

# Where Do We Start And Where Do We Go? Emerging Findings Informing the Design of Responsive Professional Learning With Secondary Science Teachers

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**Abstract:** This poster examines secondary science teachers' curricular adaptation work during summer workshops as part of the EMPOWER project, which supports teachers in adapting their curriculum to foster students' epistemic and critical science agency. Through a comparative case study, we demonstrate how two teacher teams started with different goals but each navigated tensions between connecting goals for epistemic agency (EA) and cultural relevance and responsiveness (CRR) in both the *content* and the *moment-to-moment interactions* of their focal lessons. Their varied trajectories underscore the importance of supporting teachers in toggling between these dimensions when designing justice-oriented science curricula.

## Introduction and background

This paper presents findings from the second year of a multi-site teacher professional learning (PL) project, EMPOWER, that partners with teachers to adapt their existing science curriculum materials to better promote students' epistemic and critical science agency: the understanding of and desire to transform oppressive power structures by exploring how scientific knowledge impacts communities and the natural world (Basu et al., 2009; Ko & Krist, 2019). Fostering locally and community relevant forms of science learning requires grappling with tensions inherent in bringing together NGSS-aligned pedagogies, students' and community resources, and challenges to oppressive systems (Morales-Doyle, 2020; Rosebery et al., 2016). Navigating these tensions is neither obvious nor straightforward. This paper presents two examples elaborating how teacher teams differentially navigated twin considerations of *epistemic agency* and *cultural relevance and responsiveness* as they made specific adaptations to their materials around both interactions and content. This raised the key question guiding this paper: *how did teachers embody the relationships between EA and CRR in their adaptation work, and how did these embodiments vary given differences in each PL site's starting point?*

## Data collection and analysis

The data for this study come from summer workshops held during the summer of 2024 at three different sites in two states. The Canyon district, located in a suburban mid-size city in a Western US state, held a 4-day workshop for 5 middle and high school teachers (2 teams). The Metropolis district, located in a small urban community in a Midwestern US state, held a 4-day workshop for 11 middle and high school teachers (5 teams). The John Adams district, located in a suburb of a large Midwestern US city, held a 3-day workshop for 5 high school teachers (2 teams). All sites collected video recordings of workshop activities, audio recordings from each small group teacher team, and photos of artifacts (e.g., whiteboard representations; journal entries).

We utilized a comparative case study approach (Yin, 2012), treating each teacher team as a case. We created matrices describing each case in terms of: (1) workshop focus (epistemic agency [EA] or cultural relevance and responsiveness [CRR]), determined based on the recruitment materials and framing presented to teachers at the start of each workshop; (2) team adaptation unit/lesson and focus, based on descriptions from site-specific analyses; and (3) team adaptation considerations, including coding for their adaptation focus (*interactions* or *content*) and their rationales throughout their design discussions. A focus on *interactions* meant attending to teacher-student interactions and instructional routines, thinking carefully about supporting more equitable student participation. A focus on *content* meant considering new or alternative phenomena, connections between phenomena and science content, and the ideas that students might bring to make sense of a phenomenon or investigation. We then coded for whether teachers' adaptation rationales involved considering EA, CRR, or both.

## Findings

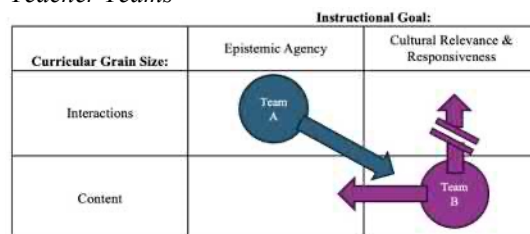
We present two teacher workgroups—Team A and Team B—as illustrative cases to compare how they considered instructional goals of both EA and CRR, and how those considerations varied depending on their starting points.

