# Leveraging Composite Methodologies for Characterizing How Science Teacher Educators' Critical Consciousness Shaped Their Designs for Professional Learning

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**Abstract:** This study is situated within EMPOWER, a Research-Practice Partnership focused on designing professional learning for secondary science teachers to make their curricula more justice-oriented. We investigate how EMPOWER researchers draw on their understandings of critical consciousness to design professional learning for science teachers. We employ a composite narratives methodology that amalgamates multiple participants' statements into fictional personas, each representing unique priorities and stances. We conducted interviews at important milestones of the project to understand how participants' critical lenses shaped their learning designs for teachers. Our multidimensional analytical framework combines Freire's conscientizaçao with decomposing justice in educational systems in three levels. Through our analysis, we describe two personas that showcase different alignments and tensions that guided the design of the professional learning workshops. Leveraging a composite methodology can help researchers and teacher educators to characterize heterogeneity in what learning was prioritized for science teachers to make their curricula more equitable.

## Introduction

As three-dimensional science learning continues to take hold in school districts across the US, there has been an increased demand for curricular materials that create opportunities for students to learn science through "figuring out" phenomena (Berland et al., 2016; Reiser et al., 2021). While these kinds of curricula are becoming more widely available and have tens of thousands of students by now, a common critique remains that these materials are often written from the perspectives of curriculum developers that do not share the lived realities of minoritized students and communities (Morales-Doyle, 2024). Investigation-driven curricula that include phenomena that are familiar to PK-12 students invite youths to investigate the how/why of phenomena, see science as part of their everyday lives, and promote engagement in the epistemic practices of science (e.g., Davis & Schaeffer, 2019). A solution that has been proposed to address this potential mismatch between the curriculum and students is to engage science teachers in cycles of adaptation, implementation, and refinement of existing materials to integrate more locally relevant phenomena. To achieve that goal, teachers benefit from professional learning (PL) aimed that supports them in developing pedagogies and dispositions that intertwine the varied sense-making repertoires and lived experiences that minoritized students bring to the science classroom with the curriculum (e.g., McNeill et al., 2024). Specifically, these kinds of professional learning opportunities for teachers would focus on analyzing and adapting curricular materials to uncover oppressive power structures and leverage science in the service of improving the lived realities of minoritized communities (Ko et al., 2024); one approach has leveraged Research-Practice Partnerships (RPPs) to achieve these goals through prioritizing teacher learning (Ko et al., 2024).

As researchers have documented, it is not always intuitive how teacher educators can design professional learning that supports teachers to develop their critical lenses (e.g., Gay & Kirkland, 2003; Shah & Coles, 2020). This can be tricky in RPPs that focus on building trust and support among its members, as well as flattening the power hierarchy between researchers and educators, given that tensions may arise when either group prioritizes learning goals that others may not share immediately (Farrell et al., 2023). These considerations require that PL providers, especially those who aim to support teachers develop justice-oriented pedagogies, have political clarity about their role and goals for teachers, students, and communities (Sleeter, 2016). For instance, Carter Andrews and Richmond (2019) argue that, when teacher educators to design and implement educational experiences that center equity, teachers develop the self-efficacy to enact equity-oriented pedagogies in their own classrooms. Acosta and colleagues (2017) put it succinctly, "if we expect teachers to enact a revolutionary pedagogy for the good of society, we must expect nothing less of the teacher educators who prepare them" (p. 241).

However, a cursory search through the teacher education scholar shows that, while many scholars say that teacher educators' political clarity is important for shaping teachers' learning experiences, this trait is often overlooked in research or, perhaps worse, assumed. Beyond including positionality statements in their writing, especially those that address the power and purpose of positioning (Boveda & Annamma, 2023), most teacher

educators who write about the impacts of their PL rarely articulate or examine their own stances, pedagogies, and practices that engage with the social-cultural-political realities of schools. To us, this limited attention to how researchers and teacher educators describe their own understandings of oppressive power structures leaves the field wondering how these stances ought to inform what gets prioritized in professional learning designs (e.g., nature of activities that support teachers to reflect on their practice, the injustices they choose to center). Here, we argue that, for teacher education to be ready to better support science teachers in making their pedagogy and curricular materials more liberatory and transformative, we need better methodologies for understanding how education researchers, teacher educators, and PL providers deploy their own critical lenses when designing PL.

