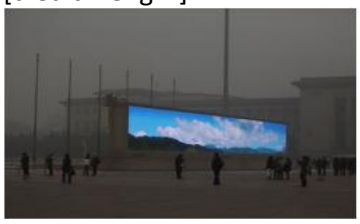
World View Fellows: *OVERBook* Project on the Environment and Sustainability: Study Guide

Title:

Study Guide Theme: Pollution

Featured Photos (minimum 3):

- (China) Blue Sky Sign: The ultimate irony- a giant LED screen on Tiananmen Square…The LED screen shows the blue sky on the Tiananmen Square at dangerous levels of air pollution on January 23, 2013 in Beijing, China. [credit: Feng Li]



- (U.S.) Fire: More frequent and more intense wildfires (such as this one in Colorado, USA)… The Waldo Canyon Fire, burns out of control, June, 26, 2012. [credit: RJ Sangosti].

- (UK) Darkening Skies: Air pollution, CO2 and water vapor rise from the stacks at a coal-burning power plantin the U.K. Aerial view of Drax Power Station, North Yorkshire, United Kingdom. January 9, 2007. [credit: Jason Hawkes]

Overview: Students will calculate the mean, median, interquartile range and mean absolute deviation of CO2 levels for various cities from the Air Quality statistics report from the Environmental Protection Agency. They will do this after observing 3 photos of air pollution from the OVERBook and reading about different types of pollution from Live Science.

Grade level(s): 6-8

Subject(s): Mathematics

Corresponding National Standards:

Common Core Mathematics Standards:
CCSS.MATH.CONTENT.6.SP.B.5.C Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
CCSS.MATH.CONTENT.7.SP.B.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.

National Curriculum Standards for Social Studies Theme:
People, Places, and Environments

Common Core English/Language Arts Standards:
CCSS.ELA-LITERACY.WHST.6-8.1.A Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
CCSS.ELA-LITERACY.WHST.6-8.1.B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate the understanding of the topic or text, using credible sources.

Corresponding Global Competency Skills:
Investigate the World: Students investigate the world beyond their immediate environment.

Essential Question(s) (include 1-3): How do I calculate the mean, median, interquartile range, and mean absolute deviation for CO2 levels for various cities? What do these numbers tell us? In what way does the size of the city impact pollution?

Day 1 of 45-60 minute period: Photo Analysis
The teacher will project the each photo one at a time and follow the protocol below.

Steps below are from the Analyzing Images Protocol from Facing History:

- "Step One: Ask students to look deeply at the picture for a good long time. Have them observe shapes, colors, textures, the position of people and/or objects, etc.
- Step Two: Have students write down what they see without making any interpretation about what the picture is trying to say.
- Step Three: Ask students: What questions do you have about this picture that you would need to have answered before you can begin to interpret it? Ask as many questions as you have.
- Step Four: Have students discuss their questions with two other students in the class to try to find some answers.
- Step Five**:** Given the historical context and subject of the piece, ask students what they think the artist is trying to say (what does the piece mean), and who they think is the intended audience?" (Analyzing Images).
- Repeat steps one through five for each photo. See possible discussion questions that you could add for each photo.

Possible Discussion Questions:

- What caught your attention in the photo?
- What feelings do you have about this photo?
- What questions do you have about this photo? What do you wonder?
- What is missing from this photo that was not captured?
- What do you think is the story behind this photo?

- Why do you think this/these photo(s) was/were chosen?
- What do you think is in common between each of these 3 photos?
- Who do you think is the intended audience for the photo?

Day 2 of 45-60 minute class period Reading the Articles:

- Step 1: Read the National Geographic Article "Air Pollution Causes, Effects, and Solutions". As you are reading the article aloud, students will be highlighting or underlining any information about what causes air pollution and what can be done about it.
    - Note: You may choose to shorten or chunk this article depending on your student needs. Some examples of chunking would be to have some students in groups of 2-3 read part of the article, highlight and take notes on key information, and then summarize to the class what it says.
- Step 2: Ask students to share what they found interesting. Give about 5-10 minutes of share time.

