Title

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Journal

Berkeley Review of Education, 14(1)

Author

McClam, Rachel Saperstein

Publication Date

2026-08-24

DOI

10.5070/B8.63540

Designing Math Classrooms for Equity: Intersecting Critical Theories With Powerful Instruction to Create Critically Inclusive Mathematics

Rachel Saperstein McClam

Johns Hopkins University

Abstract

Despite a widespread recognition of the need for greater equity in mathematics, inequities persist in the subject for those historically marginalized in mathematics—such as students of color, students labeled as English learners, students labeled with a dis/ability, and women. In this paper, I argue that equity can only be achieved via an integrated understanding of the ways in which mechanisms of oppression have served to exclude students in education writ large and in mathematics specifically. Drawing on the framework of Critical Inclusion (InCrit), I aim to integrate efforts seeking to dismantle such mechanisms—including racism, linguicism, colonialism, ableism, and the specific exclusionary culture of mathematics—into a unified whole. I contend that this vision of critically inclusive mathematics might offer a vehicle by which to envision an emancipatory mathematical future for all students.

Keywords: mathematics equity, mathematics education, emancipatory education, InCrit, teacher development

Achieving greater equity in mathematics is widely recognized as a need; therefore, policymakers and organizations supporting education often state it as an objective of their work. For example, California's newest Mathematics Framework states that a core goal of the document is to "ensure equity and excellence in math learning so that all California students become powerful users of mathematics" (California Department of Education, 2023, p. 1). The National Council of Teachers of Mathematics recently published a book series titled *Access and Equity: Promoting High Quality Mathematics* (Crespo et al., 2018), whereby equity is made central to the pursuit of mathematical excellence. The Gates Foundation centers their educational funding efforts on mathematics, writing that, "too many K–12 students in the U.S.—especially Black and Latino students and students from low-income backgrounds—experience mathematics as a barrier to success rather than as a gateway … we have made a 10–year commitment to focus on math instruction and outcomes as the cornerstone of student success" (Bill & Melinda Gates Foundation, n.d., K–12 Education: Our Strategy section).

Despite this widespread focus, inequities persist for groups historically marginalized in the subject, for example via disparate enrollment in higher level courses (Tyson, 2011); unequal opportunities to learn rigorous mathematics (Boaler, 2011; Tan & Kastberg, 2017); and underrepresentation in science, technology, engineering, and mathematics (STEM) fields that require high mathematics competence (Aviolo et al., 2020; Estrada et al., 2016; Lambert & Tan, 2017; Riegle-Crumb et al., 2019). For example, while approximately 30% of U.S. men were employed in a STEM-related field in 2021, only 18% of women held similar jobs (National Science Foundation [NSF], 2024). Similarly, while Black and African American workers make up 11% of the U.S. workforce, only 8.2% of that group is employed in a STEM occupation. Those percentages are similarly disproportionate for Hispanic individuals, and disparities increase when specifically considering higher skilled professions (NSF, 2024).

Furthermore, equity efforts in mathematics often leave students with dis/abilities[1] out of the conversation, as they have historically not been considered in discussions related to mathematics equity (Tan & Kastberg, 2017). There have been recent calls for "cross-pollination" (Waitoller & Thorius, 2016, p. 366)—or integration—of theories seeking equitable student thriving through both anti-racist and anti-ableist lenses (Alim et al., 2017; Cruz et al., 2024; Waitoller & Thorius, 2016), with the recognition that racism and ableism are intertwined and so cannot be fully understood in absence of one another (Annamma et al., 2013). Yet, much of this cross-pollination work to date has been either content agnostic or theoretical in nature (Alim et al., 2017), leaving space for practical and subject-specific applications.

In this article, I take up these cross-pollination calls and apply them specifically to K–12 mathematics. Mathematics is an especially critical site for this work given its particular exclusionary culture (Louie, 2017) and location where teachers often feel unclear about how to integrate culturally responsive education efforts (Ladson-Billings, 2021; Marshall, 2023). I situate this work in the conceptual framework of Critical Inclusion (InCrit; Cruz et al., 2024), which theorizes how the integration, rather than fragmentation, of understanding about entrenched oppressions might help connect theory to practice. Using an InCrit frame, I extend the work into the mathematics space by calling for the integration of InCrit with frameworks of rich mathematical learning (specifically, the Teaching for Robust Understanding [TRU] framework; Schoenfeld & TRU Project, 2016) to yield *critically inclusive mathematics*. I define critically inclusive mathematics educators as ones who:

1. Understand the ways in which intersecting identities have served to historically exclude students from rich mathematics learning spaces.

[1] I use the term dis/ability throughout this piece when referring to framing that recognizes dis/ability as a social construction. When referring to the medical model, specifically, I eliminate the slash to underscore the normative nature of this model.

2. Believe deeply that rich mathematical learning is a right for every student and that diverse identities represent an asset in the classroom rather than a challenge to overcome.
3. Plan and execute lessons such that all students are engaged and have ownership over rich, accessible, and relevant learning experiences.

To illustrate the third tenet, I propose a self-reflective planning tool that might be used to support teachers and teacher educators in enacting such practices.