To understand how teacher educators build on their own ideas about educational injustices, as well as what teachers can do to address them, when designing PL for science teachers, we leverage the construct of Critical Consciousness (CC). In "Pedagogy of the Oppressed", Freire defined *Conscientizaçao* as "learning to perceive social, political and economic contradictions, and to take action against the oppressive elements of reality" (Freire, 2005, p. 25). Since then, CC has been taken up by educators the world over and has become a stable in education in the US for over three decades (e.g., Gay & Kirkland, 2003; Ladson-Billings, 1995). However, as Marcelino and Gehlen (2024) argue, there is no agreement on the interpretation of what critical consciousness means, especially for science education researchers and practitioners, and how it ought to shape teacher learning. For instance, while Burges & Patterson Williams (2022) connect cultivating teachers' CC with "transformative, just, and equitable science classrooms" (p. 1074), Thompson et al. (2021) frame CC as "an understanding of one's own positionality and biases" (p. 59), and Morales-Doyle (2023) sees cultivating CC through science education as allowing students to recognize "that popular movements to reshape social relations are necessary to change the world" (p. 84). While we would not argue that these are framings are contradictory, these examples often use CC without defining it a priori and they emphasize different dimensions of how *conscientizaçao* should shape science education—from recognizing personal biases to addressing worldwide injustices. Given this ambiguity, we aim to establish a methodology that could give us insight into how researchers in an RPPs conceptualize CC and how it informs their designs for PL focused on transforming curricular materials to better serve minoritized students. Towards that end, in this study we ask the following research questions: (1) how do researchers draw on their understandings of CC to envision PL activities that further secondary science teachers' justice-oriented teaching?; and (2) what obstacles do researchers anticipate that could mitigate teachers' engagement in adapting their science curriculum to reflect their minoritized students' realities? Our goal is to provide theoretical and empirical clarity on how critical consciousness shapes professional learning, from which we can identify the on-ramps for disrupting injustices in secondary science classrooms.

## Methods

To address our research questions, we leverage composite narrative or "personas" methodologies to increase the anonymity of our participants, the reliability of their statements and our data, and the usability of our findings. Despite the importance of understanding the development and enactment of CC in science education, certain obstacles can make studying this construct elusive. First, participants may avoid sharing their insights and experiences with educational injustices, especially when doing so could pose unacceptable social and/or professional risks, such as losing anonymity (Kitchen, 2019). Additionally, the topic of study itself can seem risky, as participating in research on educational injustices could expose individuals' experiences of past discrimination, minoritized identities, or ignorance about oppression and other social privileges. These factors make research on educational injustices sensitive, especially for scholars at the start of their professional careers.

A composite narrative approach depersonalizes all data by amalgamating multiple participants' statements into fictional personas. Also termed "impressionist tales" (van Maanen, 2011), this approach adds an extra layer of anonymity to identifiable information from individual participants presented in scholarly products. Social scientists have used composite narratives to highlight important experiences, especially those of people in vulnerable positions, without risking disclosing their identities. These narratives are a mixture of data from different research participants into new "personas" that: (1) highlight commonalities in experiences or positions across participants; and (2) protect the identities of participants, especially from unintended and unwanted social repercussions. This approach has been previously applied to research on trans girlhoods in the US (Pirie, 2024), working conditions of hospital staff at the start of the COVID-19 pandemic in Ireland (Creese et al., 2021), and views on climate change among politicians in the UK (Willis, 2018). Ethically, the added layer of de-identification protects participants from risk of repercussions or social stigma, and empirically, composite reporting builds trust with participants, allowing them to be more open and forthcoming with their insights for the field.

