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Triple rigor, *Braiding Sweetgrass*, and Food Dignity lessons for eighth grade earth science and beyond

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Abstract

Christine Porter called for three forms of rigor—emotional, ethical, and epistemological—to be applied to academic research about sustainable food systems. The triple-rigor framework raises questions about what science should do, which in turn raises questions about how scientists learn. Based on an eighth grade earth science class that I design and teach, I describe teaching practices that help to achieve three goals for students: recognize that science is a worldview, just one way of knowing among many, and is not superior to any other; build capacity to grapple with complexity and use systems thinking to understand wicked problems; and use science as a tool for social and environmental justice. To explain how the teaching practices relate to the goals, I draw on personal experiences as a research assistant and postdoctoral scholar on the Food Dignity project, Christine Porter's mentorship and scholarship, and Robin Wall Kimmerer's book *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants* (2015). The teaching practices include mapping activities, systems thinking, concept maps, and global perspectives, with attention to gratitude and humility. I conclude by noting areas for continued curricular revisions and inviting readers to network and share.

Keywords

triple rigor, sweetgrass, earth science, middle school, Food Dignity

From Food Dignity to Eighth Grade

Christine Porter served on my dissertation committee and supervised me as a research assistant and postdoctoral scholar on the Food Dignity project, for which she served as the lead principal investigator. Officially, the Food Dignity project was a USDA-funded research project that over the course of five years tried to answer the question: How do community-based organizations in the U.S. promote food security, community leadership, and equity? University-based researchers and community-based organizers and activists partnered to

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answer this question. Along the way, they continually experimented with and evaluated how to collaborate equitably (Porter et al., 2018). Unofficially, the project was where I was mentored, as much by Christine as the community activists and organizers she convened, in the question: What should science do?

I didn't set out to answer this question, nor was I even aware that I was answering it at the time. I was a human geography graduate student studying food systems and justice. I loved school —navigating library stacks, writing papers, analyzing case studies, and employing participatory research methods. That is to say, I favored academic ways of knowing. Many of the Food Dignity partners favored more experiential ways of knowing. They responded to neighborhood needs with deep listening, resourceful experimentation, evaluations, and ongoing adjustments to community programming. While my academic methods of learning about community issues passed muster in the university, they paled in comparison to community partners' knowledge.

Christine was my supervisor and mentor, but she was also my friend, inviting me to be my whole self. While we shared a commitment to what she called the capital-W-work, which I understood as work stemming from a vocational call to advance justice, she never expected me to become her carbon copy and gave me unwavering support when I left academia. As our paths diverged, she gave me another gift: she told me about *Braiding Sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants,* by Robin Wall Kimmerer (2015). Food Dignity partners from the Wind River Indian Reservation in Wyoming had opened my eyes to the value of Native worldviews, and *Sweetgrass* amplified these lessons by guiding me toward a new way of practicing science.

My science education throughout high school was a collection of facts that, as far as I could tell, had no relationship with social justice. In graduate school, studying community development and environmental justice, I became familiar with case studies of science and technology becoming tools of oppression (e.g., de la Peña, 2013; Ottinger, 2010). After Food Dignity, leading a college-level field learning program about sustainable food systems I had to reckon with the reality that my aversion to science had created a major blind spot; I understood little about the challenges posed by climate change for many of the farmers from around the world whom my students and I met and learned from.

Braiding Sweetgrass exposed me to the scientific nature of traditional ecological knowledge, to applying the scientific method to sustainability, and to upholding connections between people and the natural world. Her science is not aimed at extraction or efficiency. Instead, it validates awe, celebrates human joy, and affirms the interconnectedness of all things. Shortly after reading *Sweetgrass*, I joined a citizen science project, met teachers through it, and landed in the world of private schools. Today, I am a middle school science teacher.

When I told Christine I planned to write something for this special issue about how Food Dignity informs and resonates with my work today teaching middle school science, she said, "You'll be showing different ways we can find routes to justice." Middle school science isn't inherently a path to justice, but I aim to expose my students to this possibility. Of course, my students learn to think and communicate like scientists, using scientific methods, conducting experiments, constructing models, and writing lab reports. However, I have three additional goals for my students that are not always present in science classes:

1. Recognize that science is a worldview, just one way of knowing among many, and is not superior to any other.
2. Build capacity to grapple with complexity and use systems thinking to understand wicked problems.[1]
3. Use science as a tool for social and environmental justice.

[1] Wicked problems are those that are difficult to define, lack clear answers, have an unknowable number of solutions, are unique and interconnected with other problems, and, importantly for the kind of science class that I aim to teach, have social and political dimensions (Rittel & Webber, 1973).

Christine described some of the most significant lessons to come out of Food Dignity by proposing new and equitable standards for research. She offered triple rigor as an antidote to academic supremacy (Porter, 2018; Porter & Weschler, 2018). The epistemological rigor she referred to includes the conventional gold standard of the scientific method. Two other types of rigor—emotional rigor and ethical rigor—are necessary to check some of the unintended negative consequences that arise from single-minded focus on epistemological rigor in academia—and, I suggest, science teaching more generally. In this essay, I describe several of the less conventional components of my eighth grade earth science class that help my students to meet the above goals and some of the assessments that measure student learning in these areas. I also explain how lessons learned from Food Dignity, triple rigor, and *Braiding Sweetgrass* motivate and support me to pursue these teaching goals. In doing so, I highlight Christine's legacy as a significant inspiration for my teaching.[2]

Science as a Worldview

To introduce earth science topics at the beginning of the year, my students study maps. By starting this way, I acknowledge that we're learning science as just one way of seeing the world. After examining and analyzing various maps, students make two of their own. In making maps, students experience making decisions about what to include and exclude. For the first map, they use the National Geographic and ESRI mapmaker tool to explore landforms in different countries (National Geographic Education, n.d.). They also learn about the cultural, political, environmental, and/or economic significance of the landform. At the same time, they browse more creative atlases such as the Infinite Cities series and those created by Guerilla Cartography (Cowart et al., 2022; Jensen & Roy, 2013; Jensen et al., 2017; Solnit, 2011; Solnit & Jelly-Schapiro, 2016). They propose ways to represent the significance of the landform more fully. The second map is a gratitude-based map of where they live, learn, and play, such as basketball courts, friends' homes, and summer camps (Figure 1).