  Possible Discussion Questions:
    - Has anyone ever seen smog before? If so, where?
    - According to this article, where does smog come from?
    - What is the leading pollutant for air pollution?
    - What are other examples of pollutants?
    - How can we prevent air pollution?

- Step 3: Read through the Stanford University Article "Study Links Carbon Dioxide to Increased Deaths." As you are reading the article aloud, students will be highlighting or underlining any key information and circling any words they do not understand.
    - Note: Chunk the article and make sure students understand or summarize each paragraph.

  Possible Discussion Questions:
    - How does CO_2 cause increased deaths?
    - Why is California the particular focus of this article?
    - How is water vapor involved in air pollution process?

Day 3 of 45-60 minute class period: Calculating Mean, Median, Mean Absolute Deviation, and Interquartile Range:

- Step 1: Pass out Pollution Statistics worksheet and calculators.
- Step 2: Complete worksheet as a class. Make sure students are speaking up about the process for finding mean, median, interquartile range, and mean absolute deviation and what they mean for the data.
    - During this process, students should be stating that the mean is the average of the data. You find it by adding up all the data values and dividing by the number in the data set. They should tell you that the median is the middle most number if the values are ordered in ascending or descending order. If there are two numbers in the middle, you find the mean of those two numbers. The interquartile range is the length or distance of the middle most 50% of the data. The mean absolute deviation is the average distance the data values are apart from the mean.
    - The teacher will go through step-by-step how to complete California and Texas. While you are doing California and Texas, have students take down the information, follow along by calculating the data with you on their calculators. The process can be very lengthy, but it is important to understand the process and how to compare the information.
- Step 3: Teacher says, "After looking over pictures, reading the articles about air pollution, and looking at the data, what makes a city have higher levels of CO_2?" Take student answers. "Do you think population is a factor? Are there other possible factors that could contribute to CO_2 levels?" Take student answers.

Day 4 Assessment/Writing a letter to a local representative:

- Students will be responsible for looking up a local representative in the city, state, or federal government. For

example, have students search a local county government commissioner and committees. For example, this is where you can find who is in charge of the environment for Wake County, NC. Letters can also be written to members of the House of Representatives or Senate.

- They will write a letter to that representative that includes the following:
    - Paragraph 1: They will answer the questions: What is air pollution? What causes air pollution? What are the main ways that humans contribute to air pollution?
    - Paragraph 2: Students explain how air pollution impacts them and their future.
    - Paragraph 3: Suggestions for lowering air pollution in the local area.
    - Students are required to list at least 3 statistics about air pollution in their letter.
- The teacher will use this as an assessment of their knowledge from the past couple of days.
    - For EL and EC students, sentence starters might be helpful. See the link for some examples.

Learning Extensions:

- Taking a field trip to a public transit office to learn about different types of public transit options in the area.
- Students edit letters and send them to local representatives.
- Invite in a scientist with a background in CO2 or air particulates that can describe more in depth how pollution impacts the population.

Materials:

- 3 featured OVERBook photos either projected on screen or hung up around the room
- Computer
- Projector
- Pencils/Writing utensils for students
- Copies of the National Geographic Article for each student or to share
- Copies of the Stanford University article for each student or to share
- Highlighters for each student
- Copies of the Pollution worksheet, one per student.

Bibliography:

Analyzing Images. (n.d.). Retrieved from https://www.facinghistory.org/resource-library/teaching-strategies/analyzing-images.

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Hawkes, J. (Photographer). (2007, January). *Darkening Skies: Air pollution, CO2 and water vapor rise from the stacks at a coal-burning power plant in the U.K. Aerial view of Drax Power Station, North Yorkshire, United Kingdom* [photograph]. New York, NY: Goff Books.

Herrmann, E. (n.d.). Using sentence frames, sentence starters and signal words to improve language. Retrieved from http://www.multibriefs.com/briefs/exclusive/using_sentence_frames.html#.W7jcrWhKjIV.

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