Composite narratives or personas-based research also have a tradition in the learning sciences. For instance, Lundh and colleagues (2010) used "design personas" to reason through how different users could engage with a software meant to support upper elementary students learn science. Specifically, through studying how 10

different users engaged with the platform, Lundh et al. generated distinct personas, each of which represented different experiences and priorities, which led the researchers to refine the software. Similarly, learning scientists have used personas-based methodologies to make findings from physics education research more accessible and applicable to university physics instructors. Specifically, Madsen et al. (2017) created personas to typify college educators' responses to innovations in assessment, Huynh et al. (2021) describe the development of data-grounded personas to support user-centered educational design, and El-Adawy et al. (2024) used personas methodology to characterize physicists' motivations for engaging with the public.

## Study design: Participants and context, data collection, and data analysis

This study is embedded within EMPOWER: a multi-site Research-Practice Partnership in the US that provides professional learning for secondary science teachers. Specifically, the partnership aims to support teachers to adapt their existing science curriculum materials to better promote students' agency (Ko & Krist, 2019), as well as their desire to disrupt injustices by exploring how scientific knowledge impacts communities and the natural world (Basu et al., 2009). Moreover, EMPOWER seeks to create learning opportunities for secondary science teachers to reexamine their assumptions about students' cultural backgrounds and capabilities as a means of developing justice-oriented pedagogies (NASEM, 2024). Through the partnership model, EMPOWER researchers host weeklong professional learning workshops for volunteer secondary science teachers during the summer school break in July and follow-up with shorter and more pointed engagements during the academic year.

This study recruited participation from all EMPOWER researchers, such as: (1) university faculty and investigators; (2) graduate students from each site; and (3) other senior personnel who supported PL design and implementation. It is important to note that each EMPOWER site worked with a different group of secondary science teachers, each of which brought to the workshop their own histories with the researchers, goals and needs for their curriculum adaptation work, and stances and commitments towards making science education more justice-oriented. Thus, while each team designed their PLs to maintain EMPOWER's core set of principles (e.g., adapting curricular materials is the norm, justice-oriented science teaching requires CC), they also responded to the realities, opportunities, and constraints that teachers at each partnering site identified and experienced.

We use qualitative research to explore EMPOWER participants' understanding of Critical consciousness and how it shaped their PL designs. Specifically, we planned semi-structured interviews with participants scheduled at pivotal milestones: first and last years of the project, and before and after every summer PL workshop. This longitudinal qualitative design allows us to explore participants' conceptualizations and enactment of CC at different moments in the project, as well as track any changes and what prompted them. To avoid coercion and unwanted harms, we employed collaborative drafting and member checking of research design and products as a mechanism for decreasing the likelihood of unintended and unwanted consequences of our research (Loh, 2013). Additionally, we engaged with UMass Amherst's IRB office through the design and prior to the approval process to ensure that we met the highest standards of privacy, confidentiality, and empirical rigor.

To address our research questions on how EMPOWER researchers' CC shaped the learning activities they designed for science teachers, this study focuses on analyzing the Pre-PL interview data collected from participants. All these semi-structured interviews took place in early Summer 2024 and were conducted by two researchers: the first author interviewed the project's senior personnel, while a graduate research assistant interviewed the project's graduate students. Dividing interview assignments like so was purposeful because we wanted to mitigate the potential power differentials that could have emerged if a co-investigator interviewed a graduate student, or vice versa, which could have led to the participant to be reticent with their ideas about how their CC informed their priorities for the PL. The semi-structured interviews were conducted virtually, lasted about 75 minutes each, and included questions related to the PL designs, such as: describing the team's top two priorities for the PL, how the PL activities would support teachers in addressing the needs of minoritized students, and possible successes and challenges from the PL implementation.