As I take up this work, advancing efforts to fully include those historically erased in mathematics learning environments, I am cognizant of my own positionality. A white, dominant-English-speaking, able-bodied woman, I do not share many sociocultural identities with those I write about and will never fully understand the experience of being multiply marginalized in dominant spaces. Yet, I come to this place with over a decade of experience working as a mathematics general educator and school leader in a special education-inclusive setting in service to largely low-income communities of color, experiences which have shaped my deep-seated conviction in the ability of *every* child to thrive in mathematics and the importance of dismantling systemic barriers to that reality. By centering such emancipatory ideas as culturally sustaining pedagogies (CSPs; Alim et al., 2020; Paris, 2012; Paris & Alim, 2014), Universal Design for Learning (UDL; CAST, 2024; Gordon, 2024), and dis/ability critical race theory (Dis/Crit; Annamma et al., 2013)—which form the foundation of InCrit—and integrating them into a subject that has historically resisted their inclusion (Ladson-Billings, 2021), I seek to grapple with historical oppressions present in mathematics and resist essentializing the communities I aim to serve.

This paper proceeds as follows: I first discuss the theories and frameworks from which this work draws. Then, I situate this call to action within previous cross-pollinations between mathematics and equity-centered frameworks, explain why a new iteration is necessary, and do so by expanding upon TRU (Schoenfeld & TRU Project, 2016) through an InCrit (Cruz et al., 2024) frame. Next, I illuminate what critically inclusive mathematics instruction might involve, via a series of questions a teacher might ask themselves at various points in the instructional process. Finally, I conclude with future directions for research and practical applications of this work.

Conceptual Framework

To define equity in mathematics, I bring together two definitions in the literature and describe equity as *fairness* in mathematical outcomes and *rightful presence* in the classroom space. Rochelle Gutiérrez (2002) writes about equity as fairness and describes it as the "erasure of the ability to predict students' mathematics achievement and participation based solely on characteristics" (p. 153). Importantly, achievement is defined broadly to include elements such as students developing strong mathematical identity, obtaining passing grades in mathematics classes, taking mathematics courses past minimum requirements, choosing and persisting in STEM majors in college, and achieving proficient assessment results, among others.

Calabrese Barton & Tan (2019), furthermore, conceptualize equity in STEM as creating a space of rightful presence in the classroom and define it as "legitimate membership in a classroom community because of who one is (not who one should be), in which the practices of that community work toward and support restructuring power dynamics toward more just ends" (p. 618). Rightful presence is achieved through practices that legitimize, or make present, student experiences. This may be through leveraging community expertise, giving legitimacy to issues of inequity faced by students, or purposefully disrupting the guest/host mentality that can exist in classrooms between those with and without power. While their work was conceptualized for science education, it applies equally to mathematics. Together, these definitions paint a picture of equity in mathematics that must be understood both at the level of classroom experience and of overall success in the subject.

Each definition was originally understood to be related to the need for racial and linguistic justice in mathematics. Yet, ableism is an equally pernicious structure in U.S. society (Hehir, 2002), and racism and ableism are inextricably linked as exclusionary practices (Annamma et al., 2013). Taking up calls for the integration of such practices in educational equity efforts (Cruz et al., 2024), I extend these definitions to encompass equity as fairness and rightful presence for students excluded due, but not limited, to racism, linguicism, ableism, and colonialism in mathematics. To more fully understand this intersection, I first frame the exclusionary culture that pervades education broadly and mathematics specifically, as mathematics is an especially urgent site for equity-based reform efforts.

Critical Inclusion

Critical theories in education illuminate the embedded exclusion that underlies our education system and advocate that efforts toward equity cannot be understood without such an acknowledgement and subsequent dismantling of systems of oppression (Annamma et al., 2018; Kolzeski, 2020; Ladson-Billings & Tate, 1995). Critical race theory in education, for example, contends that: (a) race is a significant factor in the United States, (b) U.S. society holds property rights as central, and (c) educational inequities might be better understood when considering race and property together (Ladson-Billings & Tate, 1995). The U.S. education system was constructed via a lens of whiteness, with white cultural norms forming the foundation of school-based practices. In this way, education serves to exclude students of color on the basis of race as property and via areas such as curriculum development, instructional pedagogy, assessment practices, funding inequities, and desegregation failures (Ladson-Billings, 1998). For example, official curriculum materials used by districts (e.g., nationally developed textbooks) and high stakes assessments administered at the state level are often written via a dominant (i.e., white, middle-class) perspective, leaving the incorporation of culturally responsive pedagogies and practices up to individual teacher dispositions and implemented aside from what students must demonstrate on the state test.

Dis/Crit (Annamma et al., 2013) extends this work into dis/ability studies and contends that conceptions of dis/ability cannot be understood in absence of race. Yet, the field of special education often fails to grapple with dis/ability studies' framing of dis/ability from a social perspective, preferring instead to adhere to a medical model of disability (Connor, 2019). In doing so, special education researchers often simultaneously operate from a race neutral place, failing to recognize the ways in which the social construction of dis/ability and race work in tandem to exclude students from rich, rigorous learning experiences. InCrit seeks to recognize the interlocking nature of racism, linguicism, and ableism and to interweave these exclusionary mechanisms together to create a holistic picture of what is required for all students to access high quality learning experiences.

Specifically, InCrit answers calls to cross-pollinate frameworks for racist and ableist emancipation (Waitoller & Thorius, 2016) and to use such work to form "strategic alliances against exclusion" (Alim et al., 2017, p. 7). Given their largely siloed nature to date (Cruz et al., 2024). InCrit does so by putting forth two components: (a) the prerequisite of viewing student variability (in terms of identity and ability) as an asset, and (b) the requirement to provide all students (especially those typically marginalized in education spaces) with "relevant, responsive, rigorous learning" (Cruz et al., 2024, p. 82). This requires "dismantling the myth of the typical child" (i.e., the concept that there exists a child who is average or normal in all ways; Baglieri et al., 2011, p. 2122) and thinking together, rather than separately, about how students have been excluded from meaningful learning based on their atypicality.

