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Equity and justice in science education: Toward a pluriverse of multiple identities and onto-epistemologies

Shakhnoza Kayumova[1] | Remy Dou[2]

[1]Department of STEM Education and Teacher Development, University of Massachusetts Dartmouth, Dartmouth, Massachusetts, USA

[2]Department of Teaching and Learning, Florida International University, Miami, Florida, USA

Correspondence

Shakhnoza Kayumova, University of Massachusetts Dartmouth, Dartmouth, MA, USA.
Email: skayumova@umassd.edu

Abstract

Concepts in science education such as "science identity" and "science capital" are informed by dominant epistemological and ontological positions, which translate into assumptions about what counts as science and whose science counts. In this theoretical paper we draw on decolonial and antiracist perspectives to examine these assumptions in light of the heterogeneous onto-epistemological and axiological values, cultural perspectives, and contributions of nondominant groups, and specifically of those who have been historically marginalized based on their gender, race, ethnic, age, and/or social class identity. Building on these arguments, we critique deficit-based approaches to science teaching, learning, and research, including those that focus on systemic injustice, yet leave intact dominant framings of the scientific enterprise, which are exclusionary and meritocratic. As an alternative, we offer a design of science teaching and learning for the pluriverse—"a world where many worlds fit". This alternative allows us to reconstruct science and science-related "outcomes," such as identity, in the service of cultural, epistemic, and linguistic pluralism. We close the paper with the idea that because mainstream theories reproduce deficit framings and educational injustices, we must engage with decolonial[1] theories of pluriversality and discuss different onto-epistemologies to be able to grapple

with existing social, racial, environmental injustices, and land-based devastations.

KEYWORDS
decolonial science, equity, heterogeneity, identity, pluriversal

1 | INTRODUCTION

Despite decades of interventions and reforms, racial, and linguistic inequities continue to persist in science, mathematics, technology, and engineering (broadly construed as STEM) education among youth from nondominant communities. In this paper, we take to task taken-for-granted dominant ontologies and epistemologies (onto-epistemologies) fundamental to teaching and learning science to explain why existing theoretical frameworks fail to adequately address inequities. Drawing on the critical scholarship of feminists of Color (e.g., Wynter, 1987) and a decolonial perspective of a pluriverse (Escobar, 2018; Mignolo, 2007), we present a review of the literature that interrogates the ontological, epistemological, and ethical basis embedded within dominant assumptions of what it means to be a science person—the doing of and relating to science. We argue that dominant onto-epistemologies underlying science education, rooted in a European, White, masculine subject and his logic, are situated in individualistic and hierarchical relations that position science and therefore scientist identity as "universal." We argue if not challenged, our field will continue to normalize deficits and educational hierarchies, re-producing racialized Others throughout research and education (Rosebery et al., 2010).

Although critical research on identity adds much to science equity efforts, science education literature has not fully engaged in the political analysis of how racialization keeps reconstituting itself and why identity differences are repeatedly figured in deficit terms. We argue for a theory of identity that engages us (the science education community) in questions related to different ways of being, knowing, and relating to our shared world. We seek theoretical framings that center on mutual care, well-being, and interconnectedness of all humans, nonhumans, and more than human worlds. Such theory engages us in both the political analysis of how dominant notions of what it means to do science and to be a scientist are complicit in maintaining the racialized and deficit-oriented history of science and simultaneously providing alternative visions and social imaginings (Bang et al., 2017). Hence, we draw upon decolonial theories and the concept of a pluriverse as powerful analytical tools to interrogate why different ways of being (including identity differences) are constantly figured in deficit terms within the current institutions of science. We offer new articulations about different ways of being in the world (identity and difference) rooted in ontologies of care, interdependence, and relational accountability as possible grounds for different ethico-political forms of action and thought in science education.

1.1 | Identity research and science education

In science education, identity studies have emerged to explain racial and gender inequities in STEM disciplines (Brickhouse et al., 2000; Calabrese Barton et al., 2013; Carlone et al., 2011; Hazari et al., 2013; Rahm & Moore, 2016). Existing learning theories promoted deficit-based explanations including supposed conceptual, cultural, linguistic, and motivational gaps among marginalized learners. Identity studies in science education emphasized the importance of accounting for sociopolitical dimensions of science culture and identity and how dominant practices, representations, and images of doing science and being a science person become inextricable and mutually connected to (in)equitable outcomes (e.g., Dawson et al., 2019; T. C. Madkins & McKinney de Royston, 2019). Collectively, critically oriented identity studies show that participation in science learning requires engagement with dominant cultural, epistemic, and language practices, behavioral norms, and expectations that

conflict with lived realities and sociocultural identities of youth from nondominant communities (Rahm & Moore, 2016). In contrast, deficit-based theories locate the problem in students' perceived differences from the dominant group (White, middle class, monolingual English-speaking) by failing to account for sociopolitical and institutional factors such as low academic expectations, lack of access to qualified teachers, course tracking practices, and persistent racial, cultural, epistemic, and linguistic oppression (Rosebery et al., 2010; Settlage, 2018).

Research studies centering on critical identity theories in science education (see Carlone & Johnson, 2007; Morton & Parsons, 2018) challenged the deficit-oriented approaches by demonstrating that the notion of equity cannot be reduced to mere knowledge and skills (Carlone et al., 2011; Godwin et al., 2020); it must also encompass the problems of representation, identification, and belonging. Interactions between adults and youth who identify as science people, as well as behaviors and practices deemed scientific, shape young people's perceptions about science, their relations, and investment in learning and participating in science (Kayumova & Harper, 2020). Studies show that identity conflicts operate as a significant factor in why youth from nondominant communities do not identify or engage with STEM disciplines. These identity conflicts may be reinforced by dominant images of science and scientists lauded in popular culture (e.g., Albert Einstein, Bill Nye) including fictitious characters (e.g., Sheldon Cooper, Captain Nemo) that perpetuate racialized and gendered representations of what it means to be a science person and to do science (Dou et al., 2019). For example, Jacobs' (2016) research showed how Black girls' identity development was directly linked to racialized media images. These racialized and gendered identity images are not only consequential for the public's perception of science, but also for their racialized implications in the ways science learning is organized and the ways in which racialized youth (and their bodily and cultural repertoires of practice) are evaluated (Nasir & Vakil, 2017; Philip & Azevedo, 2017; Rogoff et al., 2016).

Another important contribution of identity research was bringing in intersectional approaches to understanding and examining interlocking systems of inequities in science education (Hazari et al., 2013; King & Pringle, 2019). For example, a study by Gamez and Parker (2018) demonstrated how subtle gender, language, race, ethnicity, and class differences in who was perceived to be a homogenous group of children (e.g., multilingual) contributed to different degrees of inequalities in science learning. Hence, much of identity research emphasizes the importance of developing interventions and designing learning environments that draw upon and are responsive to heterogeneous ways of knowing and being that youth from nondominant communities bring to science (Rosebery et al., 2016). A study by Rosebery et al. (2010) showed the consequentiality of epistemological pluralism to equity goals. Yet, despite the emphasis put on epistemological diversity and science identity development (Rosebery et al., 2010), achieving such *heterogeneity* has been a challenge (Vossoughi & Vakil, 2018) (Box 1).