To build personas, we (i.e., Suárez and Crabtree) carried out a five-stage qualitative analysis that aimed to explore and construct the range of participants' understandings of educational injustices and ideas on how PL could address them (see Figure 1). First, interviews were transcribed with the assistance of voice-recognition software, edited for clarity by the interviewers, and anonymized by each interviewer. Anonymizing the transcripts before interviewers shared them with each other helped to detach individuals from their statements, the first step in finding global patterns across the data that would give rise to distinct personas and further minimize possible intra-project power dynamics related to roles. Once anonymized, our qualitative analytical approach built, primarily, on a deductive coding scheme (Miles et al., 2013) that we developed and have used in similar research to study how educators think about justice-oriented science education at multiple levels of schooling (Light et al., 2024). To better understand how the EMPOWER researchers conceptualized and built on CC, we decomposed Freire's definition of *conscientizaçao* (2005) into three main components: (1) *theory* were utterances from

participant on their ideas and/or perceptions of inequities or injustices; (2) *practice* were utterances related to the actions, decisions, and/or planning participants engaged in to make material changes; and (3) *reflection* were instances when a participant ruminated on lived experiences or practical ideologies, or built on those to propose new forms of theory and/or practice. Given the complexity and multi-dimensional nature of education systems, we also drew on and expanded Burgess and Patterson Williams's three layers of equity (2022) to characterize the level at which PL activities were addressed. This resulted in the following deductive codes: (i) the *macro* layer referred to instances when a participant located inequities or actions in the broader sociopolitical institutions in the US or abroad (e.g., structural racism); (ii) the *meso* layer comprised analyses of inequities or actions directly related to schools and schooling (e.g., school leadership, curriculum); and (iii) the *micro* layer focused on the intra- and interpersonal dimensions of how teachers and students work together to shape instruction.

**Figure 1**
*Stages of Analysis and Persona Amalgamation*
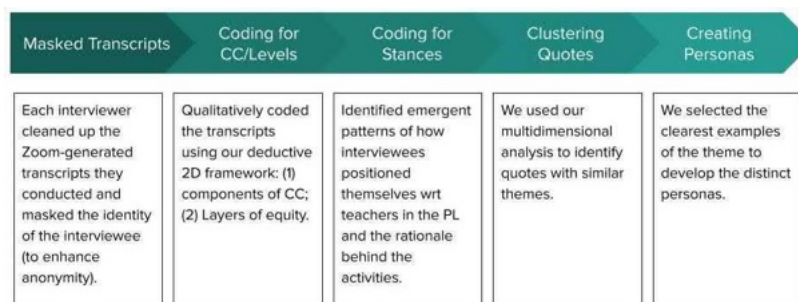


The third phase of our qualitative analysis was inductive in nature (Miles at el., 2013), as we focused on characterizing the emergent themes of how the EMPOWER researchers conceptualized their priorities and plans for the upcoming PL. As we aimed to understand how these participants built on their conceptualization of CC and visions of high-quality science education, we identified two main stances that they took towards different actors in education systems (i.e., schooling, teachers, students). Specifically, we generated two inductive codes: (a) *alignment with* captured instances when participants stated that their goals, values, and visions for justice-oriented science education were shared and/or recognized by actors in the education system (e.g., feeling empathy towards teachers whose principals opposed addressing injustices in science); and (b) *tension with* described instances when the participants expressed surprise, vexation, opposition, or disappointment in how various actors in the system would or did respond to participants' goals and visions (e.g., teachers maintaining deficit-oriented stances towards students). At each stage, we began by discussing how we operationalized each code to develop a robust codebook and then coded the anonymized transcripts independently. We met consistently to compare and refine our coding approaches, work towards consensus, and discuss themes we were constructing in our analysis.