While InCrit provides a content-agnostic framework for creating meaningfully inclusive learning experiences for students, mathematics requires specific attention in this regard. As a subject especially plagued by intersecting forms of oppression, mathematics exists as a crucial site of exclusion from school (Jorgensen et al., 2014). Examples include students of color at diverse schools being labeled as underachievers and sorted into mathematics classes far below their capacity (Ispa-Landa, 2013), or students identified with disabilities being subjected to false inclusion experiences with placement in fixed-ability mathematics groups within the general education classroom (Lambert, 2015), therefore learning separately despite being in the same physical space as their white or able-bodied peers. Additionally, despite decades of reform efforts (Schoenfeld, 2004) and many educators who promote multiple ways of understanding, as we will see in a moment, a persisting culture of exclusion in mathematics serves to privilege only one right way of understanding the subject (Louie, 2017). Applied to the mathematics space, InCrit might offer a path forward toward dismantling the exclusionary culture and racist/ableist history that pervades mathematics. Let us now explore mathematics as a persistent site of educational exclusion.

Mathematics' Culture of Exclusion

Deficit views of marginalized students—those problematized in critical educational theories—are pervasive in mathematics and serve to uphold racist and ableist beliefs of students in the subject (Celedón-Pattichis et al., 2018; Lambert & Tan, 2017). In addition to societal mechanisms of oppression that critical theories seek to explain in education writ large, mathematics is further plagued by what Nicole Louie (2017) called a "culture of exclusion" (p. 489). That is, it exists as a particular site of gatekeeping against widespread academic success (Douglas &

Attewell, 2017). What makes mathematics so problematic in this way? Reasons span from ideological to pedagogical to structural.

Mathematics Exclusion as Ideological

One reason revolves around traditional ways we view the nature of mathematics and how we come to know it as *absolutist*: through this lens, mathematics is viewed as a fixed, isolated, and abstract body of knowledge (Ernest, 2009). In other words, mathematics is seen to exist as a discoverable truth that is unchanging and composed of a collection of rules, understandings, and procedures one must memorize. This onto-epistemology is contrary to the tenets of rightful presence; if mathematics is a fixed, unchanging body of knowledge, then students' ways of knowing have no place in the mathematics classroom. Furthermore, when understood this way, grasping mathematics becomes elusive for many; mathematics was historically understood as a subject only meant for mastery by an elite few (Schoenfeld, 2004).

This lens similarly gives rise to a fixed view of one's own ability in the subject (Anderson et al., 2018; Li & Schoenfeld, 2019). Beliefs about mathematics ability as fixed often result in the phrase, "not a math person." Rarely would it be accepted to hear someone say they just do not "do literacy." Yet, it regularly goes unquestioned when the conversation of mathematics skills arises, and people dismiss their ability in the subject by citing a lack of affinity for it. It also relates to the widespread prevalence of mathematics anxiety amongst people of all ages (see Luttenberger et al., 2018). Even new teachers entering education suffer from mathematics anxiety (Schwartz, 2023); this is not a problem relegated to past generations. Students historically marginalized in mathematics, such as girls, whose teachers are mathematically anxious, tend to perform worse in the subject (Schaeffer et al., 2021). Furthermore, teachers of students as early as first grade require deep mathematical content knowledge if students are to thrive academically (Copur-Gencturk & Tolar, 2022; Hill et al., 2005). Mathematics anxiety and the absolutist views of mathematics it often comes from represent a challenge plaguing all grades. In general, such fixed views of mathematics, and the fixed beliefs they engender, perpetuate a myth of a typical mathematics learner, rather than centering the variability of approaches students naturally take toward understanding mathematics.

Mathematics Exclusion as Pedagogical

Indeed, teachers who hold an absolutist view of mathematics tend to also hold a *transmission-oriented* view of teaching it (Depaepe et al., 2020), which is sometimes called a "sage-on-the-stage" approach. This kind of teaching involves teachers feeding information to students and expecting them to replicate the steps learned from the model or focusing solely on procedure-based learning. It is consistent with the belief that there exists only one right way to solve mathematics problems, further reinforcing the view that only some people—those who gravitate toward that one right way—are good at mathematics (Boaler & Greeno, 2000; Schoenfeld, 2022). To be sure, fluency and repeated practice hold an important place in student learning and are linked to positive student outcomes (Jordan et al., 2010; Karpicke & Roediger III, 2008). Yet procedural knowledge alone is not sufficient for deep student learning (Sawyer, 2006).

A *constructivist* approach to teaching, one which includes instructional elements such as placing cognitive demand on students, facilitating metacognitive moments, and supporting student agency and mathematics identity formation, is more supportive of depth of understanding (Schoenfeld, 2016). Instruction which provides students with opportunities to grapple with and make sense of complex problems in multiple ways has been linked to student learning outcomes such as completion of lesson goals (Lazonder & Harmsen, 2016) and assessment performance (Blazar, 2015; Lazonder & Harmsen, 2016; O'Dwyer et al., 2015). Furthermore, identity-forming instruction that develops students' beliefs in themselves as capable mathematicians acts as a protective factor in students' pursuit of academic goals and mathematics achievement (Houston II et al., 2020).

Yet, transmission-oriented-only approaches persist. Decades of reform efforts in this vein have been met with fierce resistance and backlash (Schoenfeld, 2004), as well as a fear that such reform might harm rather than support student learning (Becker & Jacob, 2000). As recently as 2024, about 50% of educators report their belief that students should learn mathematics with a largely procedure-based approach (Klein, 2024). While such a solely transmission-oriented approach can be found anywhere, students from backgrounds marginalized in mathematics are more likely to receive such instruction (Bush et al., 2020) and to be taught by teachers with less experience, competence, and resources to be able to teach in a more constructivist way (Depaepe et al., 2020; Schoenfeld, 2022). Furthermore, even for teachers who aspire to utilize such inquiry-based methods, absolutist and transmission-oriented approaches to mathematics still seep into teaching practices, for example when algorithms are privileged over other solution pathways (Louie, 2017). Thus, the nature of mathematics instruction represents another critical challenge.

