

Mathematicians' Characterizations of Equitable and Inclusive Teaching

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With an increased call to attend to diversity, more postsecondary mathematics instructors are interested in using equitable and inclusive teaching (EIT) practices. Yet, ambiguity persists on what EIT practices look like in mathematics classrooms. Our study investigates the characterizations of EIT from 13 participants, each involved in a year-long equity focused workshop, with the purpose of describing what topics arose in their characterizations. Our analysis shows characterizations of EIT included both the student and teacher role in EIT, and focused heavily on awareness of students' experiences and backgrounds, student engagement, and teacher self-reflection. We provide specific details from participants' characterizations for each category and connect them to established EIT literature. These findings can help researchers and department leaders engaged in change for EIT see what topics in EIT are being consumed and what topics might need emphasis or introduction.

Keywords: Equitable and inclusive teaching, instructor beliefs, postsecondary mathematics

The past two decades have seen enhanced calls to promote diversity, equity, and inclusion (DEI) in postsecondary education broadly and mathematics specifically (e.g., Inniss et al., 2021.; MAA, n.d.; U.S. Department of Education, 2016). Such efforts are often tied to the increasing gaps in Bachelor's degree attainment between white students and members of some racial minorities (National Academy of Science, 2010; Riegle-Crumb, 2019; U.S. Department of Education, 2016). In particular, Black and Latina/o students who enter college as a STEM major are more likely than white students to switch to a non-STEM major or leave college altogether (Riegle-Crumb, 2019). Participation in the "mathematics pipeline" plays a particularly significant role in shaping the opportunities for economic and social advancement afforded to students (Gutiérrez, 2012a, p.19), yet school mathematics traditionally excludes people of color, women, and individuals who have disabilities. Many educators agree students need opportunities to engage in mathematics that valorizes their own cultural experiences, and gives them a tool for challenging the status quo in mathematics and Western society broadly (Gutiérrez, 2012a). However, research has shown instructors may struggle to provide such opportunities for their students (Rubel, 2017), and more work is needed to better understand how instructors conceptualize equitable and inclusive practices.

Postsecondary mathematics instructors play a key role in both determining the mathematics students are exposed to, as well as in shaping cultural norms around teaching within mathematics departments (Reinholz & Apkarian, 2018; Smith et al., 2021). Their beliefs and attitudes toward equitable and inclusive teaching (EIT) determine their decisions in the classroom, and further their ability to advance change in their departments (Johnson et al., 2022). There has been a shift in the field toward the use of active learning teaching methods as a way to address inequities in mathematics participation, but these methods do not automatically create an equitable classroom

(Brown, 2018; Johnson et al., 2020, Reinholz et al., 2022). Williams et. al (2022) analyzed participants' conceptualizations of active learning and found that equity was rarely connected. Given the close tie between beliefs and practices (e.g., Speer, 2008), it is important to understand how mathematics instructors conceptualize equity. An analysis of how “inclusion” has been used in research articles from 2010 to 2016 shows this term is used as a single ideology and as a way of teaching (Roos, 2018). Thus, the phrase “equitable teaching and inclusion” has the potential to be used and understood in many different ways, possibly diluting its intention and power. Therefore, it is necessary to monitor how postsecondary instructors are interpreting and influenced by these concepts. To this end, we studied how postsecondary mathematics instructors committed to active learning and teaching more equitably conceptualize EIT. Our overarching research question is: *What characteristics arise when mathematics instructors are asked to define EIT?* We intentionally left our research question broad to capture the varied and rich responses shared by our participants; in our discussion we draw connections between our findings and the research literature.

Theoretical Background

Learning is a sociocultural experience involving a complex interaction among instructor, students, content, and the underlying social and cultural systems in which these components operate (Hawkins, 1974; Lampert, 2001). Mathematical knowledge is co-constructed in the classroom with students through a focus on establishing sociomathematical norms and the development of a mathematical identity (Brown, Collins, & Duguid, 1989; Cobb & Bowers, 1999; Cobb, Yackel, & Wood, 1992; Lave & Wenger, 1991). Yet, Gutiérrez (2012b) argues even those who acknowledge a sociocultural perspective on learning and see knowledge as constructed in negotiation with others in a community of practice (Wenger, 1998; Cobb & Yackel, 1998) often fail to take into consideration students' identities or issues of power in a class community's construction of mathematical knowledge (Gutiérrez, 2010).

