

Title: Pseudoscience or Science: Examining Global Climate Change Through Empirical Evidence

Study Guide Theme: Climate Change

Featured Photos:



Darkening Skies



Dry Lake



Fire

Image Titles:

Dry Lake (pg. 274-275): A woman walks on a dry bank of a dam next to a lake that provides water to Islamabad, Pakistan.

Darkening Skies (pg. 40): Air pollution, CO₂ and water vapor rise from the stacks at a coal-burning power plant in the U.K.

Fire (pg. 272-273): More frequent and more intense wildfires (such as this one in Colorado, USA) are another consequence of a warming planet.

Overview: Less than half of Americans are worried about climate change. Students will discover why climate change is a serious concern by learning more about the causes and effects of climate change. Through research and reflection, students will differentiate between pseudoscience and science so that, going forward, they can make informed decisions on social, economic, and political efforts that address climate change.

Grade level(s): College

Subject(s): Biology

Corresponding National Standards: N/A

Corresponding Global Competency Skills: Investigate The World, Recognize Perspectives, and Take Action

Essential Question(s): What are some causes and effects of climate change? Why is it important to be able to distinguish between someone's opinion and a source that presents reliable information about climate change? What are your

feelings on climate change and global warming after completing this exercise?

Learning Activities:

(This is a two and a half week exercise for an online class. It can be extended to three weeks. Part 1 can be adapted for a 75 minute class period.)

Procedure:

1. Before completing the exercise, students should be familiar with the following:

- The difference between weather and climate
- What anthropogenic means
- What global climate change (also called climate change) refers to
- What global warming refers to - It is commonly called climate change
- Greenhouse gases
- The carbon cycle and how carbon moves through the carbon pools

2. Activity 1 – Climate change class discussion:

Learning objectives: Students will be able to identify cause and effect relationships of climate change. The students will be able to analyze photos and describe their positions on climate change.

Create a discussion board that requires students to analyze the pictures and answer discussion questions. Students must create a thread of an original post and reply to three other students' threads. Their replies must be done on at least two different days to get an active discussion going.

- Assignment description:

Climate change and its effects can be a difficult topic to discuss, especially when discussing anthropogenic induced climate change. You might hear in the news that human activities (anthropogenic factors) are causing global warming, or a family member insists on talking to you about climate change, and the changes we need to make to save humanity. There is a broad consensus (97%) among scientists that the climate change we are seeing now is predominantly caused by human activities (directly or indirectly); however, in a 2017 Gallup Poll, only 45% of Americans worry a great deal about climate change. Why do you think that is? Are people skeptical of scientists' evidence on climate change, or are people misinformed? In this exercise, you will analyze three photos related to climate change. You are going to analyze the photos using the National Archives and Records Administration's [Analyze a Photograph Worksheet](#) and then answer a series of questions. You will reply to two other students' original posts, and you must reply on different days so that we can get an active discussion going. Please be respectful of one another's opinions. Watch this [video](#) by Our Climate Our Future to get "tips and tricks on how to have effective climate conversations with family and friends".

1. What's going on in each of the pictures? What do you see that makes you say that?
2. Do you think any of the three pictures can be viewed as a human activity that is a climate forcer? If so, which one(s) and why?
3. Do you think any of the three pictures can be viewed as a consequence of climate change? If so, which one(s) and why?
4. What is your opinion on climate change? Do you believe human driven climate change is real and global warming is a threat, or do you think it's all a hoax?

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5. Do you need more evidence on climate change to influence your answer to question 4? If so, what evidence would you need to see to be more concerned about climate change?

3. Activity 2 – Research and reflection on climate change

Learning objectives: Students will compare and contrast an article that is an example of pseudoscience and a blogger's opinion, and another article that is an example of reliable information based on empirical evidence. Students will research and discuss evidence of climate change and a consequence of climate change from reputable sources.