Through framing, summarizers, discussion, and reflection, students connect the subjectivity of mapmaking with gratitude and diverse worldviews. First, analyzing maps leads students to observe that maps are sources and should be considered alongside other sources. Second, in framing the gratitude map assignment, I emphasize that our worldviews inform the questions we ask as scientists, so we must step back and become aware of our worldviews. I also emphasize that our learning community is stronger when we have a diversity of perspectives. Finally, as the gratitude map is one of the first assignments of the year, it is an opportunity for students to introduce themselves to me, and to some degree, each other. I tell them that I hope to see maps as unique as they are. Many students live in the same neighborhoods, and comparing their maps reveals differences about what they choose to represent, highlighting the subjective nature of each map. By selecting what to include in both maps, students come to understand them as representations of various viewpoints and that their biases inform the making of something they once thought of as purely factual. In seeing their own biases, they build awareness that all scientists have them.

My Food Dignity experiences inform this emphasis on subjectivity. Christine, other graduate students, community partners, and I spent ample time discussing power dynamics. I came to understand the ideal of objectivity in academia as something of a wall behind which academics had the option to hide. I saw accusations of "being emotional" levied against community partners with the intention to diminish and dismiss their ideas and perspectives. The charge was a way of protecting academia and rationality as sources of power, and it was intricately connected with academic and white

[2] The Community and Regional Development course in Food Systems at University of California, Davis, taught by Ryan Galt, who was also my advisor there, was another significant inspiration along my teaching path (Galt, 2009; Galt et al., 2012). I was part of the Food Systems teaching team while I participated in Food Dignity and remain grateful for both influences. I am also grateful to be teaching at a school that shares my values. Without such alignment, I may not have developed the approaches that I describe here.

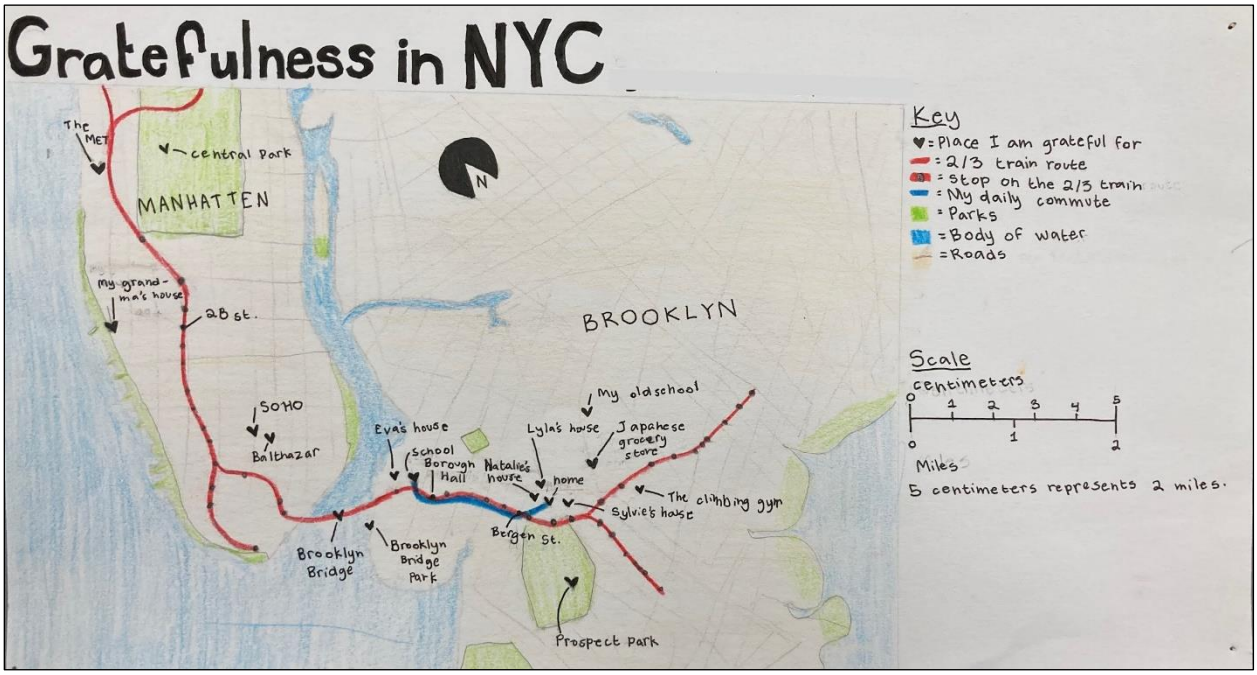
supremacy (Porter & Wechsler, 2018). Some of the most seasoned academics in the project insisted that methodological choices should exclude personal experience and perspective, resisting calls for "strong objectivity," which acknowledges the inevitability of researchers' experiences influencing their work (Harding, 1991). Similarly, Kimmerer describes science as a "language of mechanism and objectification" (2015, p. 165). It is overly concerned with naming and categorizing, to the exclusion of knowing through experience, emotion, and relationship. Scientific instruments can lead scientists to trust their own senses less, dismissing anything not learned through experimentation. Accordingly, other Food Dignity graduate students and I called for a "strategy for using emotions rigorously and productively to combat academic supremacy" (Bradley et al., 2018, p. 222). We were merely channeling what community partners taught us, and Christine took this call seriously enough to emphasize triple rigor instead of merely epistemological rigor.

