Climate Literacy in Education

Connecting Math and Climate Justice

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Abstract

This three-day unit explores the connection between mathematics, science, and climate justice through a study of water systems in Minnesota. Because the climate crisis is not explicitly included in the Minnesota math standards, the unit is designed to help students connect mathematical thinking to real-world environmental issues. Students begin with a gallery walk and an introduction to *We Are Water Protectors*, generating questions and building prior knowledge, and then analyze competing perspectives on pipelines and examine water quality, river systems, and data on human and environmental impacts. In the final lesson, students explore Earth's water distribution and Indigenous knowledge through the work of water protector Sharon Day, reflecting on stewardship and justice. While engagement was strong, reflection revealed a need for a more intentional foundation of climate empathy and personal connection, as well as more explicit and intentional connections to mathematical thinking and computation, both of which will be integrated into future iterations of the unit.

Keywords

Water, pollution, pipelines, climate justice

Overview

Teaching math at a large suburban middle school in Maple Grove, I am aware that the climate crisis is not included in the curriculum or the Minnesota math standards. As a result, math is often treated as a standalone subject, disconnected from other areas of learning. Many students struggle to see its relevance in their daily lives and frequently ask, “Why do we need to know this?” While math builds critical thinking and problem-solving skills, my role is also to help students make meaningful connections between math and the world around them, including creating opportunities for students to apply mathematical thinking to local and global climate issues, helping them understand inequities, and consider their role in promoting environmental responsibility and justice.

To begin this three-day unit, students participated in a gallery walk to preview key concepts by examining photographs and graphs from the presentation slides. Students then listened to a read aloud of We Are Water Protectors by Carole Lindstrom and analyzed information about oil pipelines using both supportive and opposing sources. Throughout the unit, students explored water quality in Minnesota, examined the distribution of water on Earth, and learned about an Indigenous climate justice advocate. Students engaged in meaningful discussions to deepen their understanding and reflected on their learning by considering the question, “What now?”

Instructional Sequence

Day 1: Preview Gallery Walk and Read Aloud

To begin the unit, students were given their handout packet (Figure 1) and instructed to complete the gallery walk. Students viewed each of the eight slides posted around the room and completed the "what I think" and "what I wonder" sections corresponding to each image. Images included different types of graphs, maps, and photos. At each station, students were asked to read and interpret the data quantitatively before recording their responses — identifying the scale, axes, and units of measurement on each graph or map, and extracting specific values to support their observations (for example, "What percent of...", "How many more... than...", or "What is the difference between..."). Students moved freely around the gallery, spending as much time as they needed at each station.

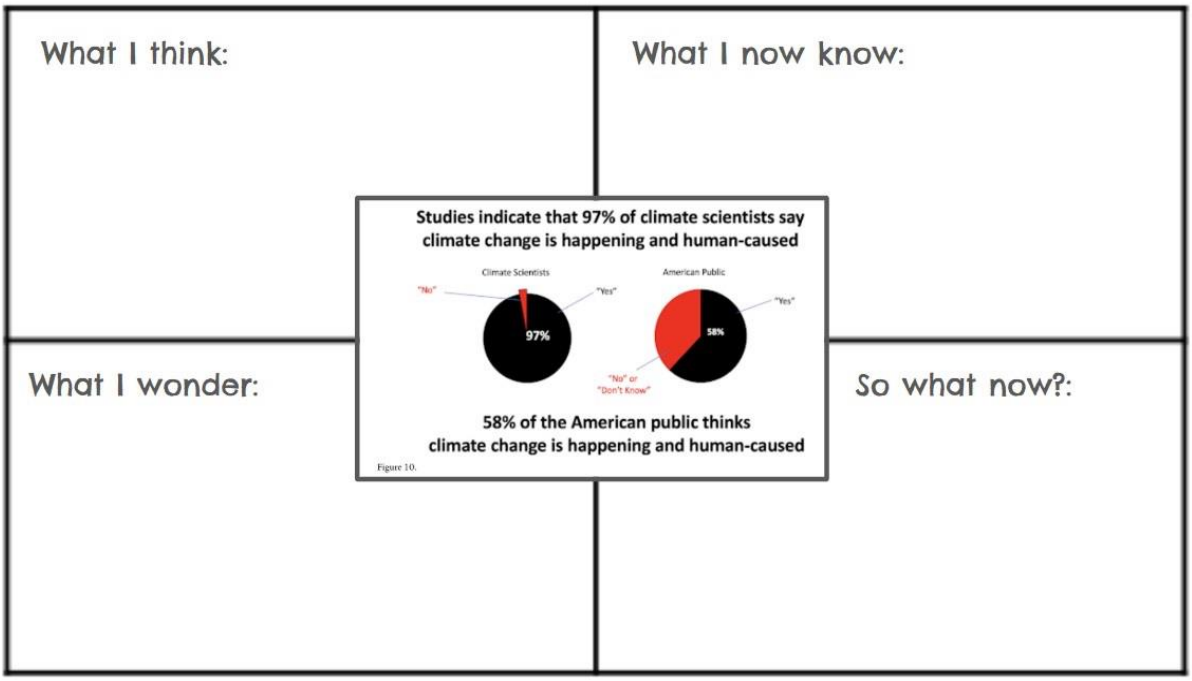

Figure 1: Page from the student handout

Next, students discussed what they saw with their table groups, each sharing their biggest wonder. Then, volunteers shared their own big wonder or one that they heard from their group. Some examples were:

- Why is one side of the river brown?
- What is a water walk?
- How does water quality affect swimming and fish?
- How do humans cause the climate crisis?
- How do people not know about the climate crisis?
- Why do we need to know this in math?
- Why is there so little freshwater?

