

Yeasty Beasties

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for the STEM Education Center at WPI's Summer 2022 Research Experience for Teachers program

Subject: General Science

Grade Level: 7

United Nations Sustainable Development Goals:

Goal 13: Take urgent action to combat climate change and its impacts.

Goal 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverses land degradation and halt biodiversity loss

Overview

Part 1: "It is the future, and a mysterious crisis is happening in Worcester. In the news and around your city, you see trash and dead matter, such as leaves, trees, and dead animals piling up. Things are getting stinky! Scientists need your help to figure out what could be causing this to happen."

Part 2: "Thanks to your hard work we now know what is happening in the environment causing this trash and dead matter to pile up. Your help is needed again to find solutions to fix this problem and make the ecosystem healthy again!"

Standards & Learning Targets

7.MS-LS2-3. Develop a model to describe that matter and energy cycle among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes

Clarification Statements:

- Cycling of matter should include the role of photosynthesis, cellular respiration, and decomposition, and transfer among producers, primary, secondary, and tertiary consumers, and decomposers.
- Models may include food webs and food chains.

State Assessment Boundary:

- Cycling of specific atoms (such as carbon or oxygen), or the biochemical steps of photosynthesis, cellular respiration, and decomposition are not expected in state assessment.

Vocabulary	Tier 1	Tier 2	Tier 3
	Develop Describe Cycle Living Process	Model Matter Energy Transfer Consumer	Ecosystem Conserve Photosynthesis Cellular respiration Decomposition



		Producer	Decomposer Food web Food chain
What do students need to KNOW ?	<p>Students will use the following vocabulary words in context:</p> <ol style="list-style-type: none"> 1. Ecosystem 2. Model 3. Cellular respiration 4. Matter 5. Energy <p>Students need to know that matter and energy cycle among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes. Students need to know that cellular respiration, photosynthesis, and decomposition are integral processes within the cycling of matter and energy in an ecosystem.</p>		
What do students need to DO ?	<ol style="list-style-type: none"> 1. Develop a model that shows how matter and energy cycle among living and nonliving parts of an ecosystem 2. Describe that matter and energy cycle among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes 		
What will students CREATE ?	<ol style="list-style-type: none"> 1. Students will create a model to demonstrate the cycling of matter in an ecosystem. 2. Students will write a lab report to report on their methods and findings. 3. Students will create a poster to share their knowledge and finding with others 		

<p>7.MS-LS2-5. Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design.*Hide details</p> <p>Clarification Statements:</p> <ul style="list-style-type: none"> • Examples of design solutions could include water, land, and species protection, and the prevention of soil erosion. • Examples of design solution constraints could include scientific, economic, and social considerations. 			
Vocabulary	Tier 1	Tier 2	Tier 3
	Benefit Discuss	Evaluate Compete Protect Limitation Solution Design	Ecosystem
What do students need to KNOW ?	<p>Students need to use the following vocabulary words correctly in context:</p> <ul style="list-style-type: none"> • Evaluate • Compete • Protect 		



	<ul style="list-style-type: none"> • Ecosystem • Design <p>Students will need to know that human activities impact ecosystem health. Students will need to know that different possible solutions to environmental problems have benefits and drawbacks. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health</p>
What do students need to DO ?	1. Evaluate and refine solutions for protecting ecosystem health
What will students CREATE ?	1. Students will create a proposal for a solution for protecting ecosystems

ELA Standard: Write informative/explanatory texts (e.g., essays, oral reports, biographical feature articles) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.			
Vocabulary	Tier 1	Tier 2	Tier 3
	Ideas Information Topic Write Text Clearly Accurate	Examine Organization Analysis Selection Effective	Informative Explanatory Biographical Oral
What do students need to KNOW ?	<p>Students will use the following vocabulary words in context:</p> <ol style="list-style-type: none"> 1. Analysis 2. Examine 3. Organize 4. Information 5. Idea <p>Students will know how to write in an informative and explanatory style in order to analyze and examine data. Students will know how to organize this information and communicate their ideas using evidence.</p>		
What do students need to DO ?	<ol style="list-style-type: none"> 1. Students will write informative/explanatory texts to examine and convey ideas and information about the concepts they learn in class, their lab and report, as well as through their poster 2. Students will share complex ideas and information with others clearly and accurately, through the effective selection, organization, and analysis of content. 		
What will students CREATE ?	<ol style="list-style-type: none"> 1. Students will create a lab report to a write in an informative and explanatory style in order to examine data and convey the scientific method clearly. 2. Students will create a poster to convey information and ideas about a 		



complex real-world problem through effective selection, organization, and analysis of content resources.

