At a professional development workshop on equity, a teacher sitting next to me said, “How does it feel to my students that I’m a cisgender white male talking about equality?” I responded, “How does it feel to your students if you don’t talk about equity?”

This short interaction has stayed with me. I don’t just teach science content and skills, but also about the people behind scientific discoveries. Telling the story of science and the contributions from the past and today often includes inequity and social injustice. To have these discussions, there are various ways to start the conversation, but the first step is to reflect on your own pedagogy and understanding of diversity, equity, and inclusion.

**Class culture**

The most important step that leads to meaningful conversations around equity is the culture we create in our classroom. Take the time to build relationships with students and establish trust. Think about what is modeled in how you speak to students and the expectations you set for how they speak to one another in your class. Find opportunities for “voice and choice” in the curriculum where students feel celebrated for who they are. Have discussions, ranging from whole class to small groups, where students see that their opinion, experience, and understanding are valued.

Part of class culture also includes how we do or don’t talk about equity. For me, that means making sure students feel seen and valued in our curriculum. In a piece in *Scientific American* entitled “Silence is Never Neutral; Neither is Science” (500 Women Scientists Leaders 2000), the authors talk about the importance of discussing racism and social justice and how these topics are embedded in both the history and practice of science. To them, ignoring the truth of what happened in the Tuskegee Experiment and to Henrietta Lacks makes science complicit. They also point out that ignoring current evidence of lack of representation of people of color in science perpetuates the problem.

**A curriculum where students feel seen**

Mensah and Jackson (2018) explained that students view science as a “white space” based on the stories and messages that are conveyed in class discussions and textbooks. This conscious or subconscious mindset has an impact on Black, Indigenous, and People of Color (BIPOC) students’ engagement with the subject and therefore leads to less ethnic diversity in science careers and the hiring of science educators. Less diversity in science fields makes science continue to feel like “white property,” which perpetuates this cycle.

In a National Public Radio interview (Kwong, Sofia, and Ramirez 2000), Dr. Esther Odekunle (a Black female scientist) shared her experience. “I felt like I belonged in science pretty early on, actually, as a kid. But when I realized the lack of diverse representation in science as I was progressing in education, I actually became less confident that I belonged in science.” In the interview, she discusses that histori-
cally, science has been dominated by white men.

Going beyond science content and skills and including the stories of the often-unseen people behind our scientific understanding can improve students’ social and historical context, as well as their compassion for the struggles that people have experienced. An example of how I interweave an understanding of social injustice with a scientific discussion involves Mary Anning. Her story resonates with students because she made her first major fossil discovery, an ichthyosaur skull, when she was 12—the same age as many of my students. We talk about her growing up poor in Dorset, which is in South West England, in the 1800s with limited education. Anning grew up on what is now called the Jurassic Coast and made money for her family by collecting and selling “curiosities,” now known as fossils. In her mid-twenties, she excavated the first full plesiosaur, a marine reptile with a very long neck. At first, Georges Cuvier, who is known as “the father of paleontology,” declared her discovery to be a fake. We discuss what it would have been like for a poor woman to make this unparalleled discovery over 100 years before women had the right to vote. Students feel angered by Cuvier’s attitude and the public’s assumption that Anning lied. This is where empathy enters the conversation by asking, “What would it feel like if you were in her shoes?” I give students the opportunity to share their opinions and frustrations. Students also learn that Cuvier would later go on to authenticate Anning’s discovery. I purposely don’t have the conversation stop there. Even after Cuvier’s verification, Anning was consistently underpaid and underrecognized for the significance of her contributions, with many of her discoveries being credited in museums to those who purchased them from her (Newman 2021).

In our geology unit, we have similar discussions about Marie Tharp, a cartographer whose mapping of the Atlantic Ocean from 1946–1952 and discovery of the Rift Valley of the Mid-Atlantic Ridge with Bruce Heezen would set the path toward future understanding of plate tectonics. Tharp was included in only some of Heezen’s publications and many of her ideas involving their discovery showing support for the theory of continental drift were dismissed as “girl talk” (Lee 2020).

Another example of how I interweave the people behind the science involves Gladys West. I lead a discussion about Gladys West before using Google Earth as a learning tool. Gladys West was the valedictorian of her high school and received an under-
graduate and graduate degree in mathematics. After applying for numerous jobs without success, in 1956 she was the second Black woman hired by (what is now) the Naval Surface Warfare Center in Virginia. West’s algorithms led to the development of the Global Positioning Systems (GPS). However, her contributions were not publicly recognized by the U.S. Air Force until 2018, when she was retired and well into her eighties (Matthias 2021).