Mathematics Exclusion as Structural

Mathematics' culture of exclusion extends further into the structural nature of course taking and the culture of tracking accepted as given in the subject. Performance in algebra predicts future outcomes in mathematics and is often a gatekeeper to graduation (Knuth et al., 2016). Thus, maintaining engagement in and mastery of mathematics is critical to future success. However, mathematics is often the place where students first disengage from their school experience (Boaler & Staples, 2008), complicating this imperative. Although efforts to de-track schools have yielded evidence of improved engagement and achievement (Boaler, 2011), tracking in mathematics still often starts at a very early age. Even when tracking takes a more flexible form, marginalized students can still end up sorted out of advanced mathematics classes based on teacher/counselor recommendations, self-perception of ability, or previously assigned (or not) gifted status (Tyson, 2011). Returning to an earlier discussion, when students with disabilities are placed into fixed-ability groupings (Lambert, 2015), or students of color take classes below their capacity from an early age (Ispa-Landa, 2013), later sorting, however flexible in name, out of advanced mathematics classes seems a foregone conclusion.

InCrit in Mathematics as Antidote

In sum, exclusion in mathematics stems from broader beliefs about the nature of mathematics, not simply a lack of teacher effort. Given this specific context, critically inclusive mathematics efforts must interrogate its history and teaching practices alongside more content-agnostic efforts toward transformation. To take an InCrit stance to mathematics instruction, I integrate three existing frameworks organized around social-justice pursuits and aimed at dismantling exclusionary practices. CSP (Alim et al., 2020; Paris, 2012; Paris & Alim, 2014) and UDL (CAST, 2024; Gordon, 2024)—frameworks upon which InCrit draws—seek to dismantle educational inequities from the lenses of racism, linguicism, colonialism (CSP), and ableism (UDL). TRU (Schoenfeld & TRU Project, 2016), on the other hand, articulates a vision for rich mathematical instruction aimed at overcoming mathematics' particular exclusionary culture. I argue that integrating these three frameworks might create a space for critically inclusive mathematics: mathematics classrooms that support student success and exist as a site of rightful presence for students who have historically been excluded from the subject. Let us turn now to a brief description of each.

Culturally Sustaining Pedagogy

CSP (Alim et al., 2020; Paris, 2012; Paris & Alim, 2014) is a theory situated in the asset-based pedagogy tradition: a collection of theories seeking to eliminate deficit-based perceptions of students of color and shift to teaching approaches that recognize their strengths in the classroom (Celedón-Pattichis et al., 2018). Such approaches have been found to support student outcomes such as increased motivation, interest, perception, confidence, and ability to engage in rich discourse (for a review, see Aronson & Laugher, 2016). CSP iterates on previous conceptions of culturally relevant pedagogies and practices (e.g. Gay, 2018; Hammond, 2014; Ladson-Billings, 1995) and seeks to create a cultural pluralism in education where students' cultural and linguistic practices are centered. It articulates three points of departure from prior iterations of asset-based pedagogies (Paris & Alim, 2014). CSP seeks to (a) iterate on prior ways that asset pedagogies have been understood, (b) recognize the ways in which culture is ever-changing, and (c) develop critical consciousness both externally and internally.

Regarding the first point of departure, Paris and Alim argue that previous iterations of asset-based pedagogies have too often prioritized the goal of supporting marginalized students to adhere to white middle-class norms. Specifically, the authors argue that enactment of culturally responsive practices in schools has thus far not sufficiently centered student ways of being. Instead, CSP seeks to "explore, honor, [and] extend…heritage and community practice" (2014, p. 86). It aims not to adopt an asset lens to shape students of color into their white peers, but rather to sustain their communities' ways of being as a pluralistic goal in and of itself.

The second point of departure calls for practices that recognize how culture evolves, rather than solely seeking to understand traditional cultural expressions. The danger in the latter is that connections drawn between culture, language, and race become essentialized, rather than allowing space for change. Instead, CSP asks educators to embrace the dynamic nature of communities. Finally, Paris and Alim (2014) call for a critical reflexivity not only outward, but also inward, arguing that problematic elements of youth culture must be contended with in the same way that white supremacist culture is undone in the first two points. Together, these three points of departure work in concert to imagine a path toward dismantling racial and linguistic hegemonic structures as they currently exist in schools. Considering equity as rightful presence, creating a learning space steeped in CSP serves to legitimize student membership, restructure the power dynamics, and shift whose knowledge and participation are valued in that space. It serves to share power amongst the learning community, and to allow students to bring their full selves to the learning environment. In mathematics, this requires undoing the link between whiteness and smartness (Ladson-Billings & Tate, 1995) by centering the multiple ways that mathematics can be reasoned about and understood.

Universal Design for Learning

Where CSP seeks to dismantle educational racism and linguicism, UDL (CAST, 2024; Gordon, 2024) theorizes how to achieve such ends for neurodiverse learners and seeks to dismantle ableism in education. It articulates three avenues by which learning might become more accessible to all students by design: via designing for multiple means of engagement, multiple means of representation, and multiple means of action and expression. Engagement relates to learning affect and addresses the question, “Why should I care about this?” Representation relates to recognition in learning and provides learners varied opportunities to understand what is being taught. Finally, action and expression connect to the varied ways learners might accomplish a task.

