

Learning Cycle (5E's)

Science 10: Explore Cultural Perspectives on Sustainability

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I: Introduction

Objectives

- To have students understand what sustainability is and critically think upon whether they believe sustainability is something within reach of our society and to have
- Students understand that scientific understanding is situated within social, economic and political perspectives.
- To have students understand their relationship with the environment and how it affects the environment and have students understand how different cultures and groups of people have different perspectives on the environment and on the idea of sustainability.

Suitable Topic for the Learning Cycle

I believe this is a suitable topic for the learning cycle because while investigating students' own beliefs on the environment as well as others beliefs, it allows for the opportunity of inquiry and for the opportunity to explore connected ideas. Since there are so many aspects of sustainability and perspectives of sustainability, it allows for student control of their learning interests. It also allows for great discussion around different cultural perspectives and how that influences organizations that are making the big environmental decisions.

Curriculum Fit

This learning cycle activity fits into Science 10, SE1: Explore Cultural Perspectives on Sustainability. The three objectives that I chose to cover in this learning cycle are:

- Objective 1: Examine how various cultures view the relationships between living organisms and their ecosystems.
- Objective 4: Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others with respect to sustainability and the environment.
- Objective 5: Identify multiple perspectives that influence environment-related decisions or issues.

Overall Success of Learning Cycle

The overall success of the learning cycle will be judged on the enthusiasm and excitement of my students. If my students are excited about learning, they will be more willing to think deeper and critically explore their role in the stability of the environment.

Time Estimate

The ideal time for this series of lessons would take approximately 5.5 hours.

- Engage Activity: What is Sustainability? Making Global Connections-20 minutes

- Explore Activity #1: Explore Personal Relationships with the Environment-60 minutes
- Explore Activity #2: Different Perspectives on Sustainability Debate-60 minutes
- Explain: Discussion-60 minutes
- Extend: Greenhouse Gasses-120 minutes

II: Engage Activity- What is Sustainability? Making Global Connections

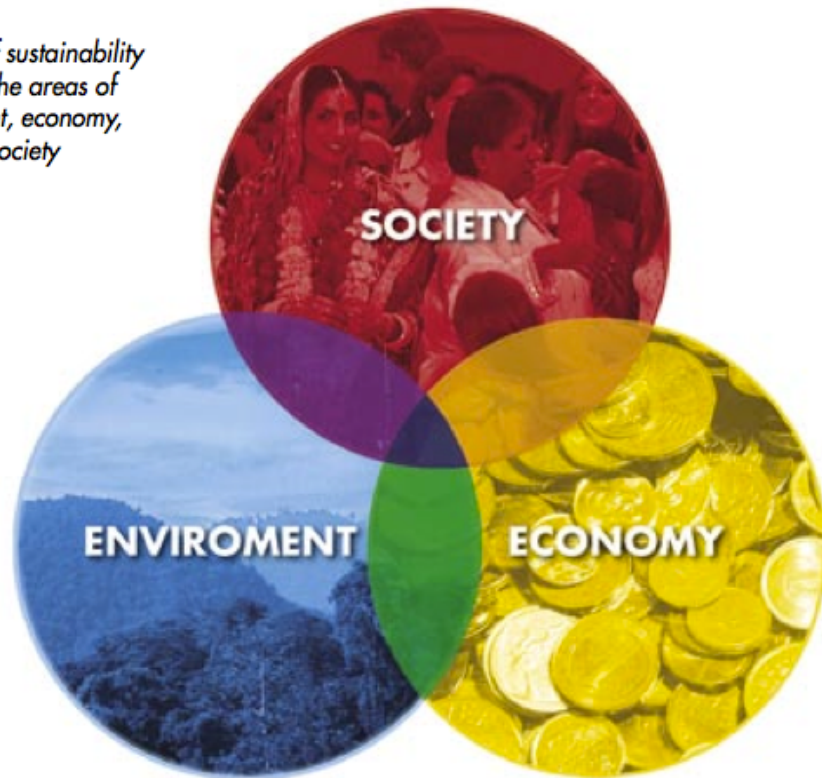
Materials and Safety

- Handout one advanced global issues card to each student.
- One string of yarn.
- Establish rules prior to the game to ensure students are not throwing the yarn hard to each other.
- Have students make an “Environmental Journal” section in their binders or notebooks.
- Have journal prompt and picture on sheet to handout to students and have them put in their journals.

