



Social Justice in the Science Classroom

STEMTLnet Theme of the Month Synthesis: January 2022

Though science is about the world, science is a social activity, and scientific knowledge is a social product; this is affirmed by our science standards, based on much scholarship about the nature and history of science. Moreover, it is conducted by individuals who are situated not only in their laboratory or field site, but also in their cultural milieu. Despite the many conventions and protocols of investigation, designed to help the investigator find as reliable and unbiased an answer as possible to their research question, culture and personality inevitably intrude. After all, to quote the physicist Percy Bridgeman, "The scientific method, as far as it is a method, is nothing more than doing one's damndest with one's mind, no holds barred." Water flowing from the pure spring of knowledge usually tastes of the pipes.

Precisely because of its success in explaining the world, and in producing knowledge that has enabled humans to design, build, explore, exploit, and transform, science confers power of many kinds, and that power can serve other values than the search for insight and for usable knowledge. It can serve the values of individual scientists, or the purposes of their sponsors, and be appropriated to support the predominating views and prejudices of the culture. Science as socially mediated therefore often has specific consequences that do harm to people and to the world.

The best scientific practice requires the practitioner to recognize and acknowledge sources of bias, to name what they see that may influence the clarity or integrity of their research — and then to correct it. Science educators can play an influential role in this self-correction process, by helping students understand the unjust aspects of the nature of science, to counter the damage that has been or is being done, and to see how they can be as much a part of the scientific enterprise as they wish. This is an indispensable part of any efforts for "inclusion" or "broadening participation," as it helps students see themselves and see others like themselves who have become scientists and science educators.

STEMTLnet's Theme of the Month for January 2022 focused directly on social justice in the science classroom. The expert panel for this theme was facilitated by [Dr. Kirstin Milks](#) who teaches high school in Bloomington, Indiana and collaborates with educators across the country on efforts to engineer world-changing learning opportunities for students and teachers. The panel included [David Upegui](#), a science teacher at his alma mater (Central Falls High School in Rhode Island) and an adjunct professor of education; [Dr. Salina Gray](#), a 7th and 8th grade science teacher in the Moreno Valley Unified School District and a member of the California Teachers Association's Human Rights Cadre; and [Sam Long](#), a teacher at Denver (CO) South High School and a cofounder of [GenderInclusiveBiology.com](#) and the Colorado Transgender Educators Network. The panelists' presentation was amplified in

conversation with the many participants in the [synchronous chat](#) and a rich and informative [post-webinar discussion](#).

Each panelist addressed a particular aspect of science and social justice and discussed implications for teaching and learning. David Upegui addressed the issue of race and minoritization, and pointed out the bivalent nature of science, which can be used with unjust results, and yet also offers a way to counteract such results, owing to its empirical foundations:

science plays a unique role among all subjects in that, as I mentioned earlier, or in an earlier conversation we had, it is democratic by nature. Science doesn't care who said it, how loudly they said it, how many times they repeated, at its heart, science demands publicly verifiable evidence. And so that empirical evidence that is required is really the currency. And it's a currency that could be gathered and garnered by our students. When we teach and empower students through science, we're giving them tools that they can use to not only improve their immediate experience because science, as we know, is related to power, but also our world. ...At its heart, and even though it hasn't always been a tool of empowerment for everyone, it has the potential to do so. And so, when we teach science, we're doing so much more than just simply delivering content. We are empowering the future stewards of the world in order to solve the problems that they will inherit.

Salina Gray explored the pedagogical implications of this understanding of science and science education, based on work that she and Prof. Alexis Patterson (UC Davis) did to suggest a "transformative pedagogy" for social justice. This, they suggest, rests on five interrelated commitments on the part of the educator:

1. The commitment to an ever-developing self-awareness.
2. The commitment to science and its practices.
3. The commitment to see science as a transformative agent.
4. The commitment to students' social and emotional wellness.
5. The commitment to restorative practices.

These commitments equip the educator with a framework within which to interrogate and transform their practice, and its results in the classroom, recognizing that

Harm has been done on all levels and so as a science educator, as a transformative science educator, we really have to think about how our classroom, our practice, our pedagogy can bring, can create, can cultivate restoration, undoing some of the harm and some of the damages that has been done by science as an enterprise, but also science as a curriculum. Many students will say they hate science. Science is not for them. There's harm there. So how do we restore that? And I get a little excited because Alexis and I believe this wholeheartedly that these commitments are crucial for all of us who are engaged and interested in science and science education reform should really consider.

Sam Long spoke of the importance of diversity in science education. In his case, the science is biology, in which diversity is an essential factor at every level from the molecular processes of metabolism and genetics, up to the diversity of the humans who are learning and doing science. He spoke of how his quest to reimagine the experience of biology learning was rooted in the question, "How can we acknowledge diversity rather than brush it off into the side or into the footnotes of biology?"