From our qualitative analyses, we began clustering transcript quotes from across all participants with similar stances towards actors in the system, characterizations of critical consciousness, and the layers of equity that were being discussed. This purposeful clustering revealed an initial set of personas, each of which had their own approaches to and priorities for how PL could address educational injustices. However, we refined our list of personas further to prioritize the stances (i.e., alignment with, tension with) EMPOWER researchers expressed towards different actors in the education system, given than their anticipation of what was possible, what was realistic, and what was futile seemed to inform much of what they thought was worth pursuing in the upcoming PL. Prioritizing the stance also meant prioritizing the layer of equity that each persona would focus on, since actors in the system were intricately connected to the macro, meso, or micro level at which to address educational injustice. From this step, we generated descriptions for new personas that connected the different dimensions of our analyses that were in and of themselves distinct in their goals, needs, and priorities.

## Findings and analysis

Based on our qualitative analysis, we generated five distinct personas that represented a range of priorities for the PL providers based on their understandings of educational injustices (see Table 1). As mentioned above, EMPOWER researchers' stances towards the actors in the education system became a prominent dimension along which to organize and generate these personas, given that their expectations of alignments and tensions shaped the learning activities that would comprise the PL. One important note is that, at no point, did the participants express any kind of tension with students, their families, and/or the communities. Instead, throughout all analyzed interviews, participants were steadfast in extolling students' capabilities, knowledge and sense-making practices,

lived experiences, and desires to belong in science. Regardless of whether these perceptions match the realities of classrooms, the complete alignment with students meant that we could not generate a persona that captured how the researchers' tensions with students shaped the PL design. Due to space constraints, we will focus on the two personas that capture the stances researchers expressed in relation to teachers: Wren and Onyx.

**Table 1**

*Personas' Stances Towards the Actors in Educational Systems that Guided the PL Design*

| Actor/Level | Alignment with… | Tension with… |
|---|---|---|
| *Systems* | Blue: committed to the 3D vision of science education codified in the NGSS; recognizes the system sometimes works for all students and its potential for good. | Jay: frustrated by how societies fail schools, teachers, students; vexed by the standards not serving minoritized students and their communities. |
| *Teachers* | Onyx: committed to supporting teachers' professionalism within schools; researchers should support teachers to reach their pedagogical goals. | Wren: surprised that science teachers are too focused on content; disappointed that teachers do not know their students beyond the classroom; wanted to end racial aggressions in classrooms. |
| *Students* | Cardi: recognized that students come to the classroom with resources and lived experiences, and curriculum and teachers should build on those. | --- |

## Wren in tension with teachers

Wren is a researcher and teacher educator who is concerned about how teachers bring the theory, action, and reflective practice of critical consciousness in the science classroom. For Wren, critical consciousness is a concept that needs to be explicitly taught in order to be understood and valued by the teachers, stating that PL ought to communicate explicitly why it is important for teachers to develop CC because without that understanding it would be challenging for them to want to change their interactions with students. And even though Wren recognized that each teacher brought their own identities, personal and professional histories, outlook on life and society, and dispositions towards developing a justice-oriented pedagogy, PL activities should create opportunities for teachers to process their lived experiences and how those may differ from other teachers' or even students'.

Because of their focus on intra- and interpersonal *micro* layer, we assert that Wren's view of critical consciousness reflects a combination of *micro theory* and *micro reflection*. Wren sees the teacher's knowledge of CC as limited and underdeveloped, which creates opportunities to assist the teachers in their professional growth of CC. Specifically, Wren recognizes the role that lived-experiences play in the teachers' personal perceptions of critical consciousness and the significance of how those lived-experiences shaped the teachers' own pedagogy. This stance reflects how Wren builds on their understanding of critical consciousness, and it shapes the lens they use while working with teachers. For instance, Wren was clear that they thought "it's really important to take on the same kinds of lenses we want our teachers to take with our students as we work as facilitators with teachers. To be generous, to be...to seek, to understand, not to judge." The work for Wren is getting the teachers to see how the lived experiences of their students are also relevant and valuable.