Description of Activity

- Students will stand in a circle.
- Hand out one global issue card to each student (poverty, consumption, population growth, peace and conflict, human migration, environment, technology, healthcare, education, food, water, price of food, discrimination, global warming, culture, social justice, non renewable resources, renewable resource, energy use, media, trade).
- Have one student hold the end of the ball of yarn. That student will then say their global issue and toss the ball of yarn to a student across the circle.
- The student that just caught the ball of yarn will state his or her issue and how it is connected to the person’s global issue that just threw the yarn.
- If the students cannot think of a way it is connected, other students may think of a connection to help them.
- Continue the exercise until everyone has caught the ball.
- Have each student step back a few steps to make sure the web is tight.
- At that time, have each student slowly tug on their piece of the string they are holding. Ask students if they felt the tug.
- After the activity, have students reflect in their journal for 5-10 minutes based on the following **prompt**:
From the activity we just did and the picture below, what do you think sustainability is? How does the interconnectedness of global issues that we saw in the activity effect your idea of sustainability? Explain how you think the use of science affects sustainability.

*A measure of sustainability
considers the areas of
environment, economy,
and society*



Background Information

- This yarn activity creates a “web” of global issues and shows how they are all interconnected.
- It is important for students to see this “web” of global issues to understand how everything is connected, how that affects sustainability and if sustainability is even achievable.
- The “tug” of the string represents the idea that if one global issue is in stress, the other global issues will either directly or indirectly be affected by it (we should be able to understand this by the interconnectedness of the global issues and global systems).
- Students may not have an idea of what sustainability consists of prior to this activity therefore the teacher may have to expand on the questions to allow for understanding.

Essential Questions & Expected Responses

1. What do you think the “tug” of the strings represents in this activity?
Expected Responses: the stress the systems are under, how if one system is under stress the rest are all affected by it.
2. Why might it be helpful to understand how and why global issues are related?
Expected Responses: Because all the global issues that are happening today affect everyone differently based on their direct relationships with the issue.
3. Do you believe different cultures or groups of people view any of these global issues differently? If so, what are some examples?
Expected Responses: poverty will be seen differently based on culture and place they live, consumption is different based on income and country of residence, population growth dependent on religious and cultural beliefs and on country's mandated regulations on population, environment seen differently between cultures and countries, health care and education seen as a priority or not depended on country, food as a necessity or luxury based on country, energy use dependent on income and beliefs.
4. Do these global issues affect certain groups of people more than other groups? Do you believe this is fair?
Expected Responses: Groups in poverty, minority groups, people with disabilities, and indigenous groups may be more subject to some of the global issues
5. Where do you see scientific influence in any of these global issues?
Expected Responses: Energy (scientific advancement of solar, wind, nuclear, biofuel, and hydro energy), Health Care (medical advancements), Technology (increasing the speed and quality of technology, advancement of internet), Education (more access to resources because of technology), Food (increasing amount of genetically modified crops), Global Warming (pollution as a result of increasing industries, global warming is affecting the ecosystems), Non Renewable and Renewable Resources (amount of global oil is starting to decline therefore we need to invent and enhance renewable resources such as mentioned above: hydro, solar, wind).

Goals/Objectives

- Students will understand the connection between global issues and how if one is in stress, others will be affected.
- Students will become aware of the global issues and global systems that are currently taking place in our world.
- The activity and journal prompt will allow students to critically think about what sustainability is, the scientific and social factors surrounding it and if it is possible.

- Students will understand how science can influence or aid in global issues.

Source

- Resource picture & definition of sustainability: Facing the Future Curriculum <http://www.facingthefuture.org/LinkClick.aspx?fileticket=a0zYpiNTrPU=&portalid=0>
- Activity: Facing the Future Curriculum (free download) http://www.facingthefuture.org/LinkClick.aspx?fileticket=TcaU_14wuhs=&portalid=0

III: Explore Activity 1-Explore Personal Relationship with the Environment

Materials & Safety

- Students will need access to computers.
- Students will need to understand how to research responsibly on the Internet.
- Students will need to have their environmental journals readily available.