I hope the mapping activities mitigate scientism, the belief that scientific knowledge is superior to other forms, which underpins academic supremacy (Porter & Weschler, 2018). In taking this approach, I hope to lay groundwork for prompting students to consider the limits of scientific questions and methods. At the end of the unit, students prepare for and run their own discussion. Their preparations begin with a gallery walk to observe their classmates' maps. A discussion planner and reflection help them organize their thinking and summarize their learning.

In discussion planners and post-discussion reflections, students noted the following:

- "A question coming to mind is, isn't science a religion of sorts?"
- "Some questions coming to mind are: What are all the different ways maps can help us in life? Are maps/science used for good or evil?"
- "A peer challenged my thinking when they said that maps are related to art, because it challenged my perspective on how they are subjective."
- "The question 'why is the world so beautiful?' [from Braiding Sweetgrass] influences me because it makes me think that there is not always one way to think about something and worldviews are an example of

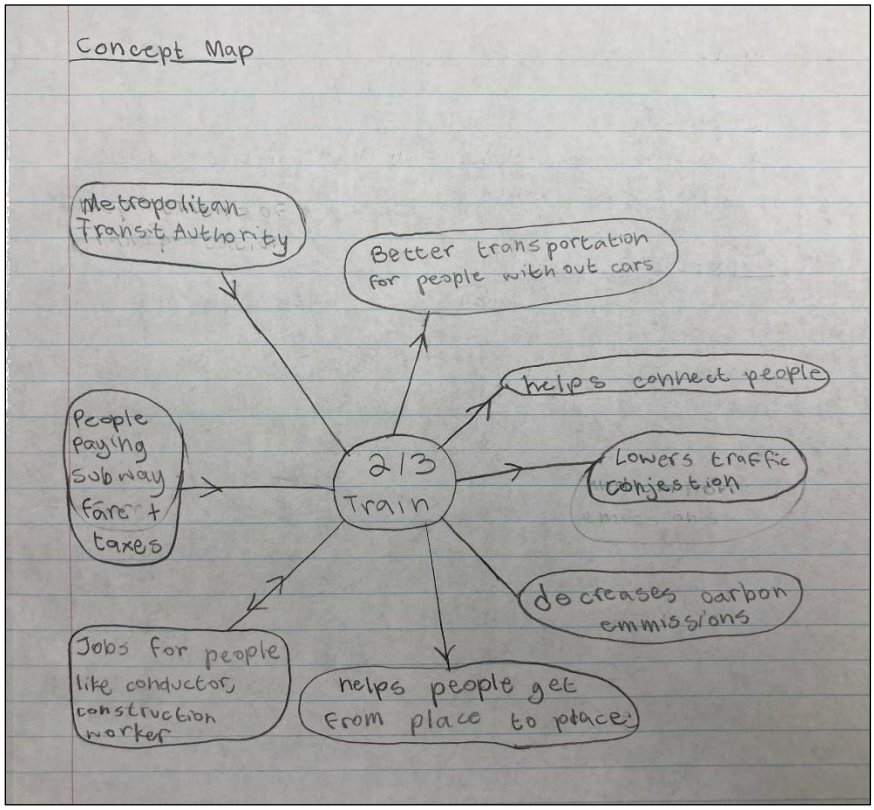
Figure 1. Example of a Student's Gratitude Map



that. Knowledge is something that you need to have, but relationships can deepen your thinking and help you find new ideas."
- "Cartographers will leave out things. Maps are imperfect since some things might not matter to the cartographer and maps are selective."
- "Something my peer said that challenged my thinking was that different cartographers will have different worldviews no matter what (even if it's just slight)."

Like maps, the focus of scientific inquiry reflects scientists' worldviews and, therefore, the limitations of the scientific method. By beginning the year this way, we establish that there are limits to objectivity and, hopefully, open an emotional dimension that can strengthen our approach to science as the course progresses (Kimmerer, 2015; Porter, 2018).

Figure 2. Example of a Student's Concept Map, Building on the Example in Figure 1
I encouraged students to use arrows to indicate inputs and outputs.



Capacity to Grapple with Complexity

Once students understand that perspective is always present and always partial, including in science, I share tools for zooming out, seeing the bigger picture, and integrating information learned by diverse means. Doing so is necessary for addressing some of the most complex issues in earth science and for the world, such as climate change, biodiversity loss, and hunger. To grapple with such complexity, I aim to equip my students with systems-thinking strategies. Systems thinking is a capacity to make sense of complexity with the understanding that systems are components, interconnections, and functions that together are more than the sum of their parts (Meadows, 2008).

To teach students systems thinking, we make concept maps, beginning with simple ones and eventually making more elaborate ones. The first concept maps they make build on the gratitude map assignment. After making a map of what they value about their home, they select one thing represented on their map to research further, making concept maps showing what they appreciate about this thing, benefits it had for other people or the environment, who made it or makes it possible, what it is made of, etc. (Figure 2). Making connections between these concepts reveals pieces of their world as part of a larger world. That their concept maps include details that their gratitude maps do not suggests that students' thinking is beginning to shift. They begin to recognize everything as part of a system that contains subsystems. While students may not fully internalize this key point right away, continued instruction and practice in systems thinking helps them to do so by the end of the year.

