



The Heat is On

Cause and Effect and Climate

About This Lesson

In order to solve a problem, we must first understand what the root of the problem is. In science, as well as in everyday life, this often involves making hypotheses about what the cause of the problem might be, and either conducting experiments or collecting data and evidence to test them. Understanding the difference between **correlation** and **causation** is a crucial part of this process, as is what constitutes good evidence. Although two or more variables might appear to be related and to change in similar ways (correlation), that doesn't automatically mean that one is causing the other to occur, or even has anything at all to do with it.

In this lesson, students will practice distinguishing between correlation and causation within the context of global climate change. Students will think critically and analyze different claims and datasets related to what might be causing increasing temperatures in a fictitious town called Solutionville, as well as around the globe. Although students will be working within the context of a fictitious town, the temperature and carbon dioxide data they will be analyzing are real and will enable them to see relationships between global temperatures and atmospheric carbon dioxide levels. Finally, students will watch a video in which they will learn that the burning of fossil fuels releases carbon dioxide into the atmosphere, and they will begin to explore the connections between human activities and global climate change.

Focus Questions

1. How might we determine if one thing causes another?
2. What's causing global temperatures to increase?

Learning Objectives

1. Students will use conceptual diagrams, prior knowledge/experience, and reason to consider what might cause a particular phenomenon to occur.
2. Students will identify the qualities of an argument or piece of evidence that make it credible by trying to identify what is causing global temperatures to increase.
3. Students will distinguish between correlation and causation.



Grade levels: 6-8

Total activity time: 60-75 minutes

Materials needed:

- Video: **What's the Deal With Fossil Fuels?**
- Computer with internet access and projector
- Fishbone Diagram Worksheet (1 per student)
- Student Activity Guide (1 per student)
- *Solutionville Inquirer* article (1 per student)





Teacher Prep

1. The day prior to the activity, print out one **Fishbone Diagram Worksheet** per student and distribute it to be completed as homework.
2. Print out one **Student Activity Guide** and one ***Solutionville Inquirer* article** per student.

Activity (60-75 minutes)

Pre-Activity Homework

In preparation for this activity, have students complete a Fishbone Diagram Worksheet as a homework assignment the night before and bring it with them to class. A fishbone diagram is a graphic organizer that can be used to brainstorm possible causes of a phenomenon (or 'effect'). For more information on fishbone diagrams and to see more advanced versions of them, visit [this website](#).

Warm-Up (10-15 minutes)

1. Give students a couple of minutes to discuss and compare their completed Fishbone Diagram Worksheets with a partner.
2. On the board, write the focus question, 'How might we determine if one thing causes another?' and brainstorm ideas as a class. *E.g., conduct surveys, plan and carry out a scientific investigation to collect data, do research to learn more about the phenomenon, find evidence, etc.*
3. Ask students what they would consider to be 'good evidence' that one thing causes another, and make a list on the board. *E.g., data from a controlled experiment, or many observations over a long period of time.*

Independent Group Work (20-25 minutes)

4. Divide students into groups of 3, and pass out one *Solutionville Inquirer* article and Student Activity Guide to each student.
5. Give students about 20-25 minutes to work through their Activity Guide in their groups.

Class Discussion (15 minutes)

6. Take a poll on which, if any, of the residents students think presented a plausible cause of increasing temperatures in Solutionville and around the globe. Discuss the three hypotheses, and what makes them either plausible or implausible.
7. Ask students to explain what criteria they used to determine who they think has the most compelling argument. For example:





- Data that shows a trend over a longer period of time (Hypothesis #3) are usually more compelling and useful for drawing conclusions than data that only spans one or a few years (Hypotheses #1 & 2).
- Data from controlled scientific experiments (Hypothesis #3) are usually more accurate than random observations (Hypothesis # 1), particularly if the experiments were repeated and the same result was found.
- It is very suspicious when people present an argument or call to action that they are likely to personally profit from (aka, conflict of interest- Hypothesis #2).

Additional Evidence: Fossil Fuels (15-20 minutes)

8. Tell students they are going to watch a video that might give them some more useful information. Show students the video **What's the Deal With Fossil Fuels?** (you might need to show it twice through) and discuss.
9. Ask students to brainstorm ways they could test or confirm one of the claims made in the video about the connections between fossil fuels, carbon dioxide, and rising temperatures. *E.g., Find data showing [fossil fuel use over time](#) and see if it correlates with carbon dioxide concentrations, or [conduct an experiment](#) to test if carbon dioxide does in fact trap heat.*
10. On the board, define the terms **correlation** (when two or more things vary or change together/in similar ways) and **causation** (when one thing causes another to occur or exist). Then, to assess understanding, ask students to identify each hypothesis' graph in their Solutionville Inquirer article as either showing **correlation, causation, both, or neither**. (*They all show correlation, but the data on the graph for Hypothesis #3 is the only one that also shows causation*).

Optional Extensions

- For homework, have students do some web research to find out more information about fossil fuel use over time and how it relates to carbon dioxide concentrations in the atmosphere.
- To further explore the heat-trapping potential of carbon dioxide, check out this fun hands-on investigation: [Fossil Fuels: Air Pollution and the Greenhouse Effect](#)

Additional Resources

- *Flipside Science* Exploring Energy Supplementary Materials: **Fossil Fuels**
- [California Academy of Sciences: Fossil Fuels: Chocolate Chip Mining activity](#)
- What are some of the impacts of our changing climate on the public? Explore this and other climate issues at [ClimateCentral.org](#)





Connections to the Next Generation Science Standards

Disciplinary Core Ideas (Grades 6-8)

- MS-ESS3.C: Human Impacts on Earth Systems

Science and Engineering Practices (Grades 6-8)

- Analyzing and Interpreting Data
- Engaging in Argument from Evidence

Crosscutting Concepts (Grades 6-8)

- Cause and Effect: Mechanisms and Explanation

Up Next in *Flipside Science Exploring Energy*:



The Heat is On:
Cause and Effect and Climate



Optimal and Sustainable:
Renewable Energy Revamp



Building Better Buses:
Transportation Design Challenges



Nuclear Energy:
What's Your Reaction?

