Reflection on Centering Students Experiences from Taking Stock of Science Standards Implementation: A Virtual Summit

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Day Two of the summit on *Taking Stock of Science Standards Implementation* included a panel focused on *Centering Students' Experiences in science*, facilitated by Dr. Ravit Golan Duncan (Rutgers University) and Jessica Henderson-Rockette (Instruction Partners) and included Rabiah Harris (Ida B. Wells Middle School), Lauren Kaupp (Hawaii Department of Education), Maria Olivares (Boston University), Enrique Suarez (University of Massachusetts), and Edna Tan (University of North Carolina at Greensboro). Central to the consideration of how, why, and for what ends we center students' experiences in science is the question of whose voices, ways of knowing, and ways of being are already centered and whose are invisible? Therefore, the panel's discussion focused on the inextricable connection between centering students' experiences in science and issues of historicized and systemic oppression, with implications for teacher professional development, school/community/university partnerships, and curriculum and NGSS coverage. In this paper, I will highlight three broad themes that emerged in the panel discussion and reflect on each through concrete examples or strategies from the field.

Theme 1: The historicized and systemic nature of oppression and the urgency of authentically centering student experiences.

Ideas raised by the panel. The panel discussed the "ecological nature of inequity": how inequity is tied into all levels of our educational systems, including:

- policies that drive assessment and curriculum implementation,
- how educational research is conducted,
- family and community engagement,
- the design of curriculum materials,
- paradigms for classroom management and pedagogy, and
- professional science practice itself.

The panel discussed the urgent need for (1) concrete strategies for centering students' experiences so that teachers are not left on their own to figure it out or make curricular adaptations, (2) professional development that makes powered and historicized oppression visible to teachers and supports them in making pedagogical shifts in their practice to center students' experiences, and (3) authentic partnerships with communities and families to share in decision-making. The panel referenced the most recent Horizon report (Banilower et al., 2018), which found that less than 20% of teachers feel prepared to teach in culturally sustaining/culturally relevant ways. There was a strong sense in the panel discussion that this was *everyone's* responsibility to address because we are all a part of powered systems (in one way or another) that uphold white supremacy. Dr. Edna Tan summed up the panel's comments

on this point, saying, “The insidiousness of systemic oppression is that we are all complicit, because this is our ecosystem, and we are stakeholders in the ecosystem. And it is insidious also because it is historical, and we are used to it, it is normalized, so it is hard to see.”

Centering Student Experience from a Critical Lens. The practice of centering students’ experiences in science classrooms can represent a refusal of normative paradigms (that center white, middle class, heterosexual, ableist discourses) because it invites multiplicities of knowing, being, and doing (Warren et al., 2020) into learning spaces. However, because we all swim in social contexts that are defined by white supremacy and that maintain extant power structures, it can sometimes be difficult if not impossible to see our way towards different, justice-centered pathways. Furthermore, systemic oppression works on multiple levels, from large systems to micro-moments of interactions between learners and teachers and between learners themselves. Addressing systemic oppression on all of these levels cannot be left up to teachers alone—there was a strong sense in the panel that there need to be multiple, overlapping supports or “equity projects” (Bell, 2019) towards these ends.

Because systemic oppression can be invisible to many of us, it is helpful to have some guidelines on how teachers/curriculum writers/researchers can center students’ experiences without perpetuating further harm on students. One useful framework comes from Rodriguez (2021), where he outlines “How to avoid seven common (but seldom discussed) STEM curriculum pitfalls” in making STEM education more culturally relevant. The seven pitfalls to avoid are: (1) Profit before ethics, (2) The 180 stereotype reversal, (3) Peoples of color as cultural background props, (4) Be creative (but not really), (5) Raise awareness! Promote Agency! (But don’t make waves!), (6) Failure is not an option, and (7) The savior fetish. Each of these pitfalls reflects ways in which STEM curricula explicitly or implicitly maintain racialized power structures, discourses, and practices in STEM education. Rodriguez encourages us to think about what it means to authentically *engage students in STEM* vs. *teaching STEM to students*. The former requires that one carefully consider and take the time to learn who students are, what STEM means to them, and for what ends. It “puts people at the center” (p. 228) and encourages us to think about our teaching contexts (including the sociopolitical contexts in which we teach) in order to deeply connect to who our students are. Teaching STEM to students puts students in a more passive role, and leaves the ends and processes of STEM unexamined. Dr. Edna Tan summarized this point when she said, “it’s not as if it is something that has happened in the past, but the past is carried in our bodies, in our ideologies, in our framings, in our positionings, and the past, whether we like it or not, really impacts how we perform as individuals in the here and now.” I expand on two pitfalls below to illustrate how to center students’ experiences in science without perpetuating harm or falling back on cultural stereotypes.