Next, students make simple concept maps about climate feedback loops involving the atmosphere and jet stream, forests, land cover and albedo, and permafrost (Figure 3), based on a series of videos (Gray, 2021). At the end of the climate change unit, students complete a research project on an effect of climate change in another country and how people there are adapting to it. They then represent what they learned by making another concept map (Figure 4).

Finally, in an end-of-unit reflection, I ask students about the usefulness of concept maps. Students explain that concept maps show multiple cause and effect relationships, nonlinearity, and the bigger picture:

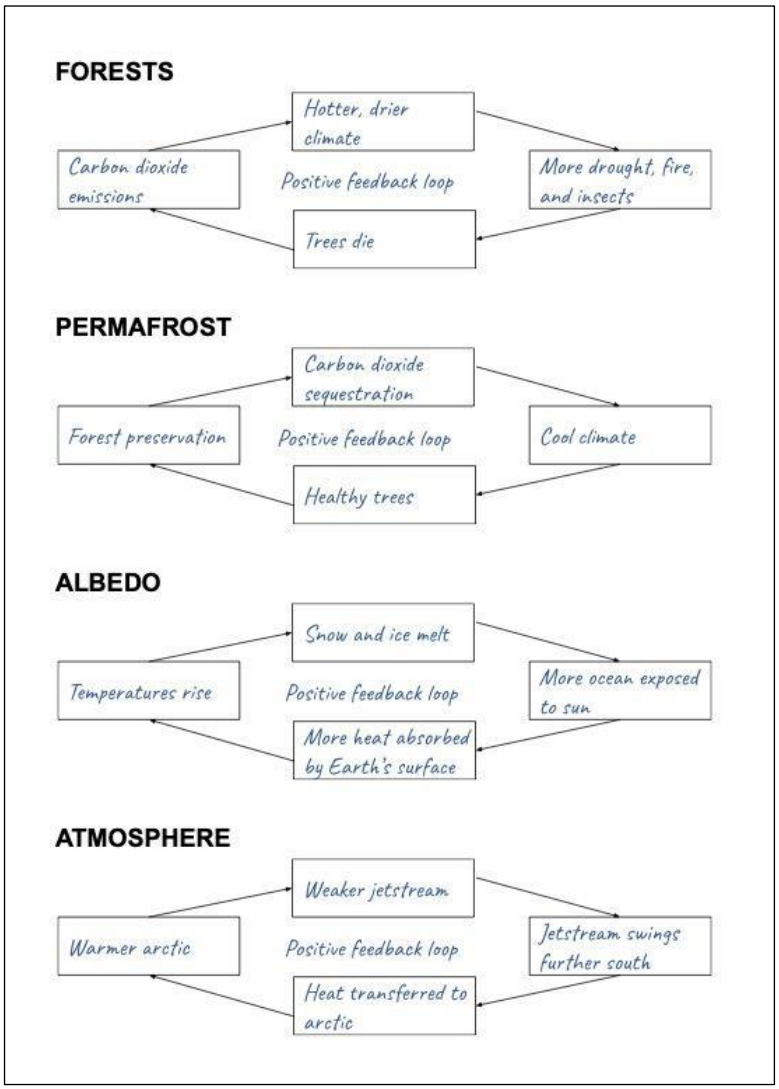
- "Concept maps are useful for describing the causes and effects of climate change because it [sic] shows a simple version of all the connections and causes. Instead of writing sentences where it seems like everything happens in a step-by-step fashion, concept maps show that [a] lot of things happen at once and lots of causes lead to different effects."
- "A concept map is useful because it shows how everything is connected. It shows how human's actions affect the planet and how the planet affects humans. It gives people a wider scope of whatever topic the concept map is about."

Concept mapping helps students to see and think about the world holistically. They visualize system components on different scales, their interconnections, and their functions, which helps them to focus on the broader contexts of climate science.

The students' first concept map is important for another reason as well. Rethinking something they value by making it the focus of a concept map can help foster humility, revealing a surprising way in which an eighth grader's capacity to grapple with complexity and emotional rigor go hand in hand. Many teens experience some version of adolescent egocentrism, which may include "challenges in understanding perspectives different from their own" (Anglemeyer, 2024). Making a concept map forces students to consider perspectives other than their own. While students do not change their thinking in drastic ways, many reevaluate the importance that they place on their own viewpoint.