However, there is a tension that Wren anticipates as they prepare to work with the teachers as part of the PL, focused on interpersonal dynamics between teachers and students (*micro*). Part of this tension comes from Wren's own recall about the power and privilege held by teachers, which they characterize as some being "resistant or uncomfortable with their privilege and how to move with that privilege." Wren also struggles with the fact that teachers often act as "the police of their schools and their classrooms…and they decide who goes home suspended or expelled." This tension deepens for Wren, as they witness teachers who hold high levels of power and privilege fail their students. Specifically, as teachers address the so-called learning loss, Wren sees them "swing back to even more traditional, even more structure, even more traditional discipline policies."

Wren's tension with the teachers frames their approach to the PL design. Specifically, Wren sees the upcoming summer professional learning workshop as an opportunity to push against the teachers' oppressive tendencies and expand on the teachers' "imagined possibility space" for building their critical consciousness. We see this as an action oriented towards the *meso* layer of schooling and curriculum. Given their understanding of how teachers' histories, goals, and values shape how they engage with PL, though, Wren understands they need to frame learning activities about CC carefully, especially for teachers new to that kind of work. For instance, Wren shared that they "would never frame it as, 'we didn't push teachers far enough'… the goal is always to meet

everyone where they are, and push them a little farther", which points to the how they are acting at the intersection of their vexation with teachers and the recognition that different teachers will have their own journeys into CC.

The key component to Wren's professional learning is to support teachers in adapting curricular materials (*meso*) to increase student critical epistemic agency: their understanding of and desire to transform oppressive power structures by exploring how scientific knowledge impacts communities and the natural world. For Wren, the first step was to support teachers to examine how they orchestrated learning for "students to feel that they are in a safe environment where they can share the things that are on their minds, not be afraid to be wrong" and create a learning "environment where there is a lot of trust." Once a shared commitment to these relational dynamics was established, Wren would then continue "to push on what are features of curriculum materials that lead to epistemic agency or increase epistemic agency" so that teachers could develop a good understanding of how they may adapt materials to increase students' epistemic agency. Wren's approach is explicit, providing teachers with unambiguous examples designed to deepen the teachers' personal sense of critical consciousness. For instance, Wren shared how they would structure a learning activity in which teachers would compare two biology units, one on diseases and another one on genetics, as a way "to get a concrete personal sense of what it means to have justice as a central guiding principle" in the curriculum. Specifically, Wren anticipated teachers' deficit-based perspectives of their students during the diseases unit, which could lead to feeling pity for students who use wheelchairs without realizing how they would be perpetuating ableism. However, the genetics unit included "seven graphs that show the inequitable distribution of wrongful incarceration" that could support teachers to see how to use science to interpret inequities and unfairness in society.

Finally, Wren's professional learning is deliberate, planning activities that would push teachers to look past the curriculum to see their actual students and to question who the curriculum was really intended for. Specifically, Wren anticipated that teachers would adopt a race-evasive approach to their teaching and could even decide that "culturally relevant pedagogy seems racist" by even acknowledging the racial disparities in society. Nevertheless, Wren was ready to engage teachers in learning activities that would show how they "are literally already doing culturally relevant pedagogy, but it's culturally relevant to white students." Ultimately, Wren wanted to keep teachers from hiding behind the standards and content that comprised the curriculum and, instead, help them recognize how they needed to focus their curriculum adaptation on elevating all their students' identities, needs, and goals. Failing to do so could harm minoritized students the most.

Wren's approach to the teachers professional learning showcases both *meso practice* and *micro reflection* dimensions of *conscientizaçao.* Wren uses the curriculum as a conduit for making critical consciousness tangible for teachers, modeling how to push theory into practice. Wren also tailors their professional learning design with explicit examples, building each teachers' sense of personal responsibility when it comes to critical consciousness. Overall, Wren's approach to professional learning is very direct, taking on a tone of tension as they convince and teach teachers of the significance of critical consciousness and the importance of student epistemic agency.