Team A consisted of high school biology teachers from the Metropolis district. Metropolis’ workshop foregrounded supporting students’ *epistemic agency* by highlighting interactional power dynamics within classrooms, how students might experience them, and how those experiences might impact student participation and engagement. Team A teachers originally considered the opening lesson of OpenSciEd’s (n.d.) high school ecosystems unit. They ended up with an adaptation focusing on *cultural relevance and responsiveness* because they asked questions about the anchoring phenomenon of a unit: Who has cultural capital to be able to relate to this phenomenon, and who might not? How might we recognize and support a broader range of cultural resources in this unit? Notably, their answers to those questions led them to make a *content-level* adaptation: adding a new set of phenomena around lithium mining (blue circle, Figure 1).

Team B consisted of high school earth science teachers from the Adams district. Adams’ workshop foregrounded *culturally relevant phenomena and integration of community-based knowledge* at the content level. Specifically, during an activity in the workshop that compared two justice-focused units of the same biology content, they raised concerns about how to facilitate a discussion about *content* like mass incarceration in a way that was responsible, respectful, and manageable on the *interactional* level, explicitly acknowledging that this movement across dimensions was difficult (broken vertical purple arrow in Figure 1). As they discussed their climate change unit, the difficulty of facilitating conversations about “politicized” content seemed to direct their adaptation work. Team B recognized their own need to know more about how students and parents in their school communities actually viewed climate change. Drawing on the SASSY! survey (YPCCC, 2024), they developed a home learning activity where students interviewed their parents about their views on climate change. Importantly, this activity had the goal of bringing in community-based knowledge and multiple experiences of the impacts of climate change rather than to “probe” the extent of “misinformation” in the community. In this sense, this activity reflected a step for Team B teachers towards incorporating student and community voices (*content*) on which phenomena to explore and how (*EA*; horizontal purple arrow in Figure 1).

**Figure 1**

*Starting Points (Circles) and Consideration Trajectories (arrows) for Two Teacher Teams*



## Discussion

The insights from these cases provide an important contribution to the literature and practical work on how to promote equity in science education. Most work leveraging curriculum materials to support equity does so by designing with a specific *content* focus - often a social justice science issue (e.g., Morales-Doyle, 2020). And yet, we see from Team B how a social justice science focus required careful consideration of how particular interactions would take place in their classroom, including with respect to EA. Their adaptation of seeking input from families is also EA: allowing the stances and perspectives of the communities represented in the classroom to shape how it is, and about which specific phenomena they engage with in class. The link between these two was also evident in Team A’s work, albeit in reverse: a serious focus on EA surfaced consideration of CRR, which led to an adaptation that engaged students in a social justice science issue—lithium mining—in a complex way. Moreover, we posit that if we are focused on content connections in ways that surface social justice issues as a way to work towards equity but forget to attend to how the interactions are playing out in the classroom, we risk perpetuating the injustices of schooling even as science classroom communities talk about justice. And vice versa: if we focus on epistemic agency and epistemic justice in classroom interactions but are not deeply considering cultural relevance and responsiveness, we risk missing the boat completely on who is included in and excluded from science learning. Explicitly keeping these dimensions in mind and responsively toggling between them as needed throughout PL design and enactment may be a productive strategy for facilitation of PL supporting teachers’ justice-centered pedagogies.

## References

- Ko, M. L. M., & Krist, C. (2019). Opening up curricula to redistribute epistemic agency: A framework for supporting science teaching. *Science Education, 103*(4), 979-1010.
- Basu, S. J., Calabrese Barton, A., Clairmont, N., & Locke, D. (2009). Developing a framework for critical science agency through case study in a conceptual physics context. *Cultural Studies of Science Education, 4*, 345-371.
- Morales-Doyle, D. (2020). The aspirin unit: Confronting a hostile political context through chemistry curriculum. *Cultural Studies of Science Education, 15*(3), 639-657.
- OpenSciEd (n.d.). <https://openscienced.org/curriculum/high-school/high-school-instructional-materials/> Accessed 11-21-2024.
- Rosebery, A. S., Warren, B., & Tucker-Raymond, E. (2016). Developing interpretive power in science teaching. *Journal of Research in Science Teaching, 53*(10), 1571-1600.
- Yale Program on Climate Change Communication [YPCCC]. 2024. <https://climatecommunication.yale.edu/visualizations-data/sassy/> Accessed 11-21-2024.
- Yin, R. K. (2014). *Case study research: Design and methods* (Vol. 5). Sage.

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