Prior Knowledge

Prior to this lesson, students should have a basic understanding of the functions of different organisms in an ecosystem in the context of a food web, including producers, consumers, and decomposers. Students should begin the lesson with an existing basic knowledge of photosynthesis, cellular respiration, and the cycling of matter and energy through an ecosystem

Materials/Resources

Introduction and Lab Report Portion:

- Videos
- Reading materials
- Powerpoint presentation
- Lab report template
- Laptops for students or print outs

Lab portion:

- Yeast packet (1 packet for each group)
- 12 oz water bottle (3 for each group)
- Balloons (3 for each group)
- Spoons (4 for each group)
- Water
- Lemon juice
- Sugar
- Molasses/maple syrup
- Honey
- Vinegar
- Lab instructions and powerpoint

Poster Portion

- Videos
- Poster paper
- Markers
- Powerpoint presentation

Timeline of Activities

Each lesson takes one, 47 minute class period.

Activity	Instructions	Product
Students will complete close reading of a scientific article and	1. Starter: 2. Go over objectives	Students will: - Complete a starter



<p>apply information learned to answer questions about their role in an ecosystem.</p> <p>Introduction of yeast as an organism that will be used through unit.</p>	<p>3. Main Activity: Students complete a close reading in pairs giving background information on yeast and their role as decomposers in an ecosystem.</p> <p>a. Potential Articles to read: Introduction from Yeasty Beasties (add paragraph contextualizing yeasts as decomposers, their role in ecosystems)</p> <p>4. Exit ticket:</p>	<ul style="list-style-type: none"> - complete a worksheet with related questions - Complete an exit ticket
<p>Students will watch a video about yeast and cellular respiration then engage in an online interactive to reinforce knowledge</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Watch yeast/cellular respiration video <ul style="list-style-type: none"> a. Followed by brief class discussion of major points and understanding questions 4. Online cellular respiration interactive with accompanying questions 5. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Complete companion questions for online interactive - Complete an exit ticket
<p>Students will watch a video about different variables to reinforce base knowledge of the scientific method.</p> <p>Students will be guided through developing an experiment to test which environment yeast prefer to grow and respire in.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Watch variables video (maybe scientific method too?) <ul style="list-style-type: none"> a. https://www.youtube.com/watch?v=J9kCgWAuBOY 4. Complete a pre-lab <ul style="list-style-type: none"> a. Hypothesis b. Questions on yeast background info c. Pick variable d. Experimental design 5. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Complete pre-lab write up - Design an experiment using the scientific method - Complete an exit ticket
<p>Students will work in groups of 3 to implement their experiments. Kits will be pre-prepared based on each group's material needs.</p>	<ol style="list-style-type: none"> 1. Starter <ul style="list-style-type: none"> a. Sit in groups (of 3) for lab, Review pre-lab procedures 2. Set up experiment <ul style="list-style-type: none"> a. Students will implement plans of trying different 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Execute a wet lab experiment designed through use of the scientific method



<p>Students will record data in pre-made/guided tables.</p>	<p>solutions for yeast growth (sugar, salt, vinegar, molasses)</p> <p>b. take initial measurements</p> <p>c. record data</p> <p>3. Exit Ticket</p> <p>a. Cleaning up from experiment</p>	<p>- Complete an exit ticket</p>
<p>Students will extend their knowledge of how yeast respire and live. They will brainstorm what yeast eat and be exposed to new discoveries about what yeast metabolize such as oil and carbon dioxide.</p> <p>Students will apply this new information to discuss how this can be used in the world-> global warming.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Post Lab activity <ol style="list-style-type: none"> a. Debrief lab b. Content review/discussion about what yeast 'eat' <ol style="list-style-type: none"> i. What did they like to 'eat' most in the lab? 4. Question- what else might yeast 'eat'?-> Discussion 5. Show video of bioremediation yeast that metabolize oil 6. Have either discussion/worksheet for groups about how these yeast could be used <ol style="list-style-type: none"> a. Global warming context 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Complete a group worksheet for yeast extension in global warming - Complete an exit ticket
<p>Students will begin the write up of their experiment.</p> <p>They will work on the title, purpose, hypothesis.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Introduce lab report 4. Go over lab report part A <ol style="list-style-type: none"> a. Begin with modeling then work in groups b. Everyone submits their own c. Title, Purpose, Hypothesis 5. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Create a lab report - Understand and be able to write a title, purpose, and hypothesis - Complete an exit ticket
<p>Students will work on the write up of their experiment.</p> <p>They will work on the materials and procedure.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Go over lab report part B <ol style="list-style-type: none"> a. Materials list, procedure 4. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Create a lab report - Understand and be able to write a materials and procedures section - Complete an exit ticket