Description of Activity

- In their environmental journal, students will write down 10 ways they believe they are connected to the environment (physically, spiritually, emotionally) and 10 ways they believe they affect the environment daily.
- Students will then go onto computers and take the quiz: Wasted Ecological Calculator (see source) to see how many global hectares their lifestyle needs.
- Students will answer essential questions in their journals.
- After individual work, there will be a large discussion presenting their findings based around the 6 essential questions and discuss any questions or concerns they may have now. The teacher will not answer questions, instead this will be a way for the teacher to see what questions they have that can be discussed in the Explain component of the learning cycle.

Background Information

- Students must understand how large a hectare is.
Definition of hectare- 100m x 100m which is roughly the size of most rugby fields.
- Students may not know what an ecological footprint is. Explain that by the

- end of this activity they will be able to come to that conclusion.
- It is important to note that some students may not be able to answer all questions such as the questions regarding the size of home, or energy resources of home. In that case, chose the “I don’t know” option.
 - Note that this ecological footprint activity is from the viewpoint of America.

Essential Questions & Expected Responses

1. How many global hectares does it take to support your lifestyle?
Expected Response: Dependent upon student. Mine was 22.3 hectares
2. How does your footprint break down?
Expected Response: Dependent upon student.
3. What can you do to reduce your ecological footprint?
Expected Response: buy food locally, ride or bike or walk to school, turn of lights and water when you are not using them, reduce reuse and recycle.
4. Does your ecological footprint compare to the way you thought you affected the environment?
Expected Response: Dependent upon student. Mine did not- I thought I was must “greener” than I am..
5. Do you think that different cultures/parts of the world affects the environment in different ways? If so, how?
Expected Response: More developed countries will be using more power and energy, eating more packaged goods, producing more waste and producing more emissions from transportation compared to developing worlds.
6. Did you learn anything new about the way you have been affecting the environment?
Expected Response: Dependent upon students
7. After this activity, what do you think the term “ecological footprint” means?
Expected Response: How our lifestyle affects the globe, how the way we live affects ecosystems, the measurement of the demand my lifestyle puts on the earths ecosystems.
8. Can scientific advancements help reduce your ecological footprint?
Expected Response: Yes because it allows for renewable resources such as hydro, solar and wind power. Technological advances such as hybrid vehicles and new energy efficient appliances. Agricultural sciences produce pesticides and herbicides which aid in a higher crop yield which means food won’t be wasted.

Goals/Objectives

- This activity will help students understand man’s relationship with the environment.
- This activity will help students to understand the effects that their lifestyle

has on the environment. It will also allow students to understand the similarities and differences that cultures have with their relationship of the environment.

- This activity will allow students to brainstorm ways that they can reduce their ecological footprint.
- This activity will allow students to critically think about what it means to be a “consumer”.

Source

- Wasted Ecological Footprint Calculator
<http://planetgreen.discovery.com/games-quizzes/ecological-footprint-calculator.html>

IV: Explore Activity 2-Different Perspectives on Sustainability Debate

Materials & Safety

- Each student group will receive one photocopy of the problem they are debating.
- Each student group will need a photocopy of the definition of their people’s perspective.
- Each group will need access to computers.
- Students will need to understand how to research responsibly on the internet.

Description of Activity

- Teacher will put students into four groups, each of the groups taking on one perspective of the following: First Nations and Metis, Enbridge Company, Environmentalist and Conservationist.
- Definition of each group:
First Nations and Metis- We respect and honour our Mother Earth. We give thanks for the gifts she gives us. We take only what we need and will use.
Enbridge Company - Everything placed on the earth is ours to use as we wish, and for any purpose that we wish. Installing this pipeline will help with Canada’s Economy.
Environmentalists: advocate for preservation, restoration or enhancement of the natural environment.
Conservationist: is important for us to know what the world looked like before we used it as we wanted to. We will develop certain areas that are untouched so that those who come after us can see what it used to look like. As long as we do this, we can use the other parts.
- Teacher will present the issue that is taking place and students will have 25