After discussing their observations and questions, I introduced We Are Water Protectors by reading the jacket description aloud. Students then watched and listened to an online read-aloud of the book. Following this, they used their gallery walk notes to complete the "What I Now Know" section. Students independently completed a story reflection page in their packet and then shared their responses in small groups. To conclude, we engaged in a whole-class discussion around the question "What now?" and students recorded their final reflections.

Day 2: Pipelines and Water in Minnesota

I began the lesson by asking students what they already knew about pipelines to activate prior knowledge, and how pipelines were represented in We Are Water Protectors. I then guided students through reading two informational excerpts from Energy for Progress (2021). I clicked the linked graphic, which revealed that this organization was "brought to you by the American Petroleum Institute" (n.p.) Before we reviewed the section on safety, I asked students to predict how the American Petroleum Institute might respond to questions about pipeline safety. Finally, we read and discussed how this organization answers the question of pipeline safety, helping students consider how the source influenced the information presented.

We continued by viewing a map of all of the pipelines in the United States and exploring the Earth Justice website. I navigated to the "Our Work" and "How We Work" sections to help students understand the organization's goals and perspective (Earth Justice, 2021). I then asked students how Earth Justice might respond to the question, "Are pipelines safe?" Before revealing the information, I prompted students to make predictions based on what they had learned about the organization. I then revealed the information and read each note about pipeline safety to the class. Finally, I asked students to reflect on why the two organizations presented different answers, encouraging them to consider how perspective and purpose influence information.

Next, I asked students if they remembered a photo from their first CER in science and whether they would swim in the water. Students first shared one reason at their tables why they would or would not swim. Then we examined the next slide together and discussed what they noticed about the Mississippi River in Minnesota, including where the Minnesota River and the St. Croix River meet the Mississippi River (Seitz, 2021). Students turned to their notes to record observations as I showed a video of the rivers flowing together and read information about how sediment from the Minnesota River is shaped by agricultural land and eroding glacial soils, which affects downstream water clarity.

We then analyzed a map and discussed patterns in water quality, including connections between sediment flow and land use. Students considered whether water quality in Minnesota has changed over the past 11 years and why water issues can become political (Dunbar, 2019; Friends of the Mississippi, 2025). Students then explored water quality in Minnesota using an interactive map with a legend showing conditions, and we zoomed in on our local area to observe patterns (Minnesota Pollution Control Agency, 2015).

Finally, students discussed what they noticed and how different water uses might be affected by these conditions.

Day 3: Water on Earth and Water Walks

On day three of the lesson, I began by showing students an image of Earth from space and asking what they noticed. Students then turned to their notes as I explained that while Earth appears mostly blue, representing the oceans, all of the planet's water is actually a very small, thin layer relative to the size of the Earth. I guided students through a demonstration of Earth's total water supply, including a comparison of all water condensed into a single sphere and a breakdown of where that water exists. Students analyzed data showing that most of Earth's water is saline, and that most freshwater is locked in ice or underground, leaving only a very small fraction available as surface water, yet this is the primary source humans rely on daily.

We then connected these scientific observations to cultural and relational understandings of water. I introduced the idea of water as a living entity through the work of Ojibwe leader and water walker Sharon Day, including the practice of water walks and the belief that water can listen, remember, and respond to human relationships. Students watched a video and discussed the purpose of water walks, considering how relationships with water differ from data-driven approaches. We then explored reflection questions about how humans impact water, including challenges such as historical inequities and infrastructure, and introduced the idea of "water wealth." To close the lesson, students recorded personal commitments on water drops (Figure 2), shared ideas at their tables, and completed reflection questions individually and as a whole group.

