Leaving Our World Better Than We Found It: Join The Movement!

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for the STEM Education Center at WPI's Summer 2023 Research Experience for Teachers program
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Subject: Science
Grade Level: 8
United Nations Sustainable Development Goals:
Goal 6: Ensure availability and sustainable management of water and sanitation for all.
Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

Overview

The students will take on the role of an environmental scientist who is researching an area of the world, focusing on the major sources of pollution and the impact humans have on the environment in that area. Using the background research and infographic created, the student is charged with developing a public service announcement to the public about using renewable energy sources appropriate for that area. and building a prototype of a device that can be used to clean the water pollution.
Extension: writing a letter to the stakeholders in the local community to fund cleanup efforts and ways to reduce carbon footprint.

Standards & Learning Targets

8.MS-ESS3-5 Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century.
Clarification Statements:
• *Examples of human activities include fossil fuel combustion, deforestation, and agricultural activity.*
• *Examples of evidence can include tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; and the rates of human activities.*

Vocabulary	**Tier 1 - Everyday**	**Tier 2 - School**	**Tier 3 - Classroom**
	temperature data activities Pollution oceans water	analyze, interpret examine describe	global warming fossil fuels human activities deforestation pesticide agriculture carbon dioxide methane
What do	1. Students will use the following vocabulary words in context: global		

students need to **KNOW**?	warming, climate change, fossil fuels, deforestation, water pollution 2. Students will be able to explain how pollution negatively affects water sources used for human consumption. 3. Students will need to research background information / data for a major city around the world. (Student choice or from a list of pre-researched places.) 4. Students will need to be able to interpret data from graphs and charts to identify relationships between variables.
What do students need to **DO**?	1. Construct an explanation for how extracting, refining, and using fossil fuels or minerals can have a negative impact on the environment and human health. a. causing more carbon dioxide in the air, which is a primary cause of climate change. b. causing more particulates in the air which contributes to asthma and other respiratory conditions. c. causing more toxic chemicals to enter water sources 2. Compare and critique arguments on the same topic and analyze whether they emphasize similar or different evidence. Argumentation is the process by which evidence-based conclusions and solutions are reached.
What will students **CREATE**?	Part 1 of Unit: 1. Cause & Effect Graphics and Card Sort 2. Padlet posting Part 2 of Unit: One-pager summary (on a Google slide) of a chosen city's climate data and primary source of greenhouse gas emissions. Includes graphs of temperature and precipitation trends. a. Pie charts representing energy sources used in the area. b. At least one image of the city. c. CIted quote to back up the claim the city is undergoing a climate crisis. Part 3 of Unit: 1. Relate information previous research and apply to the local environment. (Such as, efforts other places have tried.) 2. Public service announcement to the residents of hometown. Part 4 of Unit: A model using recyclable materials or blueprint of the solution to mitigate the pollution in a water source close to school. (scaled down model) a. Research on a specific local pollutant and how it negatively affects water sources. (fossil fuel, pesticide, etc) b. A cost-benefit analysis / advertisement to persuade water departments to use this product. Part 5 of Unit: Letter to the school committee, principal, or other stakeholders to express importance and persuade the use of water filtration technology. a. Incorporate the use of renewable energy to eliminate waste products in water sources. (ie, solar power instead of gasoline)

ELA Standard: Write arguments (e.g., essays, letters to the editor, advocacy speeches) to support claims with clear reasons and relevant evidence.

a. Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically in paragraphs and sections.
b. Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
d. Establish and maintain a style appropriate to audience and purpose (e.g., formal for academic writing).
e. Provide a concluding statement or section that follows from and supports the argument presented.

Reading Standards for Informational Text:
Cite the textual evidence that most strongly supports an analysis of what a text states explicitly as well as inferences drawn from the text, quoting or paraphrasing as appropriate.

Presentation of Knowledge and Ideas:

5. Integrate multimedia components and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

Vocabulary	**Tier 1 - Everyday**	**Tier 2 - School**	**Tier 3 - Classroom**
	organize understand state multimedia essay letters speeches presentations	clarify claims evidence reasoning clause argument audience purpose relevant	advocacy credible cohesive counterclaim explicit textual
What do students need to **KNOW**?	1. Proper grammar and spelling use that is at least near / at grade-level appropriate. 2. Researching from reputable and reliable sources and paraphrasing text into words. 3. Supporting claims with relevant data and evidence from research.		
What do students need to **DO**?	1. Create a visual that accurately presents climate data and human consumption of resources which is appropriate for their own grade level audience. 2. Explain the benefits and drawbacks of a model that is constructed to accomplish a specific goal. 3. Persuade those in the community to change to a more sustainable lifestyle through a choice of multimedia which includes, but is not limited to, a video, speeches, ad campaign, children's book, etc. 4. Write a letter to a decision-making body in the community to support and / or fund an eco-friendly energy initiative.		
What will students **CREATE**?	1. Visual with coherent and cohesive information about their selected city. 2. A persuasive writing or multimedia presentation which encourages stakeholders in the school to support a renewable energy resource. 3. A letter with well-written evidence and reasoning to support an initiative for		

	the local community.

