato-with-leaves?phrase=potato%20with%20leaves&sort=mostpopular</p> <p><i>Sandy soil.</i> (n.d.). Getty images. Retrieved December 30, 2020, from https://www.gettyimages.com/photos/sandy-soil?phrase=sandy%20soil&sort=mostpopular</p>

Soil with compost. (n.d.). Getty images. Retrieved December 30, 2020, from <https://www.gettyimages.com/photos/soil-with-compost?phrase=soil%20with%20compost&sort=mostpopular>

Appendix

Grading Rubric for Poster:

Criteria	Exceeds Expectations	Meets Expectations	Needs Improvement	Developing
Illustration: Student creates a visual poster of a food chain that contains: sun, producer, consumer, secondary consumer, and decomposer.	The food chain is complete, showing sun, producer, consumer, secondary consumer, and decomposer. All elements are in the correct order to show the flow of the cycle.	The food chain is complete, showing sun, producer, consumer, secondary consumer, and decomposer. Most elements are in the correct order to show the flow of the cycle.	The food chain is not complete, as it lacks one of these elements: sun, producer, consumer, secondary consumer, or decomposer. Elements are not the correct order to show the flow of the cycle.	The food chain is not complete, as it lacks more than one of these elements: sun, producer, consumer, secondary consumer, or decomposer. Elements are not the correct order to show the flow of the cycle.
Labeling: Student labels all elements in the food chain on the poster.	The viewer can understand the food chain because all elements are labeled accurately.	The viewer can understand the food chain because nearly all elements are labeled accurately.	The viewer hesitates to understand the food chain because only some elements are labeled accurately.	The viewer cannot understand the food chain because few or no elements are labeled accurately.

Grading Rubric for Group Dance:

Criteria	Exceeds	Meets	Needs	Developing
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	Expectations	Expectations	Improvement	
Creating and Performing: Student groups create and perform a choreographed dance to illustrate the food chain and transfer of matter and energy.	The group's choreographed dance clearly illustrated the chosen food chain's transfer of matter and energy by showing: plants producing sugars from sun, animals eating plants and/or other animals, and fungi and/or bacteria breaking down dead organisms to recycle materials back to air and soil. There was intentional and recognizable use of at least 2 of the 5 dance elements. Transitions in between each part of the food chain were present so segments flowed together smoothly.	The group's choreographed dance illustrated the chosen food chain's transfer of matter and energy by showing: plants producing sugars from sun, animals eating plants and/or other animals, and fungi and/or bacteria breaking down dead organisms to recycle materials back to air and soil. There was use of at least 2 of the 5 dance elements, but they were recognizable with some hesitation. Transitions in between each part of the food chain were present but could have been smoother between	The group's choreographed dance illustrated part of the chosen food chain's transfer of matter and energy by showing most of these elements: plants producing sugars from sun, animals eating plants and/or other animals, and fungi and/or bacteria breaking down dead organisms to recycle materials back to air and soil. It is unclear if there was use of at least 2 of the 5 dance elements. Transitions in between each part of the food chain were present but could have been smoother between	The group's choreographed dance illustrated part of the chosen food chain's transfer of matter and energy by showing few or none of these elements: plants producing sugars from sun, animals eating plants and/or other animals, and fungi and/or bacteria breaking down dead organisms to recycle materials back to air and soil. It is unclear if there was use of at least 2 of the 5 dance elements. Transitions in between each part of the food chain were not present.

			segments.	segments.	
	<p>Explaining and Reflecting: Student groups reflect, revise, perform, and explain their choices.</p>	<p>The group performed their choreographed dance two or more times. The group members took turns explaining their choices, noting how elements of the dance connected to the chosen food chain. The group collaborated to revise and perform their dance again, and took turns explaining their choices, including reasoning if they didn't make any changes.</p>	<p>The group performed their choreographed dance two or more times. The group members had some hesitations when taking turns explaining their choices, noting how most elements of the dance connected to the chosen food chain. The group collaborated to revise and perform their dance again, and had some hesitations when taking turns explaining their choices, including reasoning if they didn't make any changes.</p>	<p>The group performed their choreographed dance at least once. The group members struggled to take turns explaining their choices, and struggled to note how elements of the dance connected to the chosen food chain. The group struggled to collaborate to revise and perform their dance again, and struggled to take turns explaining their choices, including reasoning if they didn't make any changes.</p>	<p>The group performed their choreographed dance once or not at all. The group members struggled to take turns explaining their choices, and could not note how elements of the dance connected to the chosen food chain. The group did not collaborate to revise and perform their dance again.</p>

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