Among the pitfalls to avoid is “peoples of color as cultural background props” (p. 226). Instead of deeply connecting to students’ cultural identities, this pitfall involves using people of color

and the places we live as backdrops or flat contexts to engineering problems or phenomena. We run the risk of students' experiences being used as "background props" when we connect to their lives in superficial ways, for example around holidays or food traditions, rather than deeply connecting their cultural knowledge to science disciplinary knowledge, or systemic and historicized inequities that have created the need for engineering solutions in their communities. Centering students' (and families') experiences in science therefore needs to engage in routine and rich ways with phenomena, engineering projects, and disciplinary ideas. That is, not simply at the beginning or end of units, but throughout and in rich ways. To this end, the Learning in Places project has developed a model of "family tools" that accompany classroom investigations, setting up routine structures where family knowledges and practices regularly contribute to emerging investigations, data collection, and argumentation.

Another pitfall to avoid is "the savior fetish" (p. 229). As one might guess, this involves portraying members of the dominant culture as heroes or the holders of STEM knowledge and solutions, and people of color as needing saving or holding primitive or unsophisticated knowledge. This is an example of the "insidiousness" of systemic oppression—when the norm is white, cis-gender, middle class males as holders of science, it can seem perfectly acceptable when representations in curriculum materials, schools, and classrooms are consistent with this view. The first step is to become aware of these representations and how they affect our own (possibly deficit) views of our students and their families. Schools and curriculum resources, as products of systems of power, need to be held accountable for the ways in which these deficit views of families of color (and their knowledge systems) have affected relations at all systemic levels, from who is on the PTA to who is represented in science curriculum, to how teachers interact with students and their families, to how students interact with each other.

Theme 2: Curriculum, NGSS "coverage", and allowing for multiplicities

Ideas raised by the panel. Another theme from the session was how to do the work of meaningfully centering students' experiences in science while still covering the curriculum and NGSS. One point brought up in the chat was the district "pacing guides" are a significant challenge for teachers, and it is already a challenge to "cover" the curriculum, especially in elementary settings given the limited time for science in the day (NASEM, 2021). There was a strong sense that this work should not solely be placed on teachers' shoulders, but instead should be addressed **at a systemic level** with allowing room in pacing for teachers and students to "breathe" in curriculum and NGSS implementation, and that **it is critically important for science to be valued at all levels of the educational system**. This has implications for the drivers of curriculum pacing, and panelists encouraged a re-thinking away from "coverage" both in terms of curriculum and NGSS coverage and assessment systems.

Adding to this tension was a feeling from summit participants that centering students' experiences and making science meaningful would mean re-creating lesson plans or curriculum

for each student or cultural group. The panelists discussed, however, that centering students' experiences does not necessarily mean re-inventing curriculum, but instead allowing flexibility in the implementation of curriculum for students' ideas to connect to their everyday and cultural experiences. This involves teachers becoming attuned in new ways to the brilliance of their students, even if their ideas do not sound like settled scientific knowledge. It also involves seeing new opportunities in existing curricula to elicit and leverage students' cultural knowledge in learning moments, or finding opportunities within curriculum for students' cultural and community knowledges and practices to connect to classroom learning.

Self-Documentation to center students' and families' knowledges and practices Teachers and curriculum designers can offer opportunities for students to connect classroom learning to their everyday and cultural knowledge and repertoires of practice. This approach is distinct from retrofitting curriculum to "match" particular students or cultural groups, an approach that can be rife with cultural stereotyping and essentialization (Gutiérrez & Rogoff, 2003). One specific strategy for making these connections is called *self-documentation* (Tzou & Bell, 2010; Bell, Morrison, & DeBarger, 2015). This approach asks open-ended questions that invite students, along with their families if possible, to document examples of connections between their everyday lives and scientific concepts or phenomena that are being taught in the classroom. For example, when young children are learning about "balance and motion", a self-documentation can be to document examples in your life of objects in "balance". This approach has multiple affordances for teachers. First, it invites opportunities for students and their families to be experts in their everyday lives, rather than teachers feeling the need to be the cultural "experts" for the diversity of students and cultural groups in their classes. Second, it invites multiplicities of knowledge systems into the learning space (Warren, et al, 2020)—that is, by asking relatively simple yet open-ended questions like "what are examples of 'balance' in your life?", students and families are free to interpret the idea of "balance" in ways that are relevant to them. These multiplicities of meaning exist in students' lives whether teachers elicit them or not; therefore, self-documentation can be a way for teachers to better understand the multiple ways of knowing and being in their classrooms. This is also a way to refuse "settled" science (Bang, et al, 2012)—that is, curriculum, pedagogical practices, and school systems that hold historicized injustices that get reproduced in the teaching of science from narrow, dominant perspectives. Warren, et al (2020) argue that "liberatory education ought to be deeply rooted in the pasts, presents, and futures that sustain and imagine multiple values, purposes, and arcs of human learning" (p. 278). Third, self-documentation allows teachers and students to learn about each others' everyday lives in the context of specific disciplinary learning; this nuanced view of "cultural practices" goes beyond the typical holidays and foods that are often displays of cultural learning but not connected meaningfully to scientific sensemaking. As Dr. Rabiah Harris stated, "Just because you know where someone is from it doesn't mean you know all the things about their family".