BOX 1 Heterogeneity

Heterogeneity has been described as an attribute encompassing observed or perceived "differences" among individuals and groups. This includes perceived ways of being, thinking, doing, and interpreting. The nature of those perceptions can be group-dependent such that groups with high cultural affinity are often more likely to perceive less ingroup heterogeneity (Voci, 2010). We contend that our onto-epistemologies draw our attention to particular sets of characteristics that we apply in noticing heterogeneity. Onto-epistemologies valuing a single universal way of knowing and doing science consequentially exclude individuals whose ways of knowing and doing science do not align with the assumed "standard"—or force them to conform (i.e., onto-epistemological colonization). As such, multiplicities in ways of knowing and doing science present as heterogeneity. Centering heterogeneity requires a paradigm shift about identities and differences. We argue that changes in our perceptions about the presence and value of heterogeneity begin with changes in our thinking (onto-epistemologies).

In this paper, we argue that to disrupt recurring deficit-based discourses and language of "lack" (whether it is a lack of interest, culture, skill, or specific identity), we must examine the logic upon which dominant science-related epistemological and ontological assumptions are built. By doing so, we argue that recurring inequities, deficit-based discourses, and racialization of youth from nondominant communities are intertwined with larger knowledge systems in science education. These are rooted in (settler) colonial and racialized histories, which manifest themselves in our current thinking about what it means to be a science person and do science. In science learning and teaching, this includes privileged norms and modes of participation that are inextricably connected to dominant Eurocentric cultural norms, ways of being, and thinking (Mensah & Jackson, 2018). As argued by Bang and Marin (2015), such norms include binary thinking, which reduces learning to hierarchical relations thereby constraining the multitude of experiences, forms of agency, and identities that could unfold (Bang & Marin, 2015). By failing to question the onto-epistemological dominant ways of knowing and being in science we arrive at what Bang and Marin (2015) call "settled expectations." These settled expectations are situated within the ontological and epistemological assumptions of dominant science that "distance students from the lived socio-scientific challenges their communities face and often fail to position youth as contributors and participants in the pursuit of possible and desperately needed solutions" (Bang & Marin, 2015, p. 531).

But the point of this paper is not to ask the question of "why youth do not identify with science?" or "how do we get them to develop science identities?" On the contrary, we propose to learn from their *insurgent identities* (Kayumova & Cardello, 2018; Kayumova et al., 2018) and "the forms of resistance and theories of change enacted by (racialized) youth" (Tuck & Yang, 2014, p. 10). These identity positions constitute the new basis upon which we take action and ask different questions. For instance, the current construction of being a science person as having a neutral, objective, and universal position, constitutes the science subject as the one who stands apart and above others, whose actions are relieved from ethical and sociopolitical accountability. However, the challenges we are facing as humanity and science education (e.g., racial, environmental, economic, etc.,) are ethically and politically situated and therefore require ethical and sociopolitical engagement. So to grapple with the far-reaching challenges of our time, we need "other ways of knowing, other ontologies and epistemologies that enable the subject's relation to the world, to space, and to time, to be conceptualized in different terms" (Grosz, 2002, p. 173).

We argue that such work must start with an identity theory that not only takes on sociopolitical and historical analysis but also makes "insurgent" identities of racialized multilingual youth and their heterogenous, onto-epistemological perspectives key to designing and understanding relational justice-oriented science education (Kayumova & Sengupta, 2022). In such an approach, equity and justice are *not* about helping racialized youth to belong within the existing structures or assimilating them into the spaces and dominant norms of science, which were not created with or for nondominant groups in the first place (Lemke, 2001). *Drawing from decolonial and pluriversal perspectives, we purport that equity and justice are about changing/transforming science structures and norms by forging new asset-based and relational justice oriented spaces through humanizing, dignity conferring, caring, and accountable relations that explicitly value and legitimize multiple and insurgent identities, ontologies, languages, and epistemologies of youths from nondominant groups—the pluriverse.*

1.2 | Decolonial theories and the concept of the pluriverse

The concept of the pluriverse—"a world where many worlds fit" (Escobar, 2018, p. xi)—has a long lineage within decolonial scholarship. It was developed as a counternarrative to Eurocentric onto-epistemologies that rest on the notion of how knowledge and experience are universal regardless of where one stands or experiences the world. This view is situated in Eurocentric ideologies (worldviews) that historically figured "human" in the identity image of the rational white subject (i.e., "Man") and his hierarchical relations to other humans and nonhuman worlds (Wynter, 1987). As formulated by Wynter (1987), this image of Man, has become a "measuring stick through which all other forms of being are measured" (p. 3), to the extent that this ideological worldview produces

"dehumanization" by objectifying communities of color figured as "less-than-human" (Kayumova et al., 2019). As described by Snaza et al. (2014), "if one had rights simply by virtue of being human, then not being recognized as human—something that women, Black slaves, and colonized natives faced with horrifying regularity—was enough to relegate these in-humans to the status of things, objects to be used by humans" (p. 42) (Box 2).

BOX 2 Pluriversal approach

The notion of pluriversality is premised on a political ontology that challenges the universal ontology of science perpetuated and normalized by Eurocentric worldview, ways of being and knowing, around which dominant discourses of progress and modernity are organized. The pluriversal approach provides a basis for a shift in how we think about undoing injustices and designing more just and thriving communities by centering onto-epistemologies of care, interconnectedness, and radical independent ways of relating to the world. By centering identities and heterogeneous knowledge systems of those who have been delegitimized and marginalized pluriversal approach provides a new sense of unity and yet particularity about understanding, relating, and knowing natural-cultural systems, as well as a humanizing way of articulation about difference and "otherness." We view the pluriversal approach to identities in science education as akin to the intersectional approach to identities and echoing that power and injustices are multifaceted since "[t]here is no thing as a single-issue struggle because we do not live single-issue lives" (Lorde, 1984, p. 139). While intersectional theories provide critical insight into how social identities are configured by power relations, taking a pluriversal approach to identity helps to reconfigure power relations on the basis of identity. Liminal positions as described by Hooks (1991), or marginalized identities as described by Wynter (1991) become fundamental to "radical possibilities" for social, cultural, and natural imaginary on the basis of care and interdependence. In this paradigmatic shift, differences in language, conceptualization, thinking, ways of being, and knowing are assets rather than deficits that require homogenization.