- minutes to research the problem and how their perspective views it.
- **Issue to Debate (hand this out to students):** Enbridge Northern Gateway Pipeline is a company in Alberta that is currently trying to drill the largest pipeline in Canada from Bruderheim, AB to Kitima, BC. The pipeline would import natural gas to the coast of BC where Asian oil tankers would export the gas to Asia. The Federal government currently supports Enbridge, as they believe the pipeline will add value to Canada's economy. Many First Nation groups and environmentalists are denouncing the project because of the environmental, economic, social and cultural risks posed by the pipeline. There is a debate approaching where you and your group are the leaders of your given perspective: it is up to your group to provide your way of knowing and stand up for what you believe in with concrete evidence (all group members must actively participate). You will be given 25 minutes prior to the debate where you will research your way of knowing and how it will affect this pipeline. The main question regarding this debate is: Should the pipeline go forward and be implemented?
 - The students will prepare for the debate by looking at research based on the essential questions below.
 - Students have 30 minutes to debate this issue.
 - As a teacher, your job is to moderate the debate and ask questions to get them thinking.
 - After the debate, students will write an exit slip in their Environmental Journals. **Prompt:** After the mock debate, do you personally believe the pipeline should be implemented? Why do you believe this?

Background Information

- It might be helpful to remind students about the BP oil spill that took place for them to get their minds thinking.
- Important for students to understand through the whole process that there is no "right" perspective.
- Allow students to use Wikipedia.

Essential Questions

1. What views of sustainability does your group have?
2. How will this implementation of this pipe affect your way of life?
3. Why do you believe that your perspective is the "right" perspective?
4. In your opinion, will implementing this pipeline promote a sustainable way of life (think in terms of economy, environment, social and cultural ways of life being affected)?
5. Demonstrate how this pipeline fulfills or does not fulfill your perspective's wants and needs.

6. How does scientific research and evidence defend your argument?

Goals/Objectives

- Students will understand how multiple perspectives will influence the decisions that are being made surrounding potential threats to the environment.
- Students will understand how indigenous peoples are affected by certain business endeavors.
- Students will understand how certain groups of people (ie: environmentalists and First Nations people) may team up for a specific cause.
- Students will question ideas and understand the ideas of others with respect to sustainability and the environment.
- Students will understand how scientific advancements can alter the ways of life of certain cultures.

Source

- Idea of different groups taken from: Wright, John. Lessons to Support Science 10 (2008).
<https://www.stf.sk.ca/portal.jsp?Sy3uQUnbK9L2RmSZs02CjV/LfyjbyjsxsTFNFstRLlBw=F>
- Enbridge Debate: Klassen, Randi: Cultural Perspectives on Ecosystems Lesson Plan for Science 10
- Information regarding Enbridge Northern Gateway Pipeline:
http://en.wikipedia.org/wiki/Enbridge_Northern_Gateway_Pipelines

V: Explain Activity: Discussion

Essential Questions & Expected Responses

1. What is sustainability?
Expected Responses: a way to live that allows everyone to live the same as you, a lifestyle in which no one is poor or sick, a lifestyle that meets our needs and also the future generations needs, a way that the environment isn't harmed.
2. What are some factors of sustainability? (have students refer to the engage

activity if they can't come up with any)

Expected Responses: poverty, consumption, population growth, peace and conflict, human migration, environment, technology, healthcare, education, food, water, price of food, discrimination, global warming, culture, social justice, non renewable resources, renewable resource, energy use, media, trade

3. Are any of the above-mentioned factors of sustainability influenced by science in any way?
Expected Responses: population growth, human migration, environment, technology, healthcare, education, food, water, global warming, non renewable & renewable resources, energy use, trade.
4. Do you think sustainability is possible? Look at the scientific advancements made in regards to the progress of it?
Expected Responses: Answers to possibility of sustainability will be dependent upon student. Scientific advancements: greater reliance on renewable resources-wind turbines, solar power, hydroelectricity, nuclear energy, smart cars. Advancements in health care- medical equipment becoming simpler, more common and less expensive to be able used more in developing countries. Food-agricultural technology has advance and many see the world being able to feed 15 billion people. Population growth-increased advancements in birth control and the availability to get them to those countries have lowered population growth.
5. Do scientific advancements always promote a sustainable way of living? (an example the students can look at is the Enbridge Debate)
Expected Responses: Not always, there are much scientific advancements that help our economy and other aspects, but are not healthy for a sustainable future. Some advancement are Tar Sands, the BP oil spill, advancements of cars, diesel trucks and airplanes, industrialization,
6. How might one's personal beliefs about the environment and sustainability affect science or research that is taking place?
Expected Responses: two scientists might look at the meaning and applications of certain data and evidence differently based on their culture, religion, world-view.
7. How do individual and group lifestyle choices create a demand for our environment's resources? (students can revert back to their ecological footprint)
Expected Responses: consumerism, waste, pollution, energy use, food consumed,
8. Do you think the current lifestyle of most developed countries is not globally sustainable?
Expected Responses: The way people are living in many developed countries it is not sustainable. Consuming too much and producing too much waste. An example of this is the America's and China produce the most pollution from industries, creating climate change.
9. Do we have a responsibility to re-evaluate our needs and wants for the benefit of others? (students can re-evaluate their ecological footprint and ways their could reduce it)
Expected Responses: This answer will be different based on students world-