Excerpts from student reflections

- *I think safe drinking water is a right, but we are privileged to have it. We have to protect it so that everyone can have it.*
- *Small actions can help save clean water for everyone who needs it.*
- *It is our responsibility to ensure everyone's safety.*
- *Why should we listen to indigenous voices? Because they were here first. They have lived and respected water for generations.*
- *How can we encourage others to take care of the environment? By talking to others and listening.*

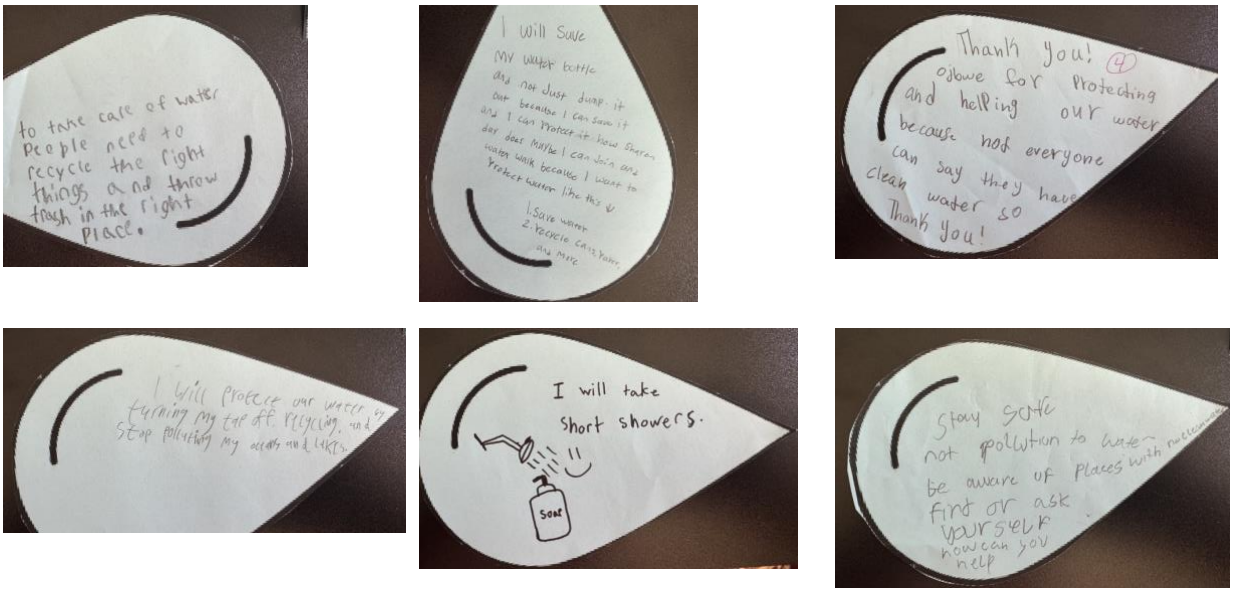

Figure 2: Photos of Water Pledges.

At a Glance

Title	Connecting Math and Climate Justice
Unit Time	3 - 50-minute class periods, taught consecutively
Grade Level(s)	6th grade
Core Text	We Are Water Protectors by Carole Lindstrom and Illustrated by Michaela Goade
Climate Literacy Terms	water, pollution, pipelines, climate justice
Objectives	Students will investigate water systems in Minnesota to understand issues of climate justice by analyzing data, exploring human and environmental impacts, and examining Indigenous perspectives on water stewardship, in alignment with Minnesota Department of Education Indigenous Education for All standards, Minnesota Science standards on Earth systems and human impacts, and Minnesota Math standards related to data analysis and interpretation.
Materials and Resources	Presentation Slides Gallery Walk Photos to Print Teacher Guide Student Handout

Going Forward

For the next school year, I plan to develop a series of lessons that explore different dimensions of climate justice, introduce students to climate justice advocates, and strengthen connections between mathematics and students' lived experiences. While student engagement was high throughout the three-day water unit, I recognized that I had missed an important foundational step: intentionally building climate empathy and fostering personal connection before introducing the water lesson. In future instruction, my first lesson in the sequence will focus on helping students explore their personal relationships with the environment and climate to establish this foundation. This could take several forms: a personal water-use journal where students track and quantify their own daily water use for 24 hours before the unit begins, giving them concrete personal data to compare against the unit's broader statistics; a "water memory map" where students write or sketch a personal experience involving water (a lake, a tap, a storm) and share it in small groups to surface prior emotional connections; or a brief survey/discussion protocol asking students where their tap water comes from and where it goes after use, building curiosity before the data-heavy lessons arrive. From there, each subsequent lesson will build on these connections by prompting students to reflect on their own experiences and relationships to topics such as water, ensuring that learning is both meaningful and personally relevant.

I also plan to strengthen the unit's math content by adding a short fourth "math lab" period or folding an additional 30 minutes into Day 2 or Day 3, where students perform actual calculations using real numbers pulled from the unit's existing sources. Currently, these sources are used primarily for reading and discussion; building in dedicated computation time would ensure students are applying, not just observing, mathematical thinking. For example, the Mississippi, Minnesota, and St. Croix River confluence and sediment discussion could support a map-scale and distance/rate problem, such as calculating river flow rate or using map scale to determine distances between points. Additionally, given my reflection above about wanting to incorporate more source-based exploration, I plan to pair that shift directly with a statistics literacy goal: teaching students to critically question a data source by asking "What's the sample size?", "What's the source's bias?", and "What's missing from this graph?" as a formal skill, using the contrast between the two pipeline organizations as the case study. I would also incorporate more source exploration to find information, rather than a direction-based instruction model.

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