I learned during my time in Food Dignity that

Figure 3. Climate Feedback Loops Concept Maps

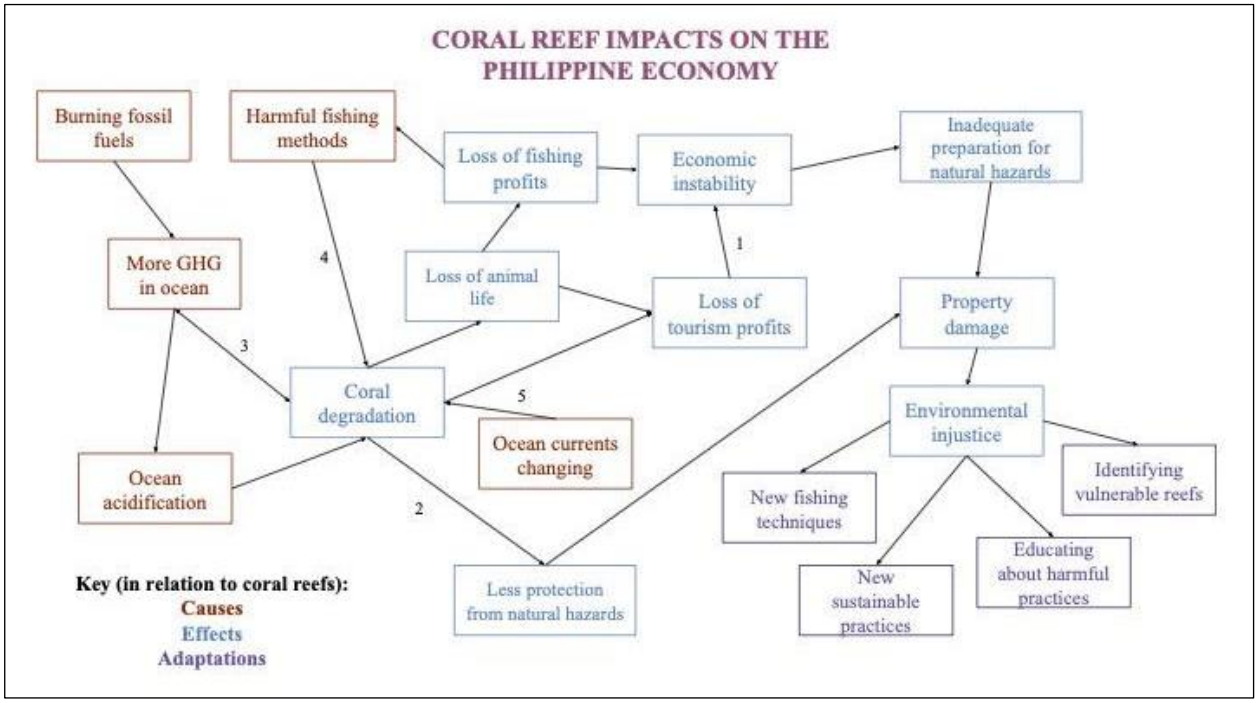


having a foundation of humility in research helped me and other graduate students to recognize community partners' dignity, respect the validity of their ways of knowing, and ultimately move toward democratizing the research process (Bradley et al., 2018). For Kimmerer, "doing science with awe and humility is a powerful act of reciprocity with the more-than-human world" (2015, p. 252). In addition, Kimmerer affirms that leading with gratitude connects us with a deeper sense of our interconnectedness and appreciation for Earth's abundance. While students' gratitude initially focuses on a single object or a direct experience, concept mapping has potential to expand what and who students appreciate.

Christine advocated for studying localized, specific, community initiatives rather than "'larger classes of similar units,'" (Gerring in Porter, 2018, p. 41) each with "narrowly focused boundaries and analysis" (Porter, 2018, p. 41). Having a local focus was an important part of epistemological rigor in Food Dignity, because focusing on a large class of food justice–oriented community-based organizations would risk missing the creativity, richness, and unique local context of community partners' work. Although middle school and Food Dignity are quite different situations, my students make concept maps about how Earth's systems play out in specific places (Figure 4). While I teach the tools needed for traditional epistemological rigor and students must be able to explain specific climate mechanisms, geological process, ecosystem dynamics, etc., the real richness of my students' learning, as revealed in their comments in class and their reflections, is in their ability to find interconnections across these phenomena and understand how they manifest in specific countries and contexts. For example, when students observe each other's work, some realize that many of the most devastating and challenging effects of climate change occur in countries that have done little to cause climate change.

Also, as students explore how climate change manifests and how people adapt to it in other parts of the world, their global perspectives expand, helping them to explore the underlying systems that contribute to complex and wicked problems. Identifying global patterns, students begin making

Figure 4. A Student's Concept Map Showing the Factors Contributing to Climate Change, the Effects in the Philippines, and Adaptations in the Philippines



connections about Western materialist culture (in which my mostly affluent students are deeply steeped), factors contributing to climate change, and global inequities in the effects of climate change. Darwinian science, as it is often taught and as it is represented in popular culture, tends to teach that species survive because of their fitness and ability to outcompete their neighbors. However, through their research, many students discover that cooperation is often employed as a climate adaptation strategy around the world. This year, to prime students to make this discovery as they research adaptation strategies, we will play a common pool resource game, Fishbanks (Meadows et al., 2016). Players are told that there is an unknown number of fish in the ocean, represented by coins in a fishtank. The goal of the game is to harvest as many fish as possible. Each round, teams submit requests for a certain number of fish, and they receive those fish if there are enough fish in the ocean. If there are any fish left over after all teams submit requests, the remaining population doubles and the next round begins. The game ends when there are no more fish.

I've only used this game once, with one group of students, but it was so successful that I plan to include it consistently moving forward. The first time we played, students assumed they were in competition with other teams, and the ocean ran out of fish after just one round. Before playing again, we discussed the reasons why they assumed they were in competition with each other and I challenged them to work cooperatively. Listening to their discussion as they played the game again, I heard them work out the necessity of transparency ("show them your card [that says how many fish you are harvesting]") and consequences for free riders ("you took too many last time so this time you don't get as many"). When they imagined themselves as members of a hypothetical fishing community, they associated cooperation with abundance, or enough for all. While they didn't get as many fish as possible, they did much better the second time around and they identified some attributes of successfully managed commons without prompting (Ostrom et al., 1999). At the end of the activity, I repeated some of their statements back to them, telling them that they identified attributes that were also identified by a Nobel prize winner. When I teach the unit this year, I will promote peer-to-peer learning through a gallery walk of climate adaptation concept maps and discussion prompts that task students with making connections between the Fish Bank game and the climate adaptation strategies they research.