L. T. Smith et al. (2018) describe decolonizing perspectives as those which attend to how coloniality and settler-coloniality "shape and serve human and nonhuman relationships across land, nation-state, waters, and time," and build on the work of critical scholars "at the intersection of Chicana studies and Indigenous studies, Pacific Islander studies and Indigenous studies, Black studies and Indigenous studies, diasporas studies, and critical Muslim studies and Indigenous studies" (p. 10). According to the decolonial perspective, the systems of racial hierarchy, Othering (of both humans, non-humans, and other forms of life), and racial and relational violence continue partly through an epistemological regime that reproduces ontological categories of Otherness and what it means to be marginalized (McKittrick, 2015). As Wynter (1987) described, the ontological categories of "minority" across disciplines historically tie back to the constitution of "human" in the image of white Man and his epistemic orientation to the world as the one who stands apart and above everyone, spatially and temporally. Decolonial scholars (Escobar, 2018; Mignolo, 2007; L. T. Smith et al., 2018) critique the "cognitive empire" (de Sousa Santos, 2015) and its onto-epistemological dominance by critically analyzing the matrix of power rooted in a (settler) colonial worldview that "persists under totalizing forms of knowledge that reaffirm the dominator-dominated binomial" (Quijano, 2007, p. 173). As such they show how epistemologies, ontologies, and axiological positions (ethics) are not distinct but rather relate to one another. Without critical historicity to challenge the "majority/minority" as a "brute fact," we allow the very same onto-epistemic orientation to reproduce descriptions of Others. Since majority and minority signify relation to power, our present onto-epistemological domains, including the scientific discipline, become implicated in reproducing dominant/marginalized binaries in which the identity of white Man is preserved in being as the universal science person (Box 3).

BOX 3 Onto-epistemology and axiology (ethico-politics)

Many non-dualistic perspectives of the Global South (Upadhyay et al., 2021), Black (Dillard, 2008), and Indigenous Studies (A. D. Smith, 1999) challenge the dominant assumption that ontology (ways of being) and epistemology (ways of knowing) and their axiological (ethico-political) basis are distinct and separable (see Bang & Marin, 2015; Salazar Pérez & Saavedra, 2017). The inextricable symbiosis between ways of being and ways of knowing is referred to as onto-epistemology. The basis of such actions can be referred as ethics and politics. For instance, there is an assumption that science that is based on objectivity is based on ethics of neutrality. For example, in the context of racial injustices an objective research towards issues of race may take on a "color-blind" approach which in actuality denies that there is a racial issue at hand. In the context of science education, it is helpful to understand onto-epistemology from a cultural perspective. That is, "[a]ll science learning can be understood as a cultural" (NRC, 2012, p. 284), since culture is reflected in peoples' and communities' identities (i.e., ways of being, knowing, and relating to the world). What we practice in schools and universities as a science disciplinary domain can be a form of a dominant science culture with its own dominant history, voice, perspectives, and onto-epistomological and ethical basis.

The novelty of pluriversal thinking is that instead of turning to epistemologies as a place of difference-making, it turns to political ontologies and worldviews of those whose human(ess) were deemed less legitimate. Learning ways of "being human" from those who have been put to the margins, those who learned to exist and thrive under the most difficult conditions can offer us new and transformative views for collective actions and shared solutions to crises facing humanity (e.g., racial, environmental). As described by Wynter "[b]eing human, in this context, signals not a noun but a verb. 'Being human' is a praxis of humanness…" (McKittrick, 2015, p. 4). This praxis draws on worldviews of, for example, African ontologies of care, healing (Dillard, 2008), dignity, collective self-determination, ancestral knowledge, and Indigenous ways of relational accountability (Wilson, 2008, p. 77). These same worldviews have been repressed and ridiculed by dominant Eurocentric, objectivist, and universal perspectives in science, which were described by Frantz Fanon (1952, 2020) this way:

> The [B]lack man has no ontological resistance in the eyes of the white man.... His metaphysics, or, less pretentiously, his customs and the sources on which they were based, were wiped out because they were in conflict with a civilization that he did not know and that imposed itself on him. (pp. 257–258)

Fanon (1952) describes a critical connection between epistemology and ontology: when visions, worldviews, and practices do not match the dominant group, they are likely to be ignored, erased, or wiped out. As such, many African and Indigenous ways of being and knowing in the world (onto-epistemologies) that would increase our intellectual diversity and that which would also provide ways to design out of the current crises are often deemed illegitimate. Even, for example, when these communities are brought to the table, the dominant groups' onto-epistemologies are imposed in the legitimizing of the agenda and solutions arrived at; Rabaka (2010) describes this "epistemic apartheid" as the ways in which Black and non-western voices are being silenced through "institutional racism, academic colonization and conceptual quarantining of knowledge, anti-imperial thought, and/or radical political praxis" (p. 16). So, turning toward ontologies is imperative because they help us to engage and perhaps even to design worlds in which articulations of nature and culture are intertwined, and not separate, in ways that we can "defend or re-create worlds that retain important relational and communal dimensions." As Escobar (2018)

argues, "[t]o think new thoughts, by implication, requires stepping out of the epistemic space of Western social theory and into the epistemic configurations associated with the multiple relation ontologies of worlds in struggle" (p. 68). These are not especially new ideas and yet only faintly heard and rarely discussed within science education research and teaching. In a campaign seeking to center equity, there exist discernible connections to be made between scholars like Fanon and names more familiar to the science education community.

1.3 | The political meets science and technology studies

Studies in science and technology (Knorr-Cetina, 1991; Latour, 1987), feminist science scholarship (Haraway, 1988), and feminists of Color (Anzaldúa, 2009), have long contested dominant Eurocentric onto-epistemologies by showing ethical-political consequences of such knowledge claims for marginalizing and objectifying women, nature, and the Global South. As an example, feminist epistemologies challenged the universal claims of objectivity arguing how "views from everywhere and nowhere" (Haraway, 1988, p. 581) conceal a conquering gaze of power (i.e., historically white supremacist, patriarchal, masculinist subject) and science's historical links to militarism, colonialism, and racism (Vossoughi & Vakil, 2018). As Haraway described,

> This is the gaze that mythically inscribes all the marked bodies, that makes the unmarked category claim the power to see and not be seen, to represent while escaping representation. This gaze signifies the unmarked positions of Man and White. (p. 581)

Hence, this critical scholarship in science and technology studies not only critiqued the claims of neutrality, objectivity, and universality but also connected it to the workings of power. Further connecting to the intertwined nature of ontology, epistemology, ethics, and politics this scholarship articulates how scientists are not *merely* documenting the world or a reality that is "out there"; they are actively participating in, and even changing the reality through their definitions and designs of systems.

1.4 | Historicizing inequities and recurrent racialized deficits in science education

Leon Walls (2017) argues that the racialized history of science has not changed since its first construction. What we currently understand as scientific practices remains embedded in science-related institutions, advantaging, as Felicia Mensah and colleagues argue, white ways of being, knowing, and relating to the world (Mensah & Jackson, 2018). And "storylines have likewise consistently placed white students at the pinnacle of academic achievement, and the standard by which all 'others' are measured" (Walls, 2017, p. 498). In science education, Bang et al. (2012) describe these hidden measures as settled expectations or "set[s] of assumptions, privileges, and benefits that accompany the status of being white" (Harris, 1993, p. 1713, as cited in Bang et al., 2012), which determine what is valued as a dominant science identity. When youths from nondominant communities resist assimilating into these identity performances of whiteness, behaving instead in ways that stray from the norms and expectations of the classroom, their differences are criminalized, invalidated, and/or further interpreted as deficiencies in cognition, attitudes, skills, identities, agencies, and/or culture (Nasir et al., 2021). From this perspective, the dominant onto-epistemological practices of science education constitute identity positions of the white masculine subject that adults (educators) and youth (learners) come to see as the "natural" way of being/becoming a science person. Therefore, dominant onto-epistemologies of deficit remain unquestioned and thus invisible, reifying the white gaze to racialize and construct youth from nondominant backgrounds as having "gaps"—despite expressed desires to make science more inclusive for "all" young people. Indeed, as recent research shows even when academically talented Black and Brown youth choose to participate in STEM, they continue

experiencing racialized deficit-based discourses that undermine their engagement and sense of belonging in STEM (see Nasir et al., 2021; Nasir & Vakil, 2017).