UDL has been operationalized more frequently in special education training programs and largely inadequately in general education venues (Vitelli, 2015); therefore, a misconception about UDL is that it is synonymous with the special education concept of *differentiation*, which is the idea that instruction should be tailored to individual student need (Tomlinson, 2000). Certainly, the ability to differentiate instruction to meet students where they are is an important teaching tool. However, UDL shifts the focus from differentiating a set curriculum to re-imagining the curriculum altogether, conceptualizing learner variability as expected and seeking to plan for such variability on the front end, rather than the back end, of instruction. Rose and Meyer (2002) write that “barriers to learning are not … inherent in the capacities of learners, but instead arise in learners’ interactions with inflexible educational materials and methods” (p. vi). UDL challenges the understanding of dis/ability as a fixed construct (Artiles et al., 2016) by instead viewing curriculum as disabling. In other words, false conceptions about who can or cannot access curriculum might be unraveled with a radical re-examining of how learning is approached through the lens of expecting and planning for learner variability. In mathematics, this requires challenging the notion that mathematics ability is fixed and that there is only one right way to solve problems. It further requires abandoning the idea that mathematics is meant for mastery by only a few.

Teaching for Robust Understanding

The TRU framework is founded on decades of research in *powerful* and *ambitious* mathematics instruction: instruction that supports students to become expert problem solvers and mathematicians (Schoenfeld, 2022). It illuminates five elements that matter most for rich mathematical learning to occur: (a) the math, (b) cognitive demand, (c) equitable access to content, (d) agency, ownership, and identity, and (e) formative assessment (Schoenfeld & TRU Project, 2016).

The first element relates to the rigor and depth of the mathematics students are learning. If the actual content does not support students to become knowledgeable about mathematics and develop the habits of expert mathematicians, it is not worthy of student time. Cognitive demand, which is related to the concept of productive struggle in mathematics, refers to whether and to what degree students are expected to use mathematics to understand situations and develop solution pathways (Hiebert et al., 1996). In other words, if the mathematics is rigorous but students are spoon-fed all the steps, the lesson does not support rich learning. Equitable access to content deals specifically with equity pursuits in mathematics. It calls for classrooms where all students are able to be actively engaged in the content, which is an important element for student learning (Fung et al., 2018). If only some students (especially students who are traditionally viewed as good at mathematics) are expected to be meaningfully involved, the depth of the mathematics and the amount of cognitive demand placed on students falls short. The fourth element (agency, ownership, and identity) recognizes the importance of students believing in themselves as mathematicians and having agency over their learning (Gutiérrez, 2012). Such a belief is related to future success in mathematics-related fields (Stinson, 2008). Finally, the formative assessment element recognizes the importance of responding to student thinking during instruction and adjusting instruction based on where students are. To do so, educators must have skill in attending to and making sense of student reasoning (i.e., *teacher noticing*; see van Es & Sherin, 2024).

Taken together, the elements in the TRU framework synthesize multiple important literatures related to what makes for powerful mathematics learning, and they provide a blueprint for the kinds of learning experiences that will support students to thrive in mathematics. Yet, as written, the framework is situated within the dominant educational paradigm. To achieve a critically inclusive vision of mathematics, the system itself must also be transformed (Paris, 2021). Doing so might be achieved with a cross-pollination between mathematics-specific equity pursuits and ones that seek to overcome the hegemonic structures currently in place in our education system.