- Assignment description:

Some people say, "So what if the temperature increases by a couple of degrees. It's only a couple of degrees". Scientists, on the other hand, will say an increase of a couple degrees in the global temperature can have devastating effects on the Earth's biomes. Someone who believes global warming is not real may justify his or her belief by saying droughts are natural, while scientists may say climate change is warming lakes, and when you couple it with how humans use lakes, it's causing them to dry up. In order to make informed decisions that can impact you, your family, or humanity in general, it's important to be able to differentiate between pseudoscience, a blogger's opinion, and science. Compare the following two articles. Do either of them seem to present information that is subjective or do both seem to report reliable information? How do you know?

<https://www.nationalgeographic.com/magazine/2018/03/drying-lakes-climate-change-global-warming-drought/>
<http://globalwarminghoax.com/news.php>

What you are to do for this assignment:

Everything in the natural world has a cause and effect. You are going to (1) research recent evidence of climate change that comes from at least two reputable sources. You will also (2) research a consequence of climate change. You can use one of the photos in the Climate Change discussion board forum to research or you can choose one of your own. You are going to write a (minimum) one page paper on your findings. You cannot use the National Geographic article above as one of your sources. Cite your source in APA format. In your paper, YOU MUST ALSO address the following:

- Did any of your articles explain how human activity or activities are accelerating global climate change? If so, what proof did they share to explain this?

You will also include a conclusion that addresses the following:

- Before completing this activity, what was your understanding of climate change due to anthropogenic factors?
- Did you believe climate change was real or did you think it was a hoax?
- After researching evidence of climate change, how do you feel about climate change now and do you believe human activities are accelerating climate change?

4. Learning extension - There is power in knowledge:

(The learning extension activity is a three week exercise for an online class. Students are given a week and a half for contacting their elected officials and a week and half to reduce their use of fossil fuels.)

Learning objectives: Students will put into action what they learned in Activity 2. Students will compose material to encourage their elected officials to do more in reducing our contribution to the Earth's temperature increasing. Students will implement a plan of action to reduce their usage of fossil fuels.

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Assignment directions:

- Now that you've done your research, write, call, or visit the office of your government representatives to share your views on why it's important that we, as a country, make decisions and make changes that will lessen our impact on the Earth's climate and limit increases in the Earth's global temperature. Use the knowledge you gained through your research to support your stance. After speaking with your government representatives or mailing your letter, you must submit a summary of your experience or a copy of your letter, respectively.
- You are going to take this a step further. Walk your talk by challenging yourself to reduce your use of fossil fuels for five days. Write a conclusion on your experience and then see if these changes can be part of a new lifestyle of reducing your impact on the Earth's climate.

Assessment(s) for the student learning activities:

Photo analysis

Group discussion

Writing assignments

Materials:

1. Students will need a computer and access to the internet.
2. Copies of the photo analysis worksheet - <https://www.archives.gov/education/lessons/worksheets/photo.html>
2. Suggested readings/resources related to the study guide include:
 - What is climate change? - <https://www.bbc.com/news/science-environment-24021772>
 - NASA's causes and effects of climate change - <https://climate.nasa.gov/causes/> and <https://climate.nasa.gov/effects/>
 - What is climate change? - <https://climate.nasa.gov/>
 - What is global warming? - <https://www.nationalgeographic.com/environment/global-warming/global-warming-overview/>
 - Climate change: How do we know? - <https://climate.nasa.gov/evidence/>
 - Biointeractive's videos, animations, lectures, and interactives on climate change – https://www.hhmi.org/biointeractive/search?text=climate%20change&sort_by=search_api_relevance&redirect=1
 - Curriculum Pathways Carbon Cycle virtual lab - <https://www.curriculumpathways.com/portal/#/info/1082?id=952>
 - New web maps tell full story of climate change - http://geographical.co.uk/places/mapping/item/2684-new-web-maps-tell-full-story-of-climate-change?awt_l=LAlZ9&awt_m=3Yxlg03upjPJO6Q
 - United Nations Development Programme's sustainable goals on climate change - <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-13-climate-action.html>
 - Does it matter if people think climate change is human caused? - <https://www.sciencedirect.com/science/article/pii/S2405880717300092>
 - Worldmapper's cartograms on carbon emissions - https://worldmapper.org/maps/?_sft_product_cat=waste

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