Kimmerer (2015) reminds readers that, from ecological and evolutionary perspectives, cooperation holds as many keys to survival as does competition. Teaching my students that cooperation and reciprocity are part of nature's path to sustainability—indeed, to survival—is an antidote to widely held beliefs about scarcity, individualism, and competition. Such beliefs can lead to a linear consume-dispose culture, which Kimmerer and Anishinaabe people recognize as Windigo, a mythical monster in each of us whose name connotes "fat excess" and "thinking only of oneself" (Johnston in Kimmerer, 2015, p. 306). Windigo depletes the abundance of the natural world. A humble, systems view of dominant, taken-for-granted perspectives around our wicked problems and inequities, and a range of responses to them help to prepare students to embrace the last goal that I have for them: seeing science as a tool for justice.

Science as a Tool for Justice

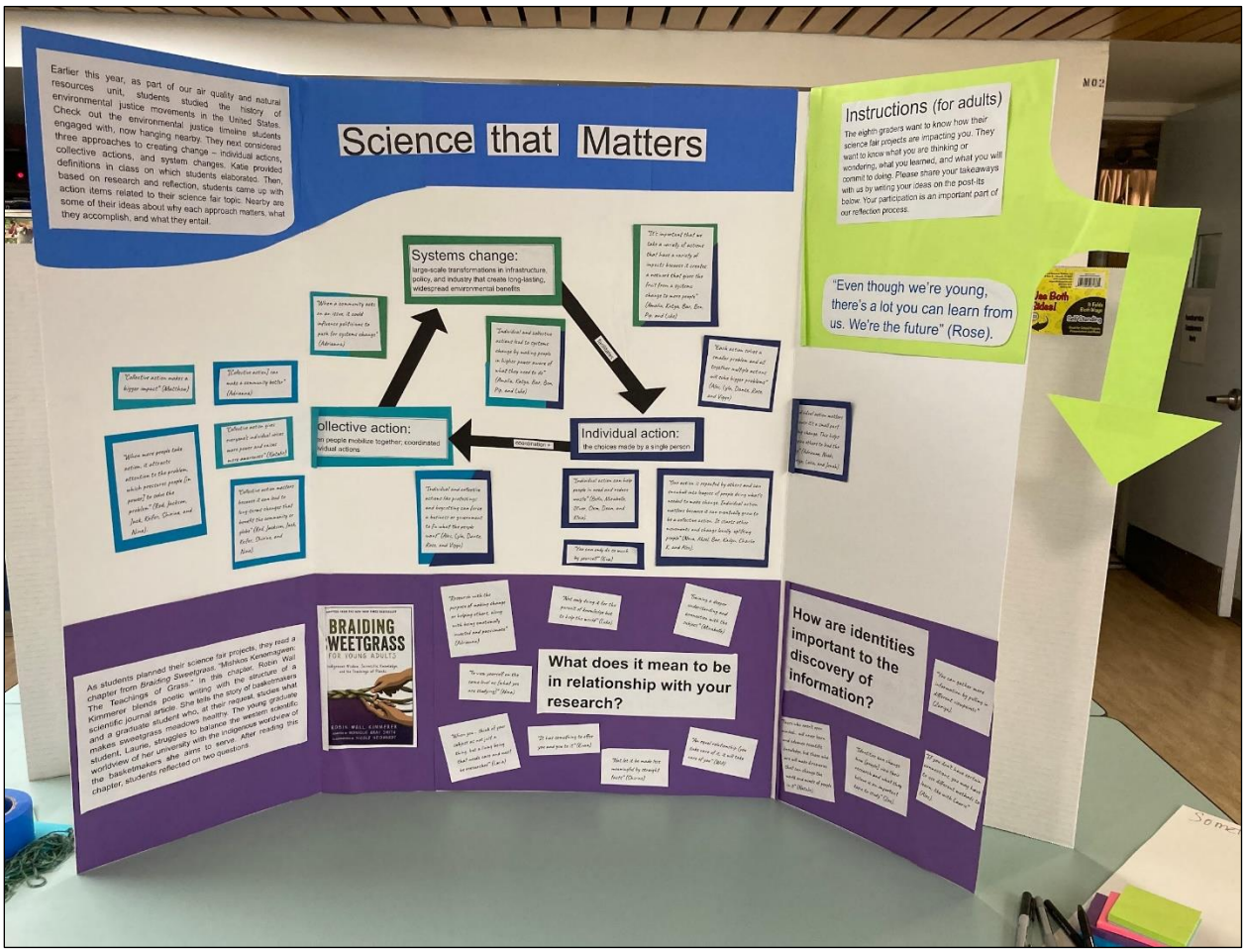
Whereas my first two goals for students are more about the disposition of the scientist, my final goal has to do with what our learning and science can do, both within our class as a learning community and the broader world. I want students to be able to identify when science is being used as a tool to advance justice and to connect their own learning to possibilities for positive action. To this end, I share some different ways that people are moved to act because of a natural phenomenon or scientific discovery, and I aim to facilitate experiences of collective efficacy for my students.

To teach students that science can be a tool for justice, I expose them to several ways people act on scientific information. For a project early in the year, they study youth leadership, art activism, or Indigenous stewardship and investigate how this strategy advances climate justice. In the middle of the year, students create a timeline of important cases in the history of environmental justice

(EcoRise, n.d.). Throughout the second half of the year, using individual action, collective action, and systems change as central concepts (Figure 5), students make recommendations for addressing local air quality, research strategies to mitigate climate change, and suggest action steps based on science fair projects. We ask adults who visit the science fair to share something they learned, are wondering about, and will do based on the projects. Students' final task of the year is to evaluate their own efficacy as agents of change by reflecting on how adults' takeaways matched their project goals. One student wrote, "I think [adults visiting the science fair] have good wonderings and have grown to understand their impacts a little more, which is all we can really ask for honestly. The one [adult reflection] that says, 'I'm wondering what keeps me from pushing for systemic change' is one that I think really highlights how much systems change is needed and is a good example of what people need to be thinking."