Toward a Critically Inclusive Mathematics Practice

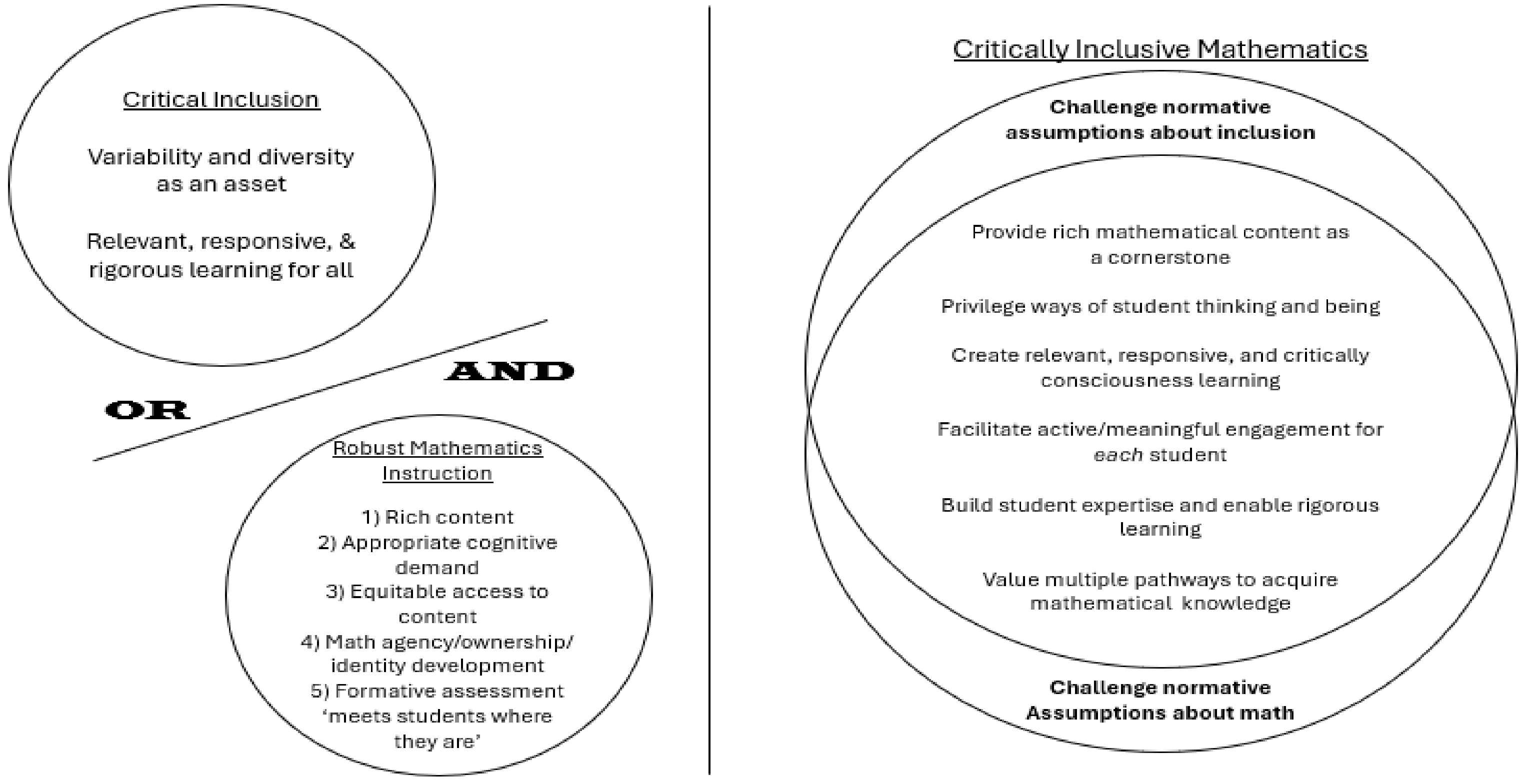
Certainly, I am not the first to call for an integration of equity-based frameworks with mathematics teaching ones. Culturally responsive mathematics teaching (CRMT; Aguirre & del Rosario Zavala, 2013) and culturally sustaining mathematics teaching (CSMT; Civil et al., 2019) and are two such examples. CRMT rests on the intersection between knowledge of constructivist mathematics, asset-based knowledge of students and communities, and development of a critical consciousness about mathematics and society (Aguirre, 2009). CSMT, similarly, directly applies CSP to mathematics and calls for: (a) developing student identities as capable mathematicians—while simultaneously maintaining their individual identities—and (b) fostering a critical consciousness within and amongst a group of mathematics learners (Civil et al., 2019). CSMT has remained largely theoretical, and there exists a paucity of research setting CSP specifically within a mathematics teaching and learning setting (Civil et al., 2019). On the other hand, Aguirre and del Rosario Zavala (2013) made important contributions to the field by developing a practical lesson analysis tool for the implementation of CRMT in the classroom. The tool, which comprises eight dimensions, supports integration of equity and mathematics frameworks into a cohesive whole.

Taking these pursuits as a starting place, further work can be done to meaningfully incorporate anti-ableist efforts with the work done thus far to bring anti-racist and anti-linguist movements into the mathematics space. Until now, studies have lacked a meaningful integration between race and dis/ability (Tan et al., 2022; Waitoller & Thorius, 2016). InCrit takes up this mantle and provides a lens by which such an integration might occur between CSP and UDL. By applying an InCrit lens, prior work might be extended to understand ableism as an equally important mechanism of oppression to overcome. Importantly, however, adopting a critically inclusive stance may occur in absence of, in addition to, or integrated with, efforts to dismantle the culture of exclusion specific to mathematics. In other words, a teacher might (a) either aim for critically inclusive teaching or rich mathematics instruction (but not truly both), (b) see these efforts as additive and therefore potentially overwhelming, or (c) view such efforts as integrated and mutually reinforcing of each other (see Figure 1 for an illustration).

Adopting an InCrit stance absent a rich mathematical frame, for example, might result in a teacher who is steeped in equitable practices but does not deeply understand how the mathematics content builds and connects, or who approaches equitable mathematics teaching without problematizing the primacy of certain solution pathways. On the other hand, a teacher deeply committed to robust mathematics instruction might attempt to meet all students where they are without dismantling the typical learner paradigm and communicating that where they are holds inherent expertise. They might see student variability as a necessary element of teaching to overcome, rather than an asset to the classroom. A teacher who understands InCrit and TRU as additive may steep themselves in both frameworks, but view each as a separate element to attend to in their teaching. In a climate where teachers regularly report feelings of overwhelm and burnout (Marken & Agrawal, 2022; Pressley, 2021) and where mathematics positions suffer from some of the highest shortage rates nationwide (Sutcher et al., 2019), continuing to add "just one more thing" is untenable. Instead, by integrating InCrit with TRU, I aim to extend past frameworks to illuminate the ways in which both efforts are equally integral and inextricably linked aspects of emancipatory efforts in mathematics.

Figure 1

Integrating InCrit and Rich Mathematical Learning



Note. Critical Inclusion from Cruz et al. (2024). Robust Mathematics Instruction from Schoenfeld and the TRU Project (2016).

Conceptualizing Critically Inclusive Mathematics

Critically inclusive mathematics seeks to integrate InCrit and TRU in order to develop educators who: (a) understand the ways in which intersecting identities have served to historically exclude students from rich mathematics learning spaces, (b) believe deeply that rich mathematical learning is a right for every student and that diverse identities represent an asset in the classroom rather than a challenge to overcome, and (c) plan and execute lessons such that all students are engaged and have ownership over rich, accessible, and relevant learning experiences.