Theme 3: Implications for teacher education and broadening partnerships with families and communities

Ideas raised by the panel. The session raised the need to think differently about teacher professional development and partnerships. Enrique Suarez emphasized the need to prepare both practicing and preservice teachers to broaden their ideas around "what counts" as science. A report of the National Survey of Science and Mathematics Education (NSSME+) conducted by Horizon Research, Inc. found that only about 11% of elementary teachers and 18% of high school teachers say felt well-prepared to teach in ways that are incorporate students' cultural backgrounds into science instruction, and 19% of elementary teachers and 23% of secondary teachers said that they attended professional development that supported them in incorporating students' cultural backgrounds into science (Banilower, et al, 2018). This has implications for how we center issues of, for example, racial equity as being fundamental to the work of science and science teaching itself. Dr. Kaupp emphasized the need to think systemically about professional development and change, and that "we can't put the full weight of that just on classroom teachers".

Research-Practice Partnerships. Dr. Olivares suggested that one way to do this is to leverage collective resources across schools, universities, and community-based organizations to structure Research-Practice Partnerships (RPPs) that re-imagine traditional "professional development" models. RPPs are long-term collaborations between university researchers and school partners at multiple levels (teachers, district leaders) and with varying expertise (c.f. Penuel et al., 2020). By broadening the voices at the decision-making table, research-practice partnerships have the potential to actively mitigate sociohistorical oppressions by examining, and then putting into practice and researching, innovative strategies that push against settled scientific knowledge and practices. Unlike one-time or short-term professional development opportunities for practitioners, RPPs have the potential to deeply shift practice over time at multiple systemic levels. They allow for questions to be asked and studied in school and district contexts, and for practitioners to be actively involved in asking and researching questions around problems of practice.

Family Engagement as an equity strategy. Another implication for partnership is between schools and families, and the need to re-examine the deficit-based frames upon which *parent involvement* (as opposed to *family* engagement) models are based: that is, framing poor families of color as "the problem", and trying to "fix" them through institutional compliance models such as attendance policies and behavior and discipline management rather than authentic and justice-based partnerships. Many learning environments, such as schools, are required to incorporate family and community engagement in their programs as part of their state and federal funding mandates, yet they tend to rely on outdated and inequitable forms of partnering that can actually disengage many families and communities. Engaging minoritized families is rooted in a history

of schooling that has aimed to assimilate racially, linguistically, and culturally diverse families into middle-class, White, heteronormative ways of being (Ishimaru, 2019; Learning in Places collaborative, 2021). There are multiple ways in which districts, schools, and teachers can collaborate with families to work towards equity and justice. For example, decision-making spaces can be formed at multiple systemic levels (district, school, classroom): family representatives can be present that represent the diversity of cultures, languages, and perspectives in the community. Gutierrez, et al (2020) offer some specific strategies for supporting this work, including (1) supporting paid time for families and educators to connect, (2) having dedicated staff at schools supporting schoolwide family engagement so that family engagement is not just left up to individual teachers, (3) connecting with community organizations, (4) investing in families as co-educators.

Concluding points

In conclusion, the panel and accompanying chat engaged in a wide-ranging discussion around the close relationship between centering students' experiences in science and issues of equity and justice, as well as the need to think systemically and historically about sources of oppression that uphold white supremacy in our educational systems and practices. The panel discussed the need for administrators to give teachers the space in their science curriculum (and space in the day) to center students' experiences. Working towards equity and justice in science is community-centered work, not only to be borne by individual teachers. Ultimately, giving space in the day for science and centering students' experiences has implications for district pacing guides, curriculum and NGSS coverage, and assessment practices--as well as partnerships with families and communities. Finally, the panel urged us to remember that students are whole beings--and they have whole lives, of which science class is only a small slice. Inviting multiplicities of ways of knowing, being, and doing in science requires broadening our conceptions of what is possible in science and working towards more equitable relationships between schools and families. This means going beyond *access only* paradigms of equity towards an expansion—epistemologically, ontologically, and axiologically—of what constitutes science and engineering learning (NASEM, 2021; Philip & Azevedo, 2017) for justice-centered futures.

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