A simple commitment to this core tenet of biological science can transform both the way students see the world, and the way they understand their own place in the diversity of our species.

It is much better to start with the whole truth, to start with inclusion. Another aspect of this framework is affirmation. Anytime we're teaching about anything that might be typical or common within humans or within living things, we can't treat it as an oddity or an exception. It's different. That doesn't mean it's bad. Affirmation means celebrating diversity, recognizing the strengths, and recognizing what we have to gain from learning about diversity.

Informed by his own experience as a teacher who is a transgender man, Long has developed a framework for gender-inclusive biology whose tenets are of value in relation to many other kinds of inclusiveness. Specific elements he mentions are:

- Authenticity, and the avoidance of over-simplification: start with an inclusive view of the question being addressed, recognizing the diversity that is present.
- Affirmation. Anytime we're teaching about anything that might be typical or common within humans or within living things, we can't treat it as an oddity or an exception. It's different. That doesn't mean it's bad. Affirmation means celebrating diversity, recognizing the strengths, and recognizing what we have to gain from learning about diversity.
- Anti-oppression: This is some of the most difficult, but most important work. We need to teach in a way that's empowering these groups that are traditionally marginalized.
- Student agency: Students' voice should be welcomed, as they pursue their learning, and participate in the construction of knowledge —, about themselves, about the phenomena being studied, and about the enterprise of science in which they are taking part.

Kirstin Milks then spoke of the impact that the Social Justice Standards (developed by Learning for Justice) have had on her own teaching and advocacy. Milks summarized the key areas of the standards: identity, diversity, justice, and action. She has worked with these standards to critique and change her own practice, and her students' experience and role in the classroom — indeed, she describes herself as "co-designing curriculum" with her high school students. She commented:

When we think about justice, we begin to learn about ways that justice and that power over has played out in topics that are adjacent or embedded in our

curricula. And then the last domain, action, helps students begin to see how they can do some of what Salina talks about as restoration and repair. What are ways that we can move forward and make changes from interpersonal one-on-one changes to big systemic changes that can lead to a more just and less oppressed world?

Each educator then described curriculum they had used which embodied the insights reflected in the presentations. Their accounts drew many similar reports, along with additional resources, from attenders (in the chat) and from participants in the discussion after the webinar. Kirstin Milks acknowledged the importance and richness of the sharing among the community when she concluded:

...this network of people who are running behind the scenes in ways we can't see to work on this stuff... for folks to come and be able to share the stories that we are able to share, it's filled my cup today. So I'm grateful to all of you.

Recommendations for teacher-leaders

- Discussion participants noted that it can be hard to know how to get the conversation started in one's school or district. Teacher leaders can contribute to the exploration of science and social justice by intentionally becoming informed about the work described in the presentation, resources, and participant contributions to this webinar, and sharing the resources with colleagues.
- Participants more than once mentioned feeling isolated as they begin to explore how to bring the social justice appropriately into their practice. Teacher leaders help teachers who are responding this issue to persist by building structures for collaboration and networking — perhaps in formal settings like study groups, professional learning communities. Perhaps, however, the conversation can begin in more informal ways, such as "issue lunches" for interested teachers.

Recommendations for administrators and policy-makers

Administrators and policy makers can support of teachers who are exploring the social justice implications in science and science education in several ways. First, they can seek out professional development opportunities for themselves as well as for their teachers. Second, they can seek out resources to help their teachers and other school personnel learn about the intersection of social justice and science. Third, administrators should bear in mind that such changes in viewpoint as discussed in this theme require teachers to experiment with their practice and evaluate their experiences with peers who can provide constructive critique. Administrators can advocate for and support professional learning communities and other techniques that have been shown to be successful in supporting changes in practice and school culture.

Recommendations for researchers

The ideas and experiments that the panelists and participants presented raise a whole series of research questions whose exploration could contribute valuable insight for

educators and others who are seeking to incorporate a concern for social justice into science pedagogy. Areas for investigation include:

Describing and analyzing change in culture and behavior. How do we characterize changes in science teaching practice, school culture, and students' self-efficacy and engagement, as a result of taking a social justice lens in science education?

Understanding mechanisms of innovation. In what ways does the acknowledgement of the social justice dimension of science change science education, that is, by what pathways do changes enter classrooms, and what are the effects of each? How do new standards, or new curriculum materials, or new teacher attitudes contribute to such changes?

Social justice pedagogy and science learning ecologies. How does the "learning ecology" of a school contribute to, or hinder teachers' move towards a transformative pedagogy as articulated by our panelists? In what ways does the adoption of such a pedagogy change the learning ecology within the school and the community — perhaps engaging new funds of knowledge within the community, for example, or enabling new partnerships? How does this contribute to students' and teachers' learning and continued engagement in science?



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