Consequently, as Penuel (2017) has posited, the historically situated legacies of science remain "an enduring challenge" in science teaching despite equity-based interventions that have attempted to disrupt persistent inequalities and racialization in science education. We see this in the troubling stories of scientifically brilliant youth from Black, Brown, Latinx, and Indigenous communities. For example, 16-year-old Kiera Wilmot, an ingenious young person taking honors courses and who aspired to a mechanical engineering career, decided to build an advanced volcano and was excited to bring it into school to show her teacher and peers. When she set off the eruption mechanism, the mixture of chemicals created a small explosion. Her teacher contacted the police who arrested and charged Kiera with multiple felony charges, even though no damage or harm took place. Similarly, in 2015, 14-year-old Ahmed Mohamed was arrested for building a digital clock, which he brought into school to impress his peers and instructors. His teachers and administrators assumed the watch was a bomb. Had these young people exhibited lighter skin color and embodied whiteness, the relational dynamics would have likely differed between them and their teachers; they may have been recognized and celebrated for their agency, creativity, and ingenuity. School-based relations between teachers and Black students mirrored the social histories of the United States police system. These relations are embodied in epistemic practices which unfold in day-to-day and moment-to-moment interactions.

Without critical historicity and reflexivity, discourses of modernity and advancements in science will continue to "enchant" us all about Eurocentric ways of being and knowing (Wynter, 1987). As long as dominant science onto-epistemologies continue to be accepted as "transcendental" (i.e., accepted as the unquestionable essence of that which constitutes science) it seems "natural" to racialize and reject other ways of being and relating to the world, "especially those found in many (most) parts of the not fully-Westernized world, labeling their ways of being, thinking, and relating to the world as primitive, uncivilized, or quaintly old-fashioned and in urgent need of modernization" (Taylor, 2006, p. 191). Hence, based on decolonial perspectives, equity and identity in science education research must take into consideration colonial histories of white supremacy in science contexts (Bang et al., 2012). Because of the inextricable relationship among sociopolitical, cultural, and historical contexts, endeavors seeking to broaden individuals' identification with science cannot be disassociated from the *onto-epistemologies* of individuals who dominate those contexts (Carlone & Johnson, 2007). Without such critical and historical reflexivity, studies that universally perpetuate racialized narratives about those from nondominant communities, delegitimize their social, cultural, and linguistic backgrounds, instead positioning them within the discourses of "lack" or general "unteachability" (Gholson & Wilkes, 2017).

1.5 | Pluriverse of identities as ethico-political project

We regard pluriversality as an ethico-political project with an emancipatory potential that encourages ontological struggles of subjugated groups. It provides a basis to reframe systems of domination and marginalization of identities in science education. As in the previous section, while it starts with critical historicity, the pluriversal approach does more than critique by virtue of centering ways of being and knowing. In science education, pluriversality would emphasize *humanizing*. This humanization begins with turning to racialized youth with multiple and insurgent identities, whose human(ess) and dignities have been oppressed, ridiculed, erased, and/or deemed illegitimate. A design for the pluriverse would make visible contextually specific and yet inherently heterogeneous modes of personhood based on the onto-epistemologies of liminal subjects and multiple insurgent identities. Such designs would honor and sustain a multiplicity of identities, heterogeneity, and differences as acts of collective self-determination. The onto-epistemological approach to undoing power and constructing new social imaginaries has been fruitful within identity research, especially as it relates to intersectional approaches to power analysis. Collins (1990) described knowledge of African American women as a vital part of such an approach, stating,

> Viewing the world through a both/and conceptual lens of the simultaneity of race, class, and gender oppression and of the need for a humanist vision of community creates new possibilities for an empowering Afrocentric feminist knowledge. Many Black feminist intellectuals have long thought about the world in this way because this is the way we experience the world. (p. 221)

While intersectional theories provide critical insight into how social identities are configured by power relations (Thompson, 2014), taking a pluriversal approach helps to reconfigure power relations on the basis of identity. Liminal positions as described by Hooks (1991), or marginalized identities as described by Wynter (1991), become fundamental to "radical possibilities" for social, cultural, and natural imaginaries on the basis of care, healing, and interdependence. In this paradigmatic shift, differences in language, conceptualization, thinking, ways of being, and knowing become assets, as opposed to being viewed as deficits that deserve homogenization. Centering multiple "insurgent" identities and heterogeneous knowledge systems would advance a fresh sense of unity as well as a humanizing way of articulating difference and "otherness."

Bang et al. (2018) provide an example of an onto-epistemological alternative from Indigenous perspectives which reworks Descartes famous phrase, "I think, therefore I am" to express something closer to an Indigenous ontology: "We are, therefore I am." Bang and colleagues explain that "extending this, we might imagine that the ontology of place-based paradigms is something like 'I am, therefore the place is,' in contrast, the ontology of land-based pedagogies might be summarized as 'Land is, therefore we are' (pp. 44–45)." Gutierrez (2017) explains such ontology as the one that recognizes that we are:

> part of a system of intelligent and sentient beings, also referred to as persons, with interconnected spirits, including rocks and bodies of water. Plants, for example, have lived on this planet for millions of years before humans. In that sense, plants are our older brothers/sisters and have developed ways of efficiently using space, relating with other living beings, and sustaining life not just for themselves but for others, often with few resources at any given moment. They have been able to withstand long droughts, communicate about impending dangers, and collaborate to protect others in the community in ways that appear to be selfless acts. They have much to teach us, and we may have something to teach them (p. 6).

As we ponder on Rochelle Gutierrez's articulations about plants and animals being our relatives from who we can learn, we think about the research we are doing with youth learning about how decomposers, mushrooms, and symbiosis between plants can help us re-envision and redesign more sustainable ways of farming, or how the seal whiskers can teach us to harvest energy in better ways (Kayumova et al., 2022). What would be the identity positions made possible for us if we see mushrooms and seals as our relatives who are sharing with us their intelligence? How would such consideration change our orientation towards other life forms? The identity positions afforded from such an onto-epistemological perspective centering on the relationality, reciprocity, and radical interdepedence, recognize consequentiality of science practice as impacting the collective (e.g., bodies, minds, and well-being of humans, nonhumans, and more than human life worlds) as opposed to the mere positioning of science as having an objective, neutral, and universal utility for the creative economy, warfare or profit. Hence, it is not about discounting Western epistemology, but understanding its historical, sociopolitical, and ontological contingencies which have been consequential to current injustices (e.g., objectification of humans, nature, and children). Furthermore, it is about recognizing that to design out the current crisis and injustices we are tasked with solving today, we need re-humanizing ways of knowing and being in the world (onto-epistemologies). The pluriversal onto-epistemologies might provide a different basis for actions in being a science person, w Such relational understanding of being a part of collectives, being intertwined, and coexisting with others and other life forms (e.g., water, bees, soil, land, air), bring in a different kind of responsibility and accountability for actions as a science person, and centers community goals over individual and economic gains.