<p>Students will work on the write up of their experiment.</p> <p>They will work on data measurements and data analysis.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Go over lab report part C <ol style="list-style-type: none"> a. Data measurements and data analysis b. Draw a model of cycling of carbon through ecosystem 4. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Create a lab report - Understand and be able to create tables and graphs to analyze data and measurements. - -Understand how to write about data. - Complete an exit ticket
<p>Students will work on the write up of their experiment.</p> <p>They will work on the conclusion.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. Go over lab report part D <ol style="list-style-type: none"> a. Conclusion 4. Exit Ticket 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Create a lab report - Understand and be able to write a conclusion - Be able to talk about the meaning of the results of their experiment - Complete an exit ticket
<p>Students will work on the write up of their experiment.</p> <p>They will work on revising the full report and adding in an extension of applying their knowledge about global warming and yeast.</p>	<ol style="list-style-type: none"> 1. Starter 2. Go over objectives 3. go over lab report, if completed work on lesson extension <ol style="list-style-type: none"> a. Add element of the extension from post lab activity to report at the end b. Revise 	<p>Students will:</p> <ul style="list-style-type: none"> - Complete a starter - Create a lab report - Understand and be able to write a full lab report. - Complete an exit ticket
<p>Students will be introduced to a "real world problem" in which decomposition isn't happening. Students will use the schema of a brainstorming template to apply their findings</p>	<ol style="list-style-type: none"> 1. Starter 2. Objectives 3. Go over "problem" - in the future, trash and dead matter is piling up, why isn't decomposition happening? Work in groups to problem-solve and discover possible explanations & solutions <ol style="list-style-type: none"> a. Use brain-storming template 	<ul style="list-style-type: none"> - Complete a starter - Complete a brainstorming template - Complete an exit ticket



from the lab to solve this problem.	4. Exit ticket	
Students will view a video and complete a worksheet/notes about real world situations which lack decomposers (oil spills, plastic pollution, etc.) Students will be introduced to poster assignment.	5. Starter 6. Objectives 7. Start with video or reading giving more information about conditions and decomposer/example of real life lack of decomposers 8. Explain requirements for what must be on the poster 9. Exit ticket	- Complete a starter - Complete Notes or worksheet with information about decomposers - Complete an exit ticket
Students will be organized into groups to work on the first part of their poster. Using their notes, knowledge from videos and close readings, as well as their lab report. Students will use CER strategies to explain the problem of "why trash is piling up, and where are the decomposers?"	10. Starter 11. Objectives 12. Work in groups on "Why is this happening?" section of poster a. Use CER, cite lab results as evidence 13. Exit ticket	- Complete a starter - Complete "Why" section of group poster - Complete an exit ticket
Students will return to the same groups from yesterday to complete the second part of the poster. Students will apply their knowledge from the lab work, close readings, and videos within a CER template to propose & defend possible solutions.	14. Starter 15. Objectives 16. Work in groups on "Possible Solutions" section of poster a. Use CER, cite lab results as evidence 17. Exit ticket	- Complete a starter - Complete "problem solving" section of group poster - Complete an exit ticket
Students will display posters and participate in a gallery walk to give feedback to and learn from peers. Students will reflect on what makes a poster/argument convincing and how they could improve their own poster.	a. Starter b. Objectives c. Gallery walk of posters i. Must write at least 3 comments and have 3 questions d. Exit Ticket i. Which poster was most convincing? Why? ii. How would you change your poster after seeing everyone else's?	- Complete a starter - A completed poster including explanations and problem solving will be presented to class through a gallery walk - Complete an exit ticket

Culturally Responsive Teaching Strategies

Purposefully Structured Instruction	Break down all portions of the lesson, especially lab procedures, lab report, and brainstorming sessions, into smaller tiered steps. This provides students with scaffolding for all levels to access material.
Modeling and exemplars provided	Modeling, providing exemplars and doing "think alouds" make expectations clear for what products students are expected to complete and make the thinking process visible and demystified for students
Pre-teach and re-teach vocabulary via direct instruction	Daily direct vocabulary instruction and review built into starters and exit tickets helps make academic vocabulary and texts accessible to all students and supports ELL vocabulary acquisition
Visuals and graphics	Visuals and graphics incorporated into lessons (eg. embedded into close reading text, videos, online interactives, lab work, posters, starters, etc.) support student understanding of vocabulary, text, and concepts
Graphic organizers with sentence frames	Graphic organizers and sentence frames support all students to be able to find the language to express and organize their thoughts
Small group and partner work	Small group and partner work support all learners to participate in the collaborative learning process
Culturally relevant/real-world problem	Assigning a visible, real-world problem (trash piling up and not decomposing) to which students can relate and localizing it to Worcester makes the lesson relatable and relevant for students, draws on their lived experiences
BIPOC representation in lesson materials	Selecting lesson materials which include images, photographs, and videos showing BIPOC people of various genders doing and discussing science promotes an inclusive & welcoming classroom environment

Career Connections

To connect this activity to STEM careers we will reference potential careers throughout the lesson as they are applicable. When discussing the real-world problem, we will mention that "a team of scientists" needs their help. We could specify that those scientists are biochemists or ecologists. Next, during their brainstorming and solution developing sessions for the real-world problem, we can mention that they are helping or working as a team of engineers.

- Environmental Engineer
- Chemical Engineer



- Biochemist
- Ecologist
- Biologist

Assessment

[Project Rubric](#)