Equity-centered pedagogy is a way of being and a continual process of becoming, not simply a set of practices one can follow (Ladson-Billings, 1995). As such, the first two tenets I outline here are less about a specific process and more about the development of a liberatory praxis (Freire, 1970/1993). To teach in such a way that critically includes students in mathematics learning, one must first understand the ways that "interlocking mechanisms of exclusion function as gatekeepers" in mathematics (Cruz et al., 2024, p. 69). This requires teachers to build a critical consciousness about, for example, the interconnectedness between race and special education identification (Cruz et al., 2021) alongside an understanding of differential mathematics instructional strategies and placements (Tan & Thorius, 2018), as well as differential mathematics outcomes (Judge & Watson, 2011) between students with dis/abilities and their non-dis/abled peers, in order to problematize calls for more special education identification as the solution to student challenges. Without such an understanding, any action toward dismantling such exclusion exists by chance alone. One must also hold a personal set of beliefs in the potential for all students to succeed. Teacher expectations are not only predictive of student learning (de Boer et al., 2018), but they also act as a protective factor in student mathematics persistence (Houston et al., 2020). Without a personally held conviction in the rightful presence of all students in the mathematics classroom and the potential for fairness in mathematical attainment, any set of teaching practices—no matter how aligned to equity they may be—will fall short of emancipatory change.

We arrive, then, at the third tenet. Following in Aguirre and del Rosario Zavala's (2013) footsteps, I offer a reflection tool teachers might utilize in their planning when considering such interlocking mechanisms of exclusion as a cohesive whole. In their work cross-pollinating CSP and UDL, Waitoller and Thorius (2016) illustrate the intersection of these two frameworks by considering a unit from four lenses: goals, materials, methods, and assessment. Using those lenses, the authors consider how CSP and UDL might shape the entire instructional process. I take up these four dimensions to integrate an InCrit lens with the tenets of rich mathematics learning. Figure 2 displays this reflective tool.

Figure 2

Critically Inclusive Mathematics Lesson Reflection Tool

	Goals	Materials	Methods	Assessment
Questions for Self-Reflection	Do my lesson/unit goals… ● center learning on rich mathematical content? ● contextualize mathematical learning to *all* my students and their identities? ● support students to use mathematics to develop a critical consciousness about our world? ● create opportunities for *each* student to find entry points into the lesson goal? ● support *each* student to deepen their understanding to become knowledgeable and flexible mathematical thinkers? ● allow *each* student to access a variety of mathematical resources and make strategic decisions about which ones will support their learning that day?	Do my materials… ● center learning on rich mathematical content? ● center *all* my students' identities and ways of being? ● engage *each* student in thinking critically about issues they care about using mathematical reasoning? ● present *each* student with opportunities to engage in "productive struggle" to make sense of important and rigorous mathematical ideas? ● challenge *all* learners to make connections across mathematical ideas? ● allow *each* of my students to employ varied and flexible strategies to support their learning?	In my lessons, do I… ● build upon student strengths and knowledge to promote rich mathematical understanding for *each* student? ● privilege my students' ways of knowing? ● help my students connect to the discipline of mathematics? ● reject the notion of prior skill or proper behavior as a cost to access rigorous mathematical learning and instead create opportunities for *all* students to contribute meaningfully to the lesson? ● position *all* students as sources of expertise about the mathematical content they are learning? ● make a variety of supports readily accessible, position *all* students as capable of determining the tools they need to succeed with challenging mathematical concepts, **and** value multiple solution pathways to answer mathematical problems?	Do I use my assessments to… ● deepen *all* students' understanding of mathematics? ● privilege my students' ways of knowing? ● help students think through real-world mathematical problems that matter to them? ● allow me to understand student thinking and uncover where students have mathematical misconceptions? ● provide feedback that builds *each* student's capacity to be metacognitive about their strengths and areas for growth? ● allow for multiple means of demonstrating mathematical knowledge?

Related to the first lens, teachers might consider whether lesson or unit goals are contextualized to their students and allow all students to find both entry points and additional depth in rich mathematical learning experiences. Engaging in such reflections might result, for example, in teachers choosing to launch their units by speaking to issues affecting their students as a way to build critical consciousness, contextualize learning, and invest students in rich mathematical content. In the Baltimore context, for instance, beginning a unit on trigonometric functions by discussing the 2024 Frances Scott Key bridge collapse (Hughes, 2024) and its impact on the Baltimore community might support student investment in understanding the unit circle (which is key to understanding bridge engineering) and factors related to the bridge collapse response and subsequent rebuilding plans, thereby connecting mathematics to issues affecting our world. Simultaneously, teachers might reflect on their teaching of the unit circle and approach it through pattern recognition rather than memorization. Doing so might tap into students' natural ability to understand patterns in mathematics, thereby supporting each student to find an entry point to this complex mathematical concept and become a knowledgeable and flexible mathematical thinker.

Similarly, materials and methods (lenses two and three) might be examined from the perspective of their relevance and responsivity to all students, whether they take a constructivist stance to learning mathematics, whether materials provide varied access points such that each student can engage productively, and the extent to which teaching methods position each student as having expertise to contribute. This might, for example, involve teachers choosing one relevant task or question from their district-selected curriculum to launch their lesson (instead of many warm-up questions potentially included), providing opportunities for students to grapple with the concept of the day through that task, and launching it as an exploration and discussion first before providing any modeling or direct instruction. Genuinely privileging multiple solution pathways would communicate that the ways students naturally think about mathematics have merit, thereby building upon strengths rather than deficits.