## Onyx in alignment with teachers

Onyx is a researcher and teacher educator who is deeply concerned about their own theory, action, and reflective practice of critical consciousness in the science education classroom and how they can bring teachers into *conscientizaçao*. For Onyx, CC is not a concept that can be taught, but rather an individual process. For instance, when describing how they design learning activities for teachers that reflected this stance, Onyx said that "to do good critical consciousness work, you can't come out and shout, 'You're gonna learn about critical consciousness' because critical consciousness is such a deeply personal and internal idea" (intrapersonal, *micro* layer). Onyx also added that it can be difficult to "fairly, behaviorally assess someone's critical consciousness on their behavior," which is why the thought that "the best strategy for working with anyone's critical consciousness is by bringing it to them in their practice and … talk about what students need and how do we build classrooms and communities of practice in our buildings and systems that better support students to thrive."

Like Wren, Onyx's view of critical consciousness reflects *micro theory* and *micro reflection*. However, unlike Wren, Onyx sees the teacher's knowledge of critical consciousness as expansive but internal. For Onyx, effective PL should get teachers to recognize their own potential when it comes to critical consciousness and student epistemic agency. Additionally, Onyx knows that this process cannot remain internal. Therefore, the second part of Onyx's PL design is to get teachers to bring critical consciousness from reflection into practice.

Onyx approaches their PL design as an opportunity to align themself with the teachers, which includes recognizing how the teachers may already have developed a certain level of CC. For instance, Onyx shared that, despite not knowing the teachers they would be working with very well, "I know they teach in a really diverse, like truly diverse school district, and they are likely to have a lot of experience with students and families and cultures." These experiences led Onyx to infer that these teachers "could do a number of other jobs but they choose to be in this school in this community," which is why they were "anticipating that these teachers are

particularly interested in supporting all students to have high quality science experiences." Given these assumed backgrounds and commitments, Onyx planned on learning activities that could "wade into deeply personal and identity latent issues, like positions and power," as well as discussions that could "help bring [teachers] face to face with their own privilege and their responsibility." For Onyx, PL activities that foregrounded these kinds of *micro* reflections could be effective at supporting teachers revisit and adapt their curricular materials.

Additionally, Onyx aligns themself by recognizing their own positionality in relation to the teachers' positionalities and choosing to exercise solidarity, bucking the traditional power differentials between university researchers and classroom educators that have fueled the deprofessionalization of teachers. Specifically, Onyx recognized that teachers' lived experiences and values shape their commitments to justice-oriented teaching, as well as the circuitous route that it can take for an individual to understand their power and privilege. Thus, Onyx approached the PL design from a place of empathy and to practice what they preached: rather than get upset with race-evasive teachers, just like teachers would get upset with students, Onyx thought it would be more effective to build a common departure point with teacher and, from there, work towards a consensus on what critical consciousness could look like in the classroom. Finally, Onyx understood that if they were to align themselves with teachers, they needed to continue in their endeavors of advancing their own critical consciousness. For instance, Onyx stated that the PL should prioritize opportunities for them to also learn "along with the teachers … learn about critical consciousness, as well and develop my own critical consciousness." This stance showcases how Onyx approached the PL design from a place of solidarity towards teachers, rather than impositions.