Hence, pluriversal approaches to cultivating multiple insurgent identities and languages as spaces of transformation enables collective actions, collective thinking, and collective sense-making, as well as collective goals of mutual care, healing, well-being, and the flourishing of all life forms. Yes, contradictions, tensions, disagreements, and differences will exist. But these differences will not be conceptualized as a negative or an opposition. On the contrary, differences and multiplicities of identities will provide new articulations and alternatives for what is yet to come. They will also become the basis for connecting "people to a number of social groups and communities that can, in turn, potentially become politicized and mobilized in order to achieve particular social [racial, environmental, etc.] justice goals" (Barvosa, 2008, p. 123).

1.6 | Science educator entry into pluriversality

We came across the idea of the pluriverse in the context of designing and researching science learning with multilingual Black and Brown youths, families, and STEM teachers. We noticed that even equity-oriented teachers and researchers often continue to orient themselves toward deficit-based constructions of young people's ways of knowing and their identities, especially when youths' participation patterns and repertoires of practice (e.g., behavior) did not match norms and expectations. This binary framing crept insidiously into our reflective meetings with our respective research teams, teachers, and youth. For example, the binary identification of multilingual youth kept recurring through teachers' language as they identified one set of youth as "scientific" and another group as "others." We heard from families describing family and community members as "not a science people."

As researchers, we took part in similar fallacies. Despite our own identification as multilingual women and men of color, as well as our colleagues' identification with Black and Brown multilingual communities, we have referred to youth as "them" (i.e., others), with self-initiated goals to "cultivate" or "develop" their positive science identities. Here "we" signified a dominant us as "science people," while youths, based on their identities and epistemic performances, were deemed as ones who were on the path to becoming like "we." Our science identity was rooted in ontologies that assumed that science concepts were independent, neutral, objective, and universal. So, we have wanted all youth in our programs to equally learn and engage with science in ways in which we imagined they would. Although we "believed" in relational equity, our bodies carried relational and racialized histories of hierarchy as us/them, expert/novice, teacher/student, science/everyday knowledge, and adult/child dichotomies. This was despite our engagement with, for example, raciolinguistic perspectives based on decolonial theories, which reminded us that the language we used to reference youth reproduced the permanence of the power relations embedded in that language (Flores & Rosa, 2015).

There are increasing calls to pay close attention to the naming of racialized multilingual youth from Black, Brown, Hispanic, Indigenous, and nondominant communities (Takeuchi et al., 2022). Such examples include shifting the language from "at-risk," "disadvantaged," and "minority" to terms such as "minoritized," and "marginalized," to signify how naming becomes implicated in the perpetuation of power relations that subordinate (Takeuchi et al., 2022). While ontological categories such as "minorities" or "at-risk" signify a being (inherently fixed position), "minoritized" signifies a doing (done to cause this position). We have written these terms in our research, often in a state of ethical conflict, and have contributed to the perpetuation of the category as "less than" or "others" despite our good intentions. In identifying a group of individuals as "underrepresented," this not only conveyed the idea that they were meeting the standard of "representation" but also by associating the former term with a particular group of people, we were complicit in reinforcing the permanence of the relationship between the group of youth considered "underrepresented" and those considered "represented." In other words, although we were aware that terms and naming firmly locked groups within that category without an opportunity to live outside of it, we found ourselves re-enacting our own colonization again and again. We continued believing that youth who were not interested in science, or who had insurgent identities towards science, were such because they did not experience a

robust and equitable science. Little did we know that the subject positions that normative science afforded were limiting and homogenizing. That is, dominant ontological categories and epistemologies through which we made sense of young people's onto-epistemologies have often been inextricably connected with legacies of colonial conquest (Wynter, 2003).

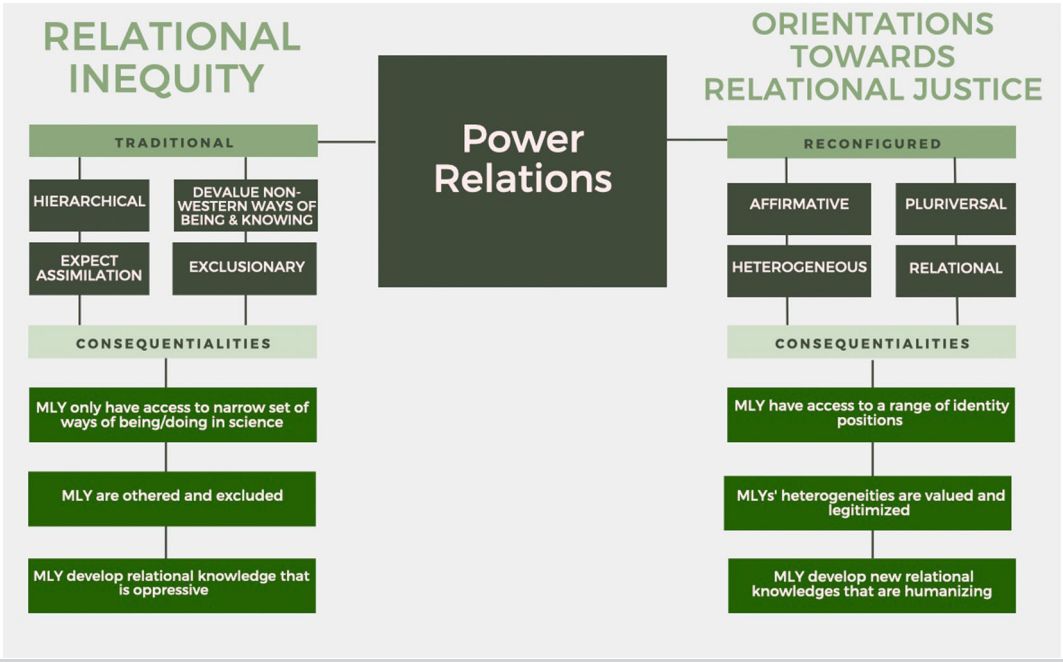
Racialized multilingual youth with insurgent identities taught us to seek alternative articulations and understandings to move beyond the contradictions we faced in our intentions and embodied practices. They taught us to center dignity, community, and collective well-being before anything else. They taught us ways to be a scientific person. Moving beyond constructions we experienced required that we shift our onto-epistemological perspective to recognize the inherent, irreducible value of young people's humanities and dignities. Such a perspective would generate a completely divergent language, meaning, and sensemaking as well as alternative articulations from what currently occurs in science and science education. We would engage teachers, caregivers, youth, and research groups in critical reflexivity about the history of science.