Prior Knowledge

- Water cycle
- Human impact on the environment: use of fossil fuels, pollution, etc.
- Effect of global temperature rise on climate
- Methods of communication

Materials/Resources

- Computer with Internet access
- Slideshow program
- Poster paper (12" x 18")
- Art materials
- Recyclable materials such as plastic water bottles, fabrics, coffee filters
- Small pebbles, activated charcoal, sand, gravels (as needed)
- Video filming equipment (if needed), ex: computer, cell phone, camera

Timeline of Activities

Each lesson takes one, 60 minute class period.

Duration	Activity	Instructions	Product
1 class	Hook / Unit Introduction	• Discussion of work at WPI and display of poster • UN Sustainable Development Goals Introduction • Climate Superhero Kahoot: Here • Climate Change / Human Impact Word Splash	Word Splash

1 class	Climate Change Review / "Crash Course"	• Water Cycle & Pollution Connections
		  ○ Cause & Effect Graphics
		• Real World Events: Group Discussion
		  ○ Padlet with student input on local effects observed (pollution, temperature changes, water usage, etc.)
			Padlet Posting

2 classes	City One-Pager	*Day 1:* • Research a world major city of one's choosing, or from a list of suggested places. • Create a one-pager following these directions.	One-Pager Google Slide **Sample Slide**
		Day 2: • Share slides with classmates in a Google Classroom discussion. • Brainstorm how these human impacts and solutions relate to the local town.	Discussion posts on Classroom Exit Ticket

		• Exit ticket: Reflect on a presentation and leave a comment that asks a question or provides feedback on the student's work.	
3 classes	Public Service Announcement	*Day 1:* • Reflecting on research of the city, work with a group to make connections to the school's town. ("What works elsewhere? What could we try?") • Fill in a graphic organizer which will include all pertinent information.	Public Service Announcement Graphic Organizer
		Day 2: • Draft PSA script / visual and proofread. ○ Peer edits • Begin creation of final product (if time)	Public Service Announcement Draft Peer Feedback Rubric
		Day 3: • Finish creating the final product. • Post it on Google Classroom and/or around the physical classroom for a Gallery Walk. • Self-Grade using rubric.	Final Public Service Announcement Rubric
4 classes	Design / Build Water Filtration Prototype	*Day 1:* • Presentation of the Problem • Read information about water pollution • Be given a list of materials and design constraints. • Brainstorm solutions on chart paper with a group of 2-3 students.	Chart paper from brainstorming EDP Packet Steps 1 &2
		Day 2: • Draw orthographic sketches of the prototype. • Decide on the type of materials and quantity of each. • Start the build.	EDP Packet Steps 3 & 4 Cost estimates
		Day 3: • Finish the prototype. • Begin testing. • Go back and redesign as needed.	EDP Packet Steps 5 & 6
		Day 4: • Finish design by the halfway point of class. • Fill in a prototype proposal form. • "Pitch" idea to fellow classmates. • Class votes on a winning prototype using a Google Form. Water Filtration Device EDP Grading Rubric	Prototype Final Vote
1 class (if time allows) or complete for extra credit	Persuasive Letter	Write a letter to the principal, superintendent, school committee, and/or the town selectmen to support their own or another "green" initiative at the school after researching the initiative. Examples are including, but not limited to: - Recycling Program - "Green Roof" - Solar Panels - Bike rentals for school-to-home transport	Persuasive Letter

Attending to Equity - Teaching Strategies

Strategy	Explain how the strategy contributes/relates to the lesson/activity
Voice in Choice	Students will be able to choose the way their public service announcement will be shared. They can make a news report, commercial, billboard campaign, public speech, or any other mode they choose.
Environmental Justice	People from all cultures, regardless of socioeconomic status, have a right to a pollution-free environment. Students will explore climate change worldwide and how it affects all different kinds of communities.
Modifications and Accommodations	Students will all be expected to put forth their best work. However, accommodations and modifications to expectations will be made as needed according to the student's ELL status, IEP, or 504 academic plan. Sentence frames will be added depending on the student's abilities.
Awareness of Global Issues	Many different areas of the world will be explored through research and shared with the class. The purpose is to provide students with a wider world view and have an awareness for other cultures and ways of life.
Chalk Talk	Students have access to a Padlet at all times which will ask questions about student connections to their own lives and experiences as the unit progresses. Can remain anonymous, but in-class sharing is supported.

Career Connections

Environmental Scientist: Study the conditions of a location and how activity from humans have affected local ecosystems, animal life, and quality of life for the people who live there.

Environmental Lawyer / Climate Activist: Representing the interests of the environment, conservation efforts, and stopping the misuse of natural resources at the expense of ecosystems and human life.

Environmental Engineer: Building instruments for various purposes (such as filtration or "green power" sources) to effectively improve air and water quality of ecosystems on a local level.

Science News Reporter / Columnist: Explain to the public the current climate crisis and efforts to mitigate the negative human impact on the world

Assessment

Performance Assessment Rubric

1. **One-Pager:** Summary of assigned city which includes data and analysis of relevant climate and human consumption of natural resources.
2. **Public Service Announcement:** A chosen medium for persuasive argument toward the citizens of their hometown to change lifestyles in order to prove environmental conditions, using knowledge from the previous assignment.
3. **Model** of a solution to filter water from the town. (Samples collected from local ponds and rivers by students.) Include drawings, benefits and drawbacks, and rationale for design.
4. **Persuasive letter** to school committee, principal, and other stakeholders to fund a renewable energy source for the building / town which aligns to their public service announcement.