For Onyx, the professional learning workshop is an opportunity to build solidarity with teachers and for teachers to address "something urgent to their own practice." To strengthen relationships, Onyx internally included opportunities for shared experiences between the researchers and the teachers within the professional learning. For instance, Onyx shared a possible learning activity in which "all the teachers had a journal, the research team, everyone had a journal," which would allow researchers and teachers to write and reflect on their learning experiences as part of the PL, alongside each other. Additionally, Onyx wanted to make sure that teachers had an opportunity to share their own experiences and insights, such as through an activity where they would bring "a description in the lesson that they described as being their favorite lesson." These examples encapsulate how, for Onyx, the key component of successful professional learning is creating opportunities for teachers to act with agency and, in turn, adapt their curricula to support their students' critical epistemic agency. And, again, rather than imposing one singular approach on teachers to take, successful PL would instead offer teachers "a long list of resources that are of good quality, such as aligned to NGSS and with students' sense-making at the center." Ultimately, Onyx wanted teachers to critically evaluate existing curricula in ways that would meet their needs. And, by the end of the PL, teachers would have a North Star: to center justice in their science teaching.

In general, Onyx *macro reflection* of privilege demonstrated their understanding that they are still working within a system of oppression. Yet, Onyx chose to focus on their own *conscientizaçao* at the intra- and interpersonal level of classroom teaching in relation to the teachers' own *conscientizaçao* at the micro level. Onyx understood that their own knowledge of critical consciousness is in development, like the teachers' and, therefore, their own stances and practices are in development, like the teachers'. They also understood that their unique lived-experiences shape their perceptions and that teachers also have their own unique lived-experiences that shape their perceptions. Like Wren, Onyx's approach to designing professional learning comprised both *meso practice and micro reflection*. Onyx, however, thought of curriculum as a conduit for making critical consciousness tangible for teachers, without downplaying the teachers' own lived experiences. In fact, Onyx's approach to professional learning takes on a tone of encouragement and support, understanding that "it is very difficult to be a teacher right now … and I'd really like teachers to feel joy in what they're doing when they go to work, and be proud of the work they are doing." Onyx withholds judgement in favor of moving forward with the teachers, which guides their approach to the PL design.

## Conclusion

As calls for more justice-oriented science pedagogy grow, there are still outstanding questions of what features teacher educators ought to exhibit to support classroom teachers to move towards critical consciousness. We argue that leveraging Freire's *conscientizaçao* can give researchers further insights into how teacher educators conceptualize educational injustices and how those understandings shape their PL designs for science teachers. In this study, we leveraged persona-based methodologies to parsimoniously characterize the heterogeneity of a sample to inform practice to understand how researchers prioritize certain dimensions of critical consciousness when designing PL for secondary science teachers. A "composite narrative approach" allowed us to create new characters that represent important features, stances, and priorities related to how EMPOWER researchers' critical consciousness shaped the PL activities. Specifically, we focused our analyses on two personas, Wren and Onyx, who expressed tensions and alignments with teachers that determined the mechanisms they used to support

teachers to make science curricula more representative of the goals and injustices students and their communities face. Together, these personas help us to begin addressing the challenge posed by many critical educators who insist on the need for teacher educators to wrestle with how their critical consciousness informs the PL they create. Future lines of research will include analyzing if and how the personas we have identified in the pre-PL interviews are also present in the post-PL interviews with EMPOWER researchers. Additionally, we would like to continue following these personas through the length of the project, studying whether they themselves change or take more or less prominent roles in the design of the PL for secondary science teachers.

In addition to the theoretical contribution, this study aims to make a methodological contribution to the literature on (science) teacher education by showcasing how to apply composite methodologies to research on critical consciousness among teacher educators. Through this approach, we aimed to protect our participants' anonymity and privacy, which is especially important for graduate student and early career faculty, while inviting them to be more forthcoming about their insights and stances. As a design methodology, personas allow us to identify the opportunities and challenges EMPOWER researchers experienced when designing PL for secondary science teachers, which would help us as a project brainstorm how to best support our goals of making science education more equitable for minoritized students in secondary school.

Given all these insights and advantages, we argue that researching critical consciousness is essential to advancing equity- and justice-oriented science education and that composite methodology is a highly ethical and efficacious approach to such investigations.

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