Pluriversal thinking helped us to look for alternative ways of making sense of our relations in ways that were consequential: teachers, researchers, caregivers, and youth engaged in collective activities result in changes to our science practices, interactions with youth, and relation to the environment. As an example of this, we have engaged in acts of "remembering" (Dillard, 2008) African ancestral ways of being in harmony with nature and their corresponding practices, such as Ubuntu—collectivist thinking about the shared world: "We are therefore I am." We also enacted Eastern (in Uzbek, Ona-Tabiat muqaddas) caring relations and ways of "good being, living" in/with sacred mother nature. These particular conceptions of nature and good living are also shared by the Quechua (sumak kawsay: "good living." As described by Cabrales Salazar and colleagues (2021)—the concept corresponds to "the world's restoration and the balance between man and nature and it develops indigenous principles, codes, and values that have withstander and persisted for over five hundred years, which should be rescued in order to recover the culture of respect, life, and the promotion of harmony with nature" (Cabrales Salazar et al., 2021, pp. 5–6). Similarly, an Anishinaabe philosophy known as mino-mnaamodzawin ("the good life"), which involves respectful relationships among humans and other life forms (e.g., Earth and water) (McGregor, 2018).

As we engaged in these discussions and enactments of pluriversality, we became less concerned about "science" identities, instead, we examined the power relations in our learning spaces and how our actions and thinking contributed to relational inequities (see Table 1). We discussed and sought opportunities to change the dominant practices and thinking in ways that would help create orientations towards relationally justice spaces in which youth enacted their multiplicities of social, lingusitic, and insurgent identities. We became less worried or obsessed about traditional "science" learning and sought to learn by engaging in humanizing science.

Rehumanizing education and practice celebrate the full humanities and dignities of racialized youth from nondominant communities, their culture, and epistemologies in everyday interactions, relationships, connections, and emotions such as joy and belonging (Gutiérrez, 2017, Goffney et al., 2018). Moreover, this approach prompted us to take youths' voices and lived experiences as central to understanding and developing new articulations. Once we changed our definitions and understanding of what it means to learn science and engage youth in science, these ontological definitions also changed our relations, from processes of working together to bringing together as a community. The youth took positions as leaders, stakeholders, and knowledge producers who enacted different ways of being, understanding, and relating to the world. Once we adopted a more "ubuntu"-like community approach, we engaged in ways of knowing that welcomed and valued differences, and practiced affirmative, humanizing, and dignity-conferring (Espinoza et al., 2020) ways of being and relating to youth, ourselves, and our environment. We began to appreciate multiplicities of identities, collaborations, and onto-epistemologies that opened new paths for inquiry and exploration and transformed our spaces (Kayumova & Tippins, 2021). The view of pluriversality helped us expose dominant assumptions about what counts as science and who counts in science, which has been embodied in our practices, but it also provided us with radical social imaginations. This granted us new visions and interpretations of identity positions in science education and their basis for more ethico-political actions toward a common good, justice, and flourishment (Kayumova & Tippins, 2021).

TABLE 1 Representation of our understanding of how different orientations manifested themselves in power relations and their consequentiality in the context of our work with multilingual youth



2 | OUR EXPERIENCE DESIGNING FOR THE PLURIVERSE

2.1 | Praxis of research and design of pluriversal spaces

Pluversality disrupts the notion that learning spaces could represent one "world," rather highlighting how learning is accomplished through engaging in multiple worlds, perspectives, and insights. It recognizes how differences in youths' performances are signs of epistemic agency, self-expression, and cultural ingenuities through which collective determinations can be forged to different ways of knowing and figuring the world. Gloria Anzaldúa articulates a pragmatic perspective of a pluriversal space, highlighting the experiences of indigenous people who have been colonized, not only in the ways that colonization is presented in historical texts but also in the ways power structures continue to colonize the epistemic and ontological systems of nondominant "others" (Anzaldúa, 1987). The design and research potential of pluriversality is both in their actuality (i.e., making sense of how the current dominant norms and practices are situated within colonial histories), and virtuality, (i.e., envisioning design and learning arrangements that are sociopolitically and axiologically just and/or desirable).

When applied to identity studies, this decolonial perspective allows us to analyze how learning processes can produce or perpetuate historical relations of power, domination, and marginalization, including identity stereotypes based on dominant colonial and settler-colonial assumptions and considerations. Studies of pluriversal spaces research how colonizing boundaries are undone/disrupted, while simultaneously examining how designs are carried out at the relational levels during and across moment-to-moment interactions. As depicted in Godwin and Potvin's (2017) case study, the story of Sara reminds us of the dangers of taking a piecemeal, temporal approach. As a woman from low socioeconomic circumstances, Sara found her humanity accepted in the science spaces created by

her high school chemistry teacher. Through meaningful social interactions, they constructed an area where their various identities coexisted, along with other students, taking the form of a clean water program that incorporated chemistry, physics, environmental justice, engineering, and philanthropy. The onto-epistemological agency that supported Sara's ways of being in those spaces inspired her to pursue a career in chemical engineering—something she related was an unexpected direction when reflecting on her previous experiences. Despite subsequent high school years of identification with science spaces, Sara's college experiences as an engineering major led her first to switch schools and then leave engineering altogether. Had Sara found room for her identities to coexist in pluriversality with others across both space and time, that is, from her high school chemistry class to completing her engineering program, her decisions may have differed.

We leverage these arguments above to present and illustrate theoretical perspectives for our community to consider adopting as a step toward addressing systemic injustice. Decolonial perspectives of a pluriverse (re)frame our (re)thinking of what it means to carry out an equity-oriented design where multiple voices, insurgent multiple identities, and onto-epistemologies and axiology coexist. The conceptual power of this onto-epistemological (re)framing is that it centers the experiences of insurgent and liminal positions of the marginalized as a fruitful place to undo domination and marginalization while imagining new possibilities in the codesign of dignity- and relational justice-oriented spaces (see Table 1 for an example how relational views can provide alternative articulations and understanding in science education).

2.1.1 | Informed by critical historicity and humanization

Historicizing and humanizing science are imperatives of designing pluriversal spaces. Teaching, learning, and the curriculum situated in a pluriversal approach will engage youth and teachers in critical historicity about not only science, but also about our society, structures, and racialization of modes of being and thinking while taking into consideration their colonial and historical character. Hence, making an intentional synthesis of epistemic/discursive/sociopolitical/humanizing dimensions of learning and participating in sciences, along with ontological and relational components. These would be based on ontologies of care, radical interdependence (Escobar, 2018), relational accountability (Wilson, 2008), and remembering ancestral ways of being and living with nature (Dillard, 2008). This process includes historical contextualization of science and its ontological and epistemic contingency, such as articulating nature-culture relations based on the Indigenous, African, Islamic, and other nondominant communities' ways of being and knowing. This way, students could not only "forge cultural affiliations" with different ways of being, knowing, and participating in science practices but also by participating in epistemological endeavors that bring different ways of being and doing science for the betterment of communities and all life forms (Taylor, 2006, p. 192).