views, cultures and religions. A few answers could be: yes we do have a responsibility to live greener because the way we live affects the way others get to live-we don't get to choose if we live green or not. No we do not have a responsibility because we can't make everyone live greener and I am going to miss out on so much if I can't consume as much (drastic answer).

Background

- Students will arrive at the discovery and understanding of what sustainability is and the factors that influence it.
 - Sustainability is the effort to meet our social, environmental, and economic needs without undermining the capacity of future generations to meet their own needs.
- Students will understand the crucial role that science and scientific advancements make in regards to sustainability and that scientists may look at data and theories different dependent on the way their worldview.
- Students will understand their relationship with the environment and how other cultures view the environment.
- Students will understand, critically think and reflect on how individual and group wants and needs influence the sustainability of our planet.

VI: Extend Activity-Greenhouse Gasses Poster

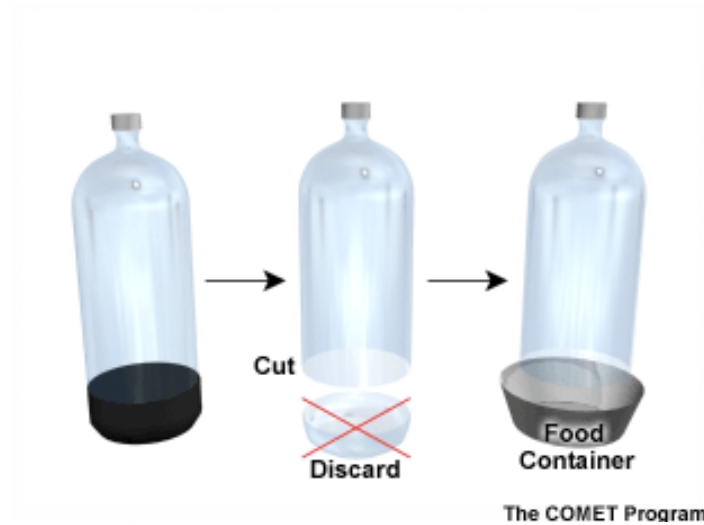
Materials

For every group of four students:

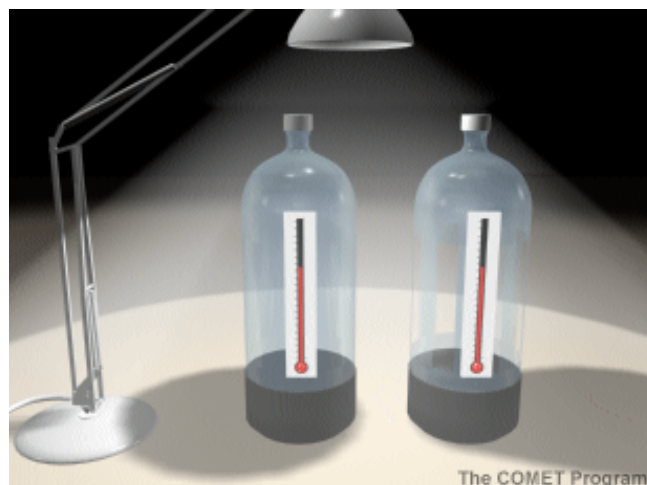
- Two two-liter plastic soda bottle "experimental chambers" (instructions to follow)
- Two 14- to 16-oz. plastic containers at least 4 1/2 inches in diameter at the top (sour cream, cottage cheese, or deli containers work well)
- Knife or scissors
- Masking Tape
- Two thermometers
- One 150-watt floodlight bulb
- Portable reflector lamp
- Stand for lamp set-up
- Markers
- Bristle Board
- Glue
- Access to Computers (online poster & research)

Description of Activity

- Remove the label off of both bottles by soaking them in warm water.
- Cut off the bottom of the bottle approximately two inches from the bottom
- Place the capped bottle in a plastic container. This is your “experimental chamber”



- Once students are in groups of four, teams will use scissors to cut elongated vents (1 x 4 inches) down the sides of one of the bottles.
- Tape a thermometer to the inside of each bottle (facing out so students can read it). Make sure the bulbs of the thermometer are above the chamber base.
- Place both bottles approximately six inches away from the lamp with the thermometers facing away from the light.



