

Mathematical Modeling of Climate Change – What, How, and Why

The purpose of this professional development workshop lesson is to *model* how pre-service teachers can teach *modeling*. This lesson was designed so teachers could easily use the resources and modify the lesson for their own future students. The lesson will likely take 2-3 class periods, depending on age and background of your students. The **place-based topic** is climate change.

This lesson considers the **high-leverage teaching practice**, reinforcing positive student behavior. Because this lesson requires students (or pre-service teachers) to visit multiple websites, two issues must be considered: 1) are all of the links live and accessible and 2) are the websites so interactive that students may not know when to leave the site? Subsequently, consider how you can reinforce the positive student behavior of staying on task by giving them guided prompts while still giving them enough time to engage in informal inquiry (i.e., playing with the climate models).

Our inclusivity focus are **people of color**. There are two links to New York Times articles that are linked to lessons for teachers on the NYT website on teaching Climate Change. Both articles focus on the impacts of changing weather patterns on biotic and human communities, as well as on local economies of Native peoples (in Alaska and in Louisiana).

Follow the following links as you work through the lesson. Look for patterns and be prepared to explain what a model is during our class discussion. The discussion questions listed on the bottom of the page are also possible homework questions. Be sure to manage your time well, so you can work with your peers to respond to the discussion prompts (and think about how you can help your students do that). To integrate accountability with your students, consider asking them to write their answers in their STEM notebook.

STEP ONE: what is a model

As a class, let's brainstorm what a model is. Remember, models are used by teachers in all disciplines, so consider a broad range of examples.

Read <https://www.climate.gov/maps-data/primer/climate-models>

Then explore a simple climate model: <https://scied.ucar.edu/simple-climate-model>

Small Group Discussion: what is the relationship between the variables (independent and dependent)?

STEP TWO: who is affected by climate change?

Select one of the following articles to read

- Louisiana Native Community: <https://www.nytimes.com/2016/05/03/us/resetting-the-first-american-climate-refugees.html>
- Alaska Native Community: <https://www.nytimes.com/2016/12/18/science/polar-bears-global-warming.html>

Small Group Discussion: what are some ways people are affected by impacts of climate change? What are the experiences of disenfranchised people, who often live in rural areas?

STEP THREE: explore more simple models

Explore interactive “toy models” at <http://simpleserioussolvable.org/toy-models/> and then click on <https://biocycle.atmos.colostate.edu/shiny/emissions/> to explore how rich and poor countries will be affected by climate change.

Small Group Discussion: what is the relationship between the variables (independent and dependent)?

STEP FOUR: Class Discussion Questions:

In small groups, using the references listed above, discuss the following:

1. There are many types of *models* that measure various aspects of climate change – what are these? Why do scientists develop them?
2. What skills are needed to develop climate *models*?
3. How can climate *models* inform scientists?
4. How can knowledge gained from using climate *models* provide communities with data to inform decision making?
5. Why are some communities “harder hit” than others? How can this be issue be resolved? What can secondary math and science students do to resolve this issue?