In addition to helping students connect inquiry with action, I aim to foster a collaborative environment. I designed a year-long series of projects that I call "Country Profiles" in which students apply whatever scientific concepts we are studying to specific countries around the world. As described above, they explore local landforms through mapping, climate justice activism, climate and biodiversity, effects of climate change, efforts to mitigate and adapt to climate change, etc. For each project, individual students learn about only one part of the world; collectively, they learn about these phenomena in about thirty countries. They depend on and

Figure 5. A Poster at the Science Fair Highlighting Students' Thinking About Strategies for Change
It invites adults to reflect on their experience at the science fair.

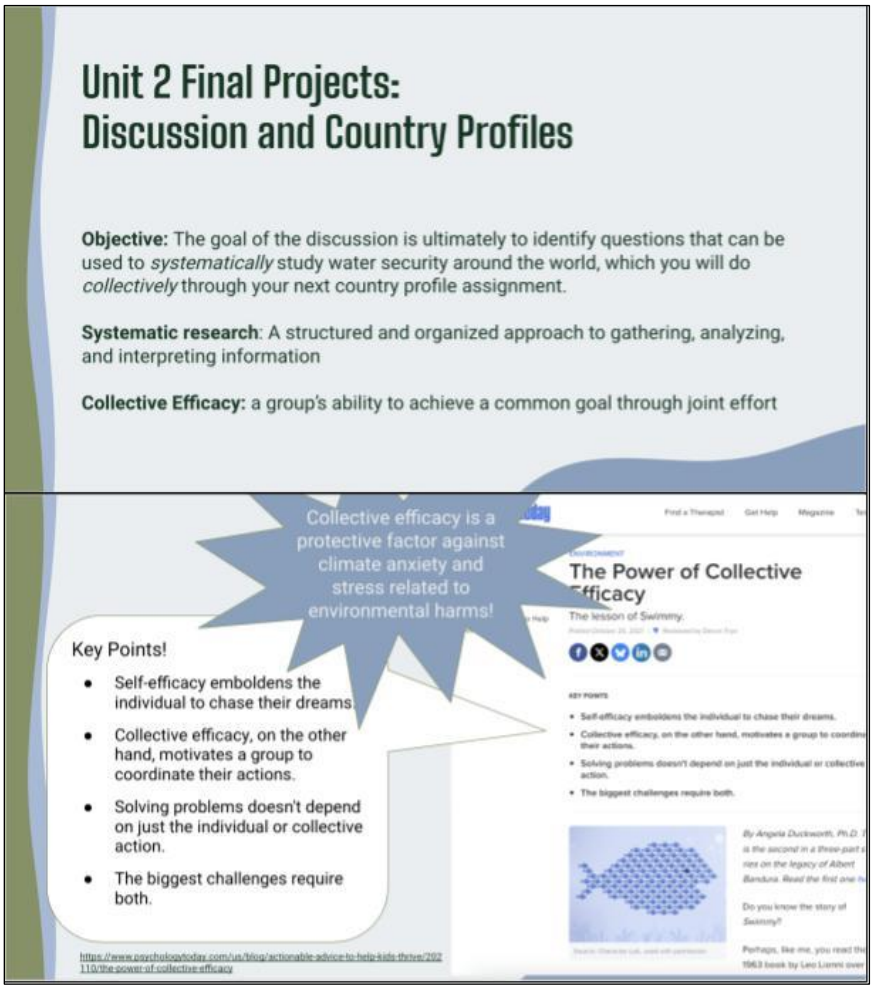


learn from their peers' parallel knowledge about other countries to identify global patterns.

When students learn from each other because of distributed responsibilities, two things happen. First, their learning methods mirror the interconnectedness of the natural world, aligning with Kimmerer's (2015) emphasis on cooperation as a key to survival. In nature, when resources become scarce, many organisms and species survive through some form of cooperation. In our class, we divide the workload to cover more material. When giving instructions and framing assignments, I emphasize the theme of interconnectedness to students, challenging them to question their assumptions about the supposed naturalness of competition in society and on our planet.

Second, when everyone learns because of distributed responsibilities, students experience collective efficacy. In my introduction to the country profiles assignment to students, I ask them how well they think they would be able to learn about the topic in all thirty (approximately) countries in just a few class periods. They generally agree that they could not do it well. We then discuss what it means to do research systematically and why it is important for everyone to address common questions in their research (Figure 6). When the individual projects are complete, students are impressed by and enjoy looking at the compilation of their work. Not only do they learn from each other about different parts of the world, but they also learn from each other's ways of approaching the assignments, which makes our learning community stronger and builds student capacity for further learning and, potentially, for action. This approach also builds students' capacity for grappling with complexity, because experiencing collective efficacy is an important protective factor against negative mental health outcomes related to studying wicked problems. Eco-anxiety and eco-despair are documented as leading to psychological paralysis, which undermines the practice of one's ethics to bring about a more just world even when one's heart is in the right place (Vedante, 2025). I explain this research to students and repeatedly remind them that they are effective in their learning, not just because of their own hard work but their peers' as well. With a distributed workload, an abundance of learning can happen.