These ontologies of care and relationality would not only extend to multiple humanities but also to Earth, nature, and other life forms. As such, sustainability can be redefined from a utilitarian perspective (the notion of the human as the utilizer of natural resources such as water, air, and Earth) to humanizing ones, "we are water, we are earth, we are air." Such an approach can move us from nonrelational practices (e.g., Reduce, Reuse, Recycle) to more relational and humanizing ones (e.g., Redistribute, Reclaim, Reflect) (Bazzul & Kayumova, 2018). Hence, the emphasis on the humanization of being a science person becomes about moving away from Eurocentric ontologies of individualism (e.g., individual responsibility) to community participation or collective activism (Kayumova & Tippins, 2021). Such approaches have implications for articulating how to shift science onto-epistemologies from hierarchical, top-down, individualistic, competitive, and status-difference oriented toward collective, multi-generational, ancestral, and relationally just. In such learning spaces, diversity and identity differences are desired and valued, since they provide modes of engagement that center on dignity, humanization, and flourishment of all life forms.

From this perspective, pluriversal design of science learning spaces could be about reimagining and rearticulating meanings of science learning, being a science person, and engaging in science as people who are caring, interconnected, respectful, humanizing, honoring, reverent, just, and dignifying. It begins with reclaiming identities, practices, and ways of being a "science person," otherwise disqualified from the current constructions of white science (also as manifested in notions of being modern, cultural, and progressive) (Table 2).

2.1.2 | Informed by insurgent identities, multi-languages, and self-expression of racialized youth

Young people engage in various activities and tasks outside the school based on their cultural and familial ways of being, all of which can speak to their evolving social selves. They may be living in multigenerational households. They may be in charge of taking care of younger siblings or translating for their grandparents. They may be navigating worlds undergoing political, economic, environmental, and cultural shifts. Their knowledge and notions of the family may include nuclear and extended family members. Their knowledge systems may be based on oppressive and liberating life experiences. In all these, they may engage in different ways of sensemaking, meaning-making, and questioning practices, which contribute to identity-based, intellectual-epistemic resources. However, much of what youth do (their ingenuities) are often racialized if they do not reflect dominant ways of being and doing science.

Earlier, we described the power of language and how language participates in meaning-making and perception of the world. Youth from multilingual Black, Brown, and Indigenous bring with themselves languages, vocabularies, and articulations that can help us to develop meanings, understandings, and relations that are based on humanization, reciprocity, and care. For example, words such as observation and experimentation tend to carry hierarchical and objectifying meanings. Bringing new vocabularies, languages can also bring new perceptions, understandings, and relations. Thinking about science and designing new spaces, tools, and practices of science from the liminal ways of being, speaking, and relating to the world that youth bring to learning, results in different sets of questions, vocabulary, actions, and designs that are honoring not only youth's but all living and non-living, human and non-human life forms, their assets, intelligences, briliances, and their full personhood, humanity, and dignity (Espinoza et al., 2020), while simultaneously providing us with new social imaginations, articulations, and praxis orientations of being humanizing STEM persons. As described earlier, Rochelle Gutiérrez describes rehumanization in the context of living mathematics education as an active, ongoing, explicit, and relational effort to redefine what it means to feel comfortable with and connected to issues we engage within the discipline, in ways that embrace the experiences, dignities, and humanity of youth in the coconstruction and coproduction of knowledge. As Goffney et al. (2018) argues, rehumanization "departs from a Western view of [mathematics and science]" and "seeks to not only decouple [mathematics and science] from wealth, domination, and compliance;

TABLE 2 Examples of relations informed by dignity and justice-oriented ways of being

Youth identities and subjectivities	Youth and adult relations	Relations to science knowing and learning
Positions from which to reimagine what it means to learn, to know, to be science people	Antihierarchical, antioppressive, and humanizing	Knowing as response-able, interdependent, and accountable
Positions from which to make sense of working of power, and to relearn everyday and fluid epistemological and intellectual resources	Respect, justice, and dignity oriented	Development and learning is collectively articulated and jointly achieved

it also recouples it with connection, joy, and belonging" (2018, p. 4). She puts the emphasis on "re" intentionally because it is a practice of bringing/referring back to ancestorial and already existing, and yet erased and delegitimized ways of being science and mathematics persons. Shifting our pedagogies toward rehumanizing practices teaches us about interconnectedness, reciprocity, ethics, care, relational accountability, and respect toward humans and more-than-human collective life forms.

Elsewhere, we (Kayumova & Sengupta, 2022; Kayumova & Tippins, 2021) provide an example from our research where we documented how purposeful designs of learning spaces that position multilingual youth in re-humanizing and dignity cofnerring ways changes the ways in which youth and teacher approach science learning. Such purposeful design of science learning spaces also depends on "listening" to youth voices and centering their heterogeneous onto- epistemologies, which are chiefly connected with the positioning of youth and their communities in asset-based terms. In this example, multilingual youth and their science teachers grappled to make sense of community issues related to water and fracking. They used their histories, narratives, and stories from the community as valid observations; they have been involved in dialogs and conversations and accounted for these discussions as valid data based on ontologies of care, interdependence, and relational accountability. Students and teachers were authors and knowledge producers whose epistemological endeavors were situated in ontologies of relational accountability, care, reciprocity, respect, interconnectedness, and the flourishing of human and nonhuman life. In that space, everyone shared their life histories, including relationships to bodies of water, like local rivers. Youth interviewed community members about their histories and experiences with water. They investigated possible chemical contamination of water or disposal of wastewater resulting from fracking. They invited representatives from the oil industry to speak with them about the issues. As they collected data, youth made computer models which enabled them to calculate the quantity of oil left in reserve and predict how long it might last. They created graphs to illustrate the behavior of the oil reserve stock. The graphs and models the youth created illustrated different results than those provided by representatives from the oil industry. This became an occasion for youth and teachers to organize a town hall meeting with the community about their findings. In this sense, the emerging epistemic narrative surrounding fracking issues in the community was no longer controlled solely by the petroleum industry. These engagements helped humanize science by deconstructing what is typically viewed as "self-evident and factual, rather than as constructed or open to interpretation" (Manz, 2016, p. 1113). Youth identity positions included ancestorial and caring epistemic practices which rendered their presence as actively transforming the cognitive domain of science (e.g., by presenting new forms and meanings of evidence, sense, and meaning-making), as well as transforming boundaries, relational knowledges, and histories.

2.1.3 | Informed by ethico-political and social imaginaries

Pluriversal approach to identities, and specifically Wynter's (1984) insights about being, offer new articulations and imaginaries about "being a science person," the ethical-political position that is "yet to come." It gestures to the revolutionary potential of insurgent, hybrid, and multiple identities and subjectivities by connecting racial, social, and environmental struggles (against all kinds of supremacies and oppressions). This involves positioning insurgent identities of youth as legitimate contributors to the solutions and discourse and listening to their experiences that emerge within the given order, making it hard to live and flourish as they have a better understanding of the workings of power. For instance, Shea and Sandoval (2020) showed that when science educators are aware of young peoples' cultures, histories, and the historical and political implications of marginalization, they are more likely to enact the kinds of pedagogies that center community activities and affirm youths' ideas and material, cultural, and political belonging through science. This pluriversal classroom community allows science settings to become spaces of "science and engineering as entry points for creation, political expression, and intellectual expansion" (Shea & Sandoval, 2020, p. 27).