- Ask students to predict which bottle will get hotter when you turn on the

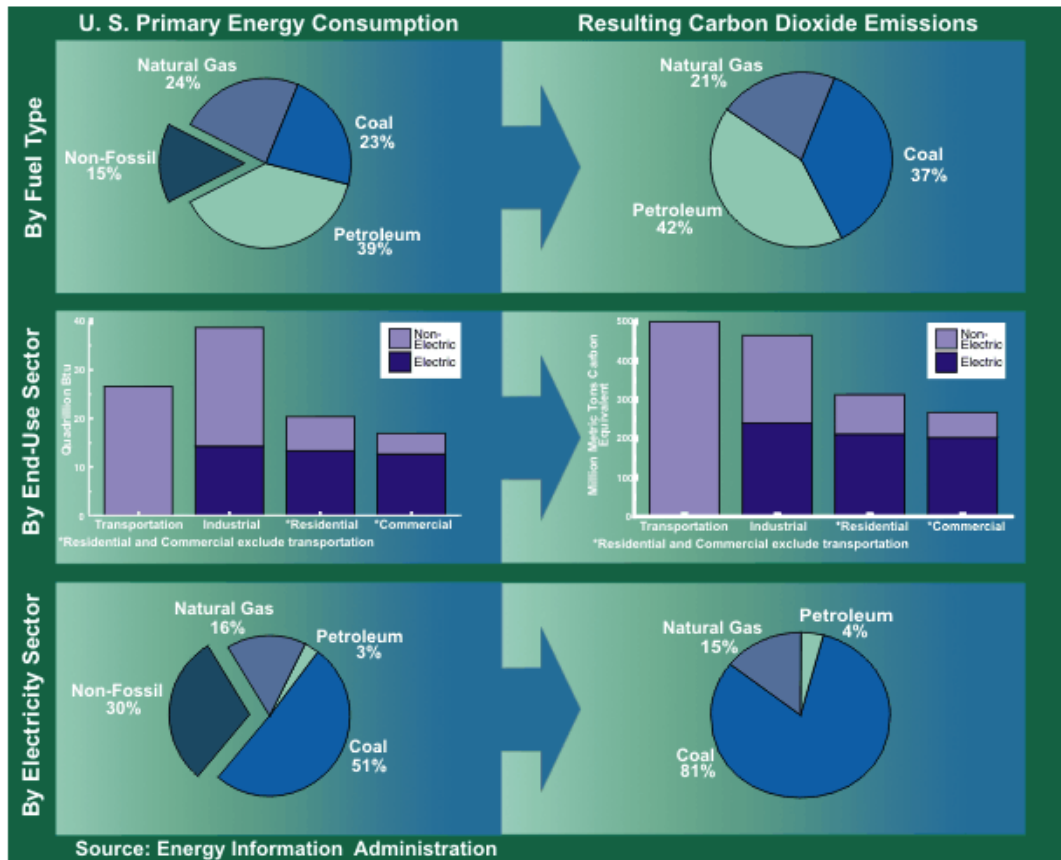
- light.
- Turn on the light and begin collecting data every minute for 20 minutes (two students for each bottle)
 - Graph the data for both bottles.
 - After data has been collected, students will **make a poster explaining:**
 - What they observed in their experiment
 - How they believe greenhouse gasses affect sustainability.
 - Their research regarding how different cultures and other groups view greenhouse gasses.
 - Provide ideas from their research regarding what scientists are doing to lower greenhouse gasses.
 - Students should have their graphs and other pictures they believe enhance their poster's ideas.

Background Information

- Our atmosphere retains heat at the surface of the earth. Energy absorbed by the earth is remitted as infrared radiation (heat radiation).
- Certain gasses in our atmosphere can absorb this infrared radiation (allow sunlight to enter the atmosphere) and as a result the heat energy is trapped in our atmosphere and makes the earth warmer.
- Causes of an increased greenhouse gasses: large scale industrialization, CO₂ emissions, change in weather patterns and agriculture.