Furthermore, when teachers employ methods such as complex instruction during instructional tasks (Boaler, 2006; Cohen & Lotan, 2014), where students are positioned with equal status in the classroom despite differences in prior knowledge, it rejects the notion of prerequisites as a cost for entry into the content and centers learning on deep mathematical ideas and the connections between them. For example, instead of requiring students to be able to solve equations expertly before even reasoning about the meaning of the solution to a system of equations (thereby relegating some students to remedial groups to repeatedly practice the solving steps), introducing systems conceptually and embedded in a context that matters to students, and creating materials that allow students to engage with recognizing patterns between representations of systems solutions gives all students an entry point. From an assessment standpoint (lens four), teachers might interrogate whether their assessments center students' ways of knowing, allow for multiple ways of demonstrating mastery, work to build student capacity and expertise over time, and provide the teacher important information about developing student understanding of the mathematics concepts.

Importantly, the tool is meant to be used as a cohesive whole. Reflecting on the extent to which materials offer a constructivist approach to learning, for example, only becomes emancipatory if those same materials are connected to student identities and allow all students to find points of entry into them. The point is not to see each question as additive, but rather to examine practice from a holistic lens, whereby the total learning experience supports each student to thrive mathematically. While a teacher might be more adept at one aspect of this than others, critically inclusive mathematics requires that teachers plan, execute, and assess lessons in a way that integrates these elements together. It would not be sufficient for lesson execution to address participation patterns without also addressing the notion that all students should be supported to participate in equally rigorous ways. It would not be sufficient to provide multiple avenues to demonstrate knowledge unless the knowledge students are demonstrating is steeped in important mathematical ideas and habits. It would not be sufficient to engage all students in productive struggle if the task does not center students' ways of understanding. None of it would be sufficient without a deep-seated belief in the capacity of all students to engage in rich mathematical learning. To be sure, this is no modest request. Even for teachers who are ready to enact such practices, structural barriers such as limited planning time (Organisation for Economic Co-operation and Development [OECD], 2022), inflexible curriculum (Valli & Buese, 2007), and inadequate resources (Condron & Roscigno, 2003) often add layers of challenge. Yet, it is no less than what students deserve, so organizations looking to take it up must contend with these barriers alongside classroom-focused efforts at reform. Critically inclusive mathematics asks us to imagine a vision of mathematics instruction not yet achieved, but no less necessary.

Future Directions

If we accept the premise that critically inclusive mathematics might envision a future of mathematics that unravels the myriad forms of exclusion within the subject today, where might we go from here? As does much of the work applying CSP to mathematics (Civil et al., 2019) and cross-pollinating anti-racist and anti-ableist frameworks (Alim et al., 2017), this framework is meant to offer practical application but currently lives in a theoretical space. Future work should test and refine it in practice. Much as Ladson-Billings (1995) did when theorizing culturally relevant pedagogy, researchers might take an asset-based approach to teaching by seeking out educators who are integrating anti-racist and anti-ableist teaching well and endeavoring to understand what else those teachers are asking themselves as they work to create critically inclusive spaces of mathematical learning. Doing so would reveal elements currently missing from the critically inclusive mathematics framework or reflection tool that should be added.

This framework might also be utilized in teacher development—both for in-service and pre-service teachers—to help them develop this complex skill set and understand changes to student learning outcomes. Applications to pre-service teachers via teacher training programs are particularly salient, as the first two tenets of critically inclusive mathematics call for a foundational set of knowledge and mindsets. If teachers can build this foundation even before entering the classroom, they might be better equipped to enact practices aligned with the third tenet. The critically inclusive mathematics framework might be introduced at the start of a mathematics methods course, for example, as a set of guiding assumptions. Subsequent readings throughout the course could then build student understanding of the tenets embedded in critically inclusive mathematics. The lesson reflection tool, as well, might be introduced when pre-service teachers are practicing with lesson planning to provide them a set of guiding questions to follow as they generate some of their first instructional plans. Feedback from instructors could also pose questions for teacher candidates to consider using the tool.

From an outcomes lens, measuring student outcomes has often historically been confined to standardized test scores. Equitable outcomes require a more complex understanding of achievement and demand that we additionally define success in terms of student engagement; attendance in mathematics class; mathematics identity development, grades, and advanced course taking; among others (Aronson & Laughter, 2016). Performance on standardized tests must not be discounted given their prominent role in determining student futures in mathematics, yet they offer only a partial representation of student mathematical thriving (Gutiérrez, 2012).

Finally, future work might seek to hear from students to understand how they define critically inclusive mathematics and how they experience classrooms that attain such a vision. Education research and reform efforts too seldom hear from students (Nobody Asked Me Campaign, 2022). Yet, if we endeavor to create spaces where students feel rightfully present and where fairness in mathematics is achieved, we must understand their experience in such a pursuit.

Conclusion

In his book *Educating for Insurgency*, Jay Gillen (2014) challenges educators to begin from the assumption that students come to school with all the tools they need to succeed. He writes, “to see the students as anything other than desperately in love and desperate to learn is the schools’ worst error. Birds fly; fish swim; people learn. Learning is how we survive and thrive, and is never avoided” (pp. 164–165). In this paper, I sought to provide a frame whereby educators might do just that: position students as experts in their own mathematics learning by drawing on understandings of the intersectional nature of oppression to work with, not for, students to create a space of mutual thriving. The set of questions presented here might support teachers in developing this complex and multi-faceted skill set. Inclusion into the current system cannot be the goal because the current system rests on interlocking forms of oppression (Alim et al., 2017). Critically inclusive mathematics instead offers a path forward toward reimagining what an inclusive mathematics space, a space of rightful presence (Calabrese-Barton & Tan, 2020) and fairness (Gutiérrez, 2002), might be.

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