Simply put, such orientations participate in dismantling boundaries and opening up cognitve, social, cultural and physical spaces (Soja, 1996) of transformation grounded in heterogeneous identities, knowledge systems of communities, and social imaginaries of possible futures. As Vossoughi and Vakil (2018) argue:

STEM education rooted in "enlightened self-interest" begins with and organizes learning around the needs and political agendas of the state, whereas STEM education rooted in "deep moral concern" for issues of equity begins with and organizes learning around the needs, capacities, values, identities, and possible futures of under-represented students and communities (p. 133).

As such science learning spaces become pluriversal spaces of social reimagination, and critical and ethical-political thinking that foster collective sense-making, problem-solving, and designs for better futures.

2.1.4 | Informed by community-centeredness, collective sense-making, and collective action

Working from a pluriversal perspective challenges the traditional top-down approach to science and science education that separates the classroom from our communities. Starting from knowledge systems of youth and communities necessarily extends science beyond the confines of the classrooms and makes explicit connections to problems confronting our societies (e.g., racism, poverty, various forms of extraction, oppressions, land, human, and environmental exploitations, and etc.). As Bang and Marin (2015) note, beginning with communities, families, and youth will allow the science community to ask how we know what we know and "expand the boundaries of reality and possible futures for students" (p. 542).

Historically, a myriad of success stories where complex science-related problems facing societies (e.g., disease, hunger, potable water, waste) remained unsolved until addressed by community-driven initiatives highlight the contributions of approaches that value the cocreation of scientific knowledge and practice. The Flint, Michigan, water crisis is a well-known example of how the inactions of those in the environmental, scientific, and political groups harmed Black and Brown people in low-income communities (Campbell et al., 2016). By failing to raise an appropriate response to the high levels of lead in water, dozens of individuals died or became seriously ill (Booker, 2021). Many children were put at risk for long-term harm (Hanna-Attisha et al., 2016). The negative impact of this environmental disaster was felt most strongly by those living in the poor, predominantly African American communities of Flint. The Michigan Civil Rights Commission identified systemic racism as the underlying cause of the injustices (Denchak, 2018). What followed marked a community "insurgent" science story that brought the problem to the surface, a bottom-up approach, where community organizations and individuals coalesced to pursue justice for those living in Flint. What qualified these solutions as an example of pluriverse is not merely that they responded to the problem but instead that they were generated by residents of Flint and a wide variety of community groups, including faith-based organizations, families, and youth groups (Carrera et al., 2019). With members of the communities in and around Flint, these groups represented a community-grounded approach led partly by victims of the crisis and a commitment to amplifying the voices of those who had previously faced marginalization. Indeed, the just and equitable outcomes directly resulted from broad, widespread, pluriversal, community-generated objectives and actions.

3 | IDENTITY THEORIES TO ADVANCING SOCIALLY JUST AND THRIVING WORLDS

In this paper, we argued while researchers document how (settler) colonial, racial, and class hierarchies are perpetuated through school curricula (Tejeda et al., 2003) situated within nature-culture relations (Bang & Marin, 2015), racial storylines (T. Madkins & Nasir, 2019), and deficit and damage-centered narratives

(Tuck & Yang, 2018) about youth from Black, Brown, and Indigenous communities, a little research has directly addressed the ontological analysis of coloniality (Patel, 2014) and (settler) colonial logic as it manifests in science education (Bang et al, 2017) and how this logic creates hierarchies, racialization, and deficit-based thinking on the basis of Eurocentric identity and white ways of being, knowing, and relating to the world (Mensah & Jackson, 2018). Hence, we argue that the solution is not to assimilate or enculturate diverse people into a system that is not sustainable or just; we need youth with diverse backgrounds, ideas, perspectives, and worldviews who can provide a different social imagination and way forward. We believe that cultivating critical pluriversal identities can be a way forward to bringing onto-epistemologies oriented toward flourishing and relational justice among and between human and nonhuman life. We argued that science education must take on such logic directly, understand how they inform science practices and identity relations, and engage with onto-epistemologies that focus on antiracist, relational, and pluriversal conditions grounded in decolonial framing (González García, 2006; Kayumova et al., 2022; Nxumalo, 2021).

If science spaces continue to operate through dominant cultural norms and values, merely providing access to materials or opportunities to participate in science will not make the kind of changes we seek. Instead, equity and justice-oriented work must seek orientations that center on interconnected, humanizing, caring, and dignity-conferring relations by drawing on racialized youth and communities' cultural, epistemic, and linguistic knowledge and repertoires of practice, as well as their identity resources so that these heterogeneities (Kayumova & Sengupta, 2022; Warren et al., 2020) can transform dominant science spaces to be more diverse, ethical, and thriving for all. From this perspective, the design of learning ecologies must create conditions of possibility that center on identities, community histories, relations, and experiences of racialized youth from nondominant communities rather than erase them.

Key to these endeavors is educational spaces that are reorganized toward relational justice to undo the histories of relational injustices housed in our bodies (Kayumova et al., 2022). When youth from nondominant communities bring their experiences and knowledge systems and take on identities oriented toward collective well-being, justice, and thriving, this will contribute to transforming the field onto-epistemologically. Together, these practices can help us create pluriversal conditions, facilitating radical social re-imagination of disciplinary practices towards our collective histories, communities, and futures (Kayumova & Sengupta, 2022). These spaces of pluriversality, we believe, afford us a justice-oriented vision of education and attune us to STEM disciplines oriented toward the betterment and healing of humanity, nature, and the environment instead of capital and power.

However, we do not suggest that we focus on onto-epistemologies alone. We also need to draw attention to institutions and actions/decisions of individuals in power who currently dominate STEM-associated structures, including funding agents, policymakers, and science curriculum/program developers. Avoiding this temporal and cross-sectional imbalance requires a humanizing transformation of and within the individuals who propagate the culture, norms, and practices of those institutions, as well as recruitment efforts that invite the participation of multiple humanities. Transformative (re)design of science spaces for the pluriverse must occur at systemic levels, including macro, meso, and micro-level teaching and learning processes (e.g., King et al., 2021; Parsons, 2008). Such a redesign would require expanding science education equity goals beyond narrow notions of broadening participation for economic or global competitiveness. Toward this, we argue that theories and theoretical frameworks manifest onto-epistemological beliefs and identities and are therefore lenses through which we can see, analyze, and build new visions and justice-oriented worlds. Hence it matters through which theories we make sense of notions of identity. We believe that our pluriversal approach is one of many approaches which can help us to think differently in our collective ability to grapple with "current social, racial, environmental, and land-based devastations." The diversity of ways of being and knowing is imperative for this effort so that we can critically rethink and reinvent being "science people" (Wynter, 2003) through our collective sense-making, resulting in rearticulations of the basis for our actions, practices, and design of worlds in which all life forms can flourish.

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ORCID

Shakhnoza Kayumova http://orcid.org/0000-0001-9771-2212

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