Essential Questions & Expected Responses

1. Compare and contrast the graphed data from the vented bottle and the intact bottle. What happened? How do you explain your observations?
Expected Responses: The bottle with the slits in the side was less hot as the hot air could escape from the bottle, while the bottle without slits was more hot because the hot air had nowhere to go.
2. How does this activity relate to what is happening on earth?
Expected Responses: This is happening in the atmosphere right now. The infrared rays from the sun (heat radiation) are being allowed into our atmosphere by certain gasses but they are not allowing them back out making our atmosphere similar to the bottle without slits.
3. How could you "change" your greenhouse to now have a temperature range in between the two you tested?
Expected Responses: You could make a bottle with a few less slits, or put less heat on the bottles.
4. What are some human activities that may be causing the increase of greenhouse gases?
Expected Responses: burning of coal, oil and natural gas. Deforestation, agricultural and industrial practices (an increase in CO₂ creates a warming effect). See chart for more info.



5. What effects is the increase in greenhouse gasses having on the earth?
Expected Responses: temperature of the earth's core is increasing resulting in increasing atmospheric temperature which affects agriculture, water and disease.

Goals/Objectives-3

- By using this experiment and answering the essential questions, students will be able to understand some of the scientific aspects that affect sustainability and the environment.
- Students will be able to work on their observation and communication skills
- Student-centered collaboration.

Source

- Activity, Questions #1, #3, and Pictures taken from: University Corporation for Atmospheric Research-Education
http://www.ucar.edu/learn/1_3_2_12t.htm
- Picture for Question #4
<http://www.eia.gov/oiaf/1605/ggcebro/chapter1.html>

VII: Evaluation

1. Environmental Journal

Aims of Assessment

- this type of assessment will allow for the teacher to see the deeper thoughts of the students regarding the issues being discussed in class throughout the whole unit.
- This type of assessment allows for the teacher to see where the students minds were at the beginning of the unit, and how their minds have expanded in regards to what has been taught.
- Having students keep a journal allows for a interdisciplinary approach in the classroom.

Expected Responses of Assessment

- I would expect students to critically think about the prompts and understand their contributions to sustainability and the environment.
- Students should be asking questions they now have regarding the environment in their journal.
- Students will gain and understanding of their impacts on the environment.
- Students will show a respect and understanding for different cultures perspectives on the environment, decisions regarding the environment, and sustainability.

Rubric for Journal Assessment

Criteria	4	3	2	1
Structure Ideas	All or almost all of the entries have a connection to the prompts	Most entries have a connection to prompts.	Few entries have a connection to prompts.	None of the entries have a connection to structure.
Feelings and Thoughts	Feelings and thoughts are revealed in all or almost of the entries.	Feelings and thoughts are revealed in most entries.	Feelings and thoughts are revealed in few of the entries.	None of your feelings and thoughts are revealed in any of the entries.
Critical Thinking	Critical thinking has been displayed in all entries.	Critical thinking has been displayed in most entries.	Critical thinking has been displayed in a few entries.	Critical thinking has been displayed in no entries.
Questions	Students have asked questions they now have regarding the	Students have asked questions they now have regarding the	Students have asked questions they now have regarding the	Students have asked no questions.

	topic of each prompt.	topic of most prompts.	topic of a few prompts.	
Completion	All entries are present, in order, and together.	All entries are present, but are either not together or in order.	All entries are not present, but they are together or in order.	All entries are not present, nor are they together or in order.

2. Poster: Greenhouse Gasses

Aims of Assessment

- Using a poster as a form of assessment allows for the teacher to see creativity and out of the box thinking.
- The poster allows for the teacher to see how well the students understood the previously learned material and could connect what they have learnt to new ideas.

Expected Responses of Assessment

- I would expect the students to have observations of the experiment and explanations for their observations.
- I would expect students to present their topic in an interesting way.
- I would expect students to relate this experiment to sustainability
- I would expect students to find ways that scientists are trying to lower greenhouse gasses

Rubric for Poster

Criteria	3	2	1
Creativity Students show out of the box thinking and creativity in the making of their poster.			
Connections Students have made connections with the greenhouse gas effect to sustainability answering the 5			

main questions.			
Critical Thinking Students have shown a display of critical thinking in their research.			
Organization The poster is organized, neat and easy to understand.			