Figure 6. Class Slides Introducing a Country Profile Assignment
As part of the introduction to the assignment, I reiterate what collective efficacy is and why it is important (Duckworth, 2021).



In Food Dignity, we held ourselves to a standard that required that both the ends (what we learned) and means (our methods) make positive impacts. According to Christine, building individual and community agency and capacity for engagement through research qualifies as ethical rigor (Budowle & Porter, in press). In this vein, I've sought to create a classroom dynamic in which learning experiences bring students together and equip them, socially, analytically, and emotionally, to be change makers.

A Journey and Aspiration

Triple rigor and *Sweetgrass* science are close cousins in the Work, to borrow another phrase from Christine (McMichael & Porter, 2018). If science is to produce the rich insights that Food Dignity community partners developed through experience and that Indigenous worldviews add to so many biophysical sciences, scientists must recognize and honor diverse ways of knowing, take responsibility for what our methods and findings do in the real world, and come to the Work with humility and self-awareness. I have described how activities that highlight multiple worldviews, systems-thinking skills, global perspectives, and collective efficacy sow seeds for my students to grow into scientists who practice triple rigor and remember the lessons from *Sweetgrass* even after they leave my class. Like a newly planted meadow that requires dynamic care over multiple seasons to reach its desired diversity, for the seeds to flourish students will need ongoing guidance. That is to say, their future teachers must continue to validate and encourage this approach. Refining my practices might make other teachers more likely to adopt them. I hope other educators in the biophysical sciences, regardless of level, will seek ways to teach future scientists to practice triple rigor.

Christine maintained that she "has never 'achieved' triple rigor, and she considered it a journey and aspiration, as opposed to a destination or end" and the same is true of my teaching (Porter & Budowle, forthcoming). Similarly, the learning goals and approaches I have described in this essay can always benefit from improvement. In writing this essay, I was able to reflect more deeply than I typically have time for during the school year. I was able to see ways my teaching practices can more explicitly align with my goals. While I was intuitively moving in this direction, the process of writing this essay has laid bare the trial and error nature of my curriculum development and helped me to clarify how students can demonstrate that they are achieving the goals I set for them.

There are several crucial features of my trial and error curriculum creation. First, I have made changes gradually, paying close attention to the work and process of students who "get" the ideas entailed in the three goals laid out here. Paying attention to students who "get it" at early stages of my experimentation shows me how to better scaffold and chunk skills so that they are more accessible to more students. Second, I capitalize on students' capacity to give feedback. Many of my eighth graders will ask to repeat an activity they liked or complain about something they disliked. Whenever this happens, I ask follow-up questions, such as, What did you like/dislike about it? Why was it hard? How did you get past the challenge(s)? These conversations are often brief and happen in passing moments, so I have rarely documented them, but they have provided invaluable insights that inform constant refinement.

Thanks to this writing and revision process and learning from my own mistakes, successes, student feedback, I have honed assessments that help students demonstrate their learning, which helps them also to consolidate their learning. New in the 25–26 school year are several assessment formats that I have begun using more consistently, refining with each use. Discussion planners help students summarize their learning; discussions make space for students to test out their thinking, make connections, and learn from each other; gallery walks allow them to see and learn from each other's work; and structured, written reflections help students connect the learning processes with the learning outcomes, consolidating their learning, and help me to evaluate the efficacy of my instruction and assessments more systematically (Coppens, 2020; Gonzalez, 2015). I am already seeing that my newfound clarity from my writing process and the curriculum revisions inspired by it are helping my students realize the goals I set for them more consistently. Yet, the Work never ends.

There are a number of things I hope to improve in future course revisions. First, I want to continue improving my instructional and lesson design so that I'm reaching all my students as effectively as possible. The abstract thinking needed to understand a complex topic holistically is something eighth graders are just becoming capable of, in terms of neurological development (Dumontheil, 2014; Stanford Medicine Children's Health, n.d.). I need to find better methods of differentiated instruction (McCarthy, 2023) so that all my students make great strides in their thinking about how and why to do science, which will help more students to think outside of their own direct experience and bring more ethical rigor to my classroom. Second, I aim to include, more consistently and systematically, examples of scientific information leading to action and to make time in my curriculum for students to take action within our school community. Related to this, I hope in the future to build partnerships for community collaboration and experiential learning. I am also working towards organizing a climate policy symposium, inspired by but significantly adapted from the Reacting to the Past curriculum, although I have not done this yet with my students (Henderson & Henderson, 2018). Third, and as referenced throughout this paper, I have already begun including reflection and discussion more consistently to support students' emotional rigor, practice of holistic thinking, and ability to recognize how worldviews operate in science, in our relationships with the natural world and with each other.

Finally, I don't see a way to achieve these next steps without joining a broader network of similarly minded educators. Christine was an expert at this, and I feel her guiding me and giving me the confidence to share curriculum maps, student-facing materials, and samples of student work more broadly. I hope these examples from my teaching practice speak to a few audiences. First and foremost, I share them for Christine and anyone who loves her. She gave so generously to so many of us, and while there were common threads in our experiences with her, I'm sure we each learned something unique from what she shared with us. By sharing what I've done with her lessons—in an unexpected way, in an eighth grade earth science course—alongside others' stories in this special issue, I hope Christine's wisdom continues to give and to remind us of the ways she still lives. Additionally, I hope that what I've shared speaks to people who didn't know her while she was alive. In this sense, this essay is also for anyone who loves learning and knows in their hearts that it can be a tool in their justice kit. To this end, I hope this essay allows me to connect with other educators who share my triple rigor- and *Sweetgrass*-informed vision for science education in middle school. I invite you to be in touch.

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