In our ecology unit, to help students see themselves in the curriculum, I teach them about young people, such as Xiuhtezcatl Martinez and Anna Du, who have made a difference. Xiuhtezcatl Martinez is a young activist who uses music and writes books to inspire change; he has also spoken to the United Nations and received the 2013 United States Community Service Award (Eyen 2017). Du, at the age of 12, built a remote-operated vehicle (ROV) that finds microplastics on the ocean floor. She’s currently working on getting a patent and won the grand prize at her state’s middle school science and engineering fair in 2019 (Du 2020). My students are engaged and inspired when learning about kids their age who are taking action about problems they are passionate about.

Systems thinking
In designing a unit, I think about the stories I can share as part of that unit’s design. Some examples are short anecdotes like the one about Gladys West. Others are embedded into the unit, and we have more in-depth conversations around them, such as listening to Xiuhtezcatl Martinez’s music and discussing how he uses hip hop as a tool to empower and educate young people about the environment. Sharing and discussing these stories shows students that I value these individuals and their role in our learning.

Some units involving equity go far beyond conversation and involve a greater depth of study, research, and application of systems thinking. Environmental injustice occurs when systems are in place that propel inequities and a disproportionate burden of intended and unintended consequences fall...
on those who are poor or BIPOC (Waikar 2017). We discuss environmental injustice and systems thinking with a case study of the Flint water crisis where students evaluate the problem and examine the root cause. Students explore the complexity of the problem including issues such as poverty, racism, policy, health, dishonesty, economics, and the unintended consequences on everything ranging from needing new educational programs for children with lead poisoning to plummeting house values. For more details on this lesson, see my article “Whole-Class Discussion Strategies That Engage Students and Enhance Understanding” (Coppens 2020).

When students are learning about the climate crisis, we talk about how temperature rise is linked to greenhouse gas concentrations in the atmosphere and discuss that our world’s shared atmosphere has a disproportionately higher amount of greenhouse gas emissions from countries like China, the United States, and India. These emissions affect the entire planet. For example, Sub-Saharan Africa is experiencing greater temperatures, leading to increased droughts and heat waves. Climate change impacts crops and has a disproportionate effect on those living in this region, an area that makes up over half of the world’s people living in poverty (Patel 2018). This is an opportunity to discuss conscious and unconscious bias. Conscious, or explicit, bias is when someone is aware that their feelings and attitudes are in favor of or against a particular person or group. Unconscious, or implicit, bias is outside of one’s awareness. Implicit bias can impact a person’s beliefs or actions by unconsciously impacting their affect or behavior (National Center for Cultural Competence 2022). We explore misunderstandings about poverty in Sub-Saharan Africa by examining the systems in place that led to the problem and what propels it today, including colonization, decolonization, civil conflicts, and food and job scarcity, as well as inadequate funding for the educational system. Dell and Jones (2012; as cited in Coumou et al. 2016) found for every degree (Celsius) of temperature increase in Sub-Saharan Africa, there was a 2.66% reduction in agricultural output, leading to an economic reduction of 1.3%. We also talk about people making a positive impact, including Wangari Maathai who won the 2004 Nobel Peace Prize and founded the Green Belt Movement organization, which started in Kenya. This organization trains women in community-based forestry and is responsible for over 30 million trees being planted in Sub-Saharan Africa. The empowering of women and the planting of trees have resulted in social, economic, and environmental benefits (Ighobor 2011). Our ecology unit ends with students propelling their empathy and understanding into an environmental action project. Some students have been so inspired by Maathai’s work that they put their energy toward raising awareness and financial support for this organization.

**Pause, reflect, and pivot**

All of these examples involve mindfulness around equity in our curriculum. However, it’s also important to reflect on one’s own pedagogy, policy, and practices to see if you’re doing anything that promotes inequality. After observing student work on an assignment, I realized that I had created an inequitable learning opportunity and, as a result, inequitable grading. I had asked my students to make visuals or models of a concept as a homework assignment. In the past when I introduced this assignment, I gave students time to brainstorm and create a draft of what they wanted to make, then instructed them to come into school a week or so later with a finished product. Students with financial means were able to purchase materials to support their construction; other students did not have access to such materials. After this realization, I changed my approach. I now have dedicated storage containers that I fill with supplies such as sturdy cardboard boxes, fabric, big paper, containers, and paint that I collect throughout the year. When I recently introduced a visual model assignment, I gave students the whole class period to work on it and placed materials out for students to choose from. Not only did this activity feel more equitable, but the creativity and ownership of the projects improved as
students needed to make do with the materials provided. Students also enjoyed seeing alternative uses for the same supplies, and the experience became a shared rather than inequitable one. See Figures 1 and 2.

Mindfulness around equity has taught me to reflect on the learning environment I create and to make adjustments as needed. My teaching around equity looks different than it did 5, 10, and 20 years ago; it should look different 5 years from now.

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FIGURE 2: Student models of the Grand Canyon’s layers where supplies were provided by the teacher.
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