Gutiérrez (2002) defines equity as “the inability to predict mathematics achievement and participation based solely on student characteristics such as race, class, ethnicity, sex, beliefs, and proficiency in the dominant language” (p. 153). In later work, she expands this definition to include four dimensions: access, achievement, identity, and power (Gutiérrez, 2012a). Briefly, access refers to the resources students have access to for learning, and achievement references educational student outcomes. Both dimensions make up the dominant axis of equity, as they focus on helping students succeed according to the dominant culture's values. Identity and power make up the critical axis. Gutiérrez uses a mirrors and windows metaphor to describe identity, which focuses on opportunities for students to see mathematics as meaningful in their everyday lives: there should be places in the mathematics curriculum both for students to see their identity reflected back at them (mirrors) as well as be given access to the broader world of mathematics (windows). Power refers to issues of social transformation, including which voices are highlighted in education, using mathematics for social justice, etc.

There are several pedagogical traditions which prioritize inclusivity (e.g., culturally relevant pedagogy, critical pedagogy, humanizing pedagogy, reality pedagogy). While each tradition has different foci, collectively, inclusive pedagogies highlight the importance of empowering students by using students' rich cultural backgrounds and identities to design curriculum, providing students the tools to enact social and political change, positioning students as experts in the learning process, fostering caring and trusting relationships between instructors and students, and embracing students' voice and lived experiences (including their social, political,

psychological, and emotional selves) in the classroom (Carter, Andrews, & Castillo, 2016; Emdin, 2016; Howard, 2003; Macrine, 2009; Tuitt, Haines, & Stewart, 2018).

Methods and Participants

This qualitative study investigates how 13 undergraduate mathematics educators from eight institutions involved in SEMINAL's (see Smith et al., 2021 for more information) equity-focused professional learning community (PLC) conceptualize EIT. Each participant was paid a \$1,000 stipend to participate, which met every two weeks from September 2020 to May 2021. Participants were interviewed for approximately 60 minutes at the beginning, middle, and end of this timespan. They shared their racial and gender identities in the interview and names were pseudonymized to support participants' confidentiality. Participants include three women of color (Aadaya, Camila, and Cassandra), one man of color (Robert), five white women (Crystal, Emma, Kathleen, Lacy, and Shea), and four white men (Bill, Collin, Mark, and Thomas).

For this study we focused on responses to the question "How would you define or characterize equitable and inclusive teaching (EIT)?" from their first and last interviews. We analyzed responses using rounds of first and second cycle coding (Miles et al., 2014). For the first cycle of analysis, we developed 13 participant summaries to identify key ideas within the participants' responses. These key ideas were highlighted within the transcript, summarized below, then agreed upon by at least three of us. In pairs we then engaged in a second cycle of coding to sort the summarized key ideas for one-third of the 13 participants into different categories. Each pair looked at a different third of the participants. We then met to compare categories. The commonalities across groups led to a condensed structure that focused on awareness of students, student engagement, teacher reflection, and specific actions for EIT. The first three authors drafted a codebook (see Table 1) of these overall categories with defined subcategories, independently coded three participant responses (by coding each of the highlighted key ideas within the response) and met to reconcile and subsequently refined the codebook. Afterwards, they independently coded and reconciled the remaining 10 participants.

Findings

We generated three major codes of how participants characterize EIT: *Awareness and Consideration of Students*, *Student Engagement*, and *Reflective Practice* with relevant subcodes (see Table 1). All participant's conceptualizations of EIT included each of these three codes. Table 1 includes counts for each subcode. Below we describe each of these codes in detail using examples from participants' responses.

Table 1. Characterization of EIT and Number of Responses

Code	Description	# of responses (n=13)
<u>Awareness and Consideration of Students</u> : Awareness and consideration of how students' environments and lived experiences impacts their identity and capacity; this one is about the more general classroom environment		

Background and Learning Experiences	Mention of the student's broader background or environment: prior academic/learning experiences, "meeting them where they are," etc. E.g., "They bring different experiences to the classroom"	11
Access to Material Resources	Mention of student access to materials, finances, resources E.g., "Some students can't attend office hours"	6
Emotions	Mention of students' feelings, emotional health, "social belonging" (which includes a nod to gender, identity, disabilities, bringing whole self to the classroom) E.g., "Students should feel safe"	11
<u>Student Engagement:</u> Emphasizes the student experiences and academic culture of the classroom; ensuring each student possesses a sense of academic belonging		
Participation	Focus on student participation in the classroom E.g., "Students should engage with peers and content"	13
Ownership/Investment	Focus on student investment and ownership of participation (ownership of their learning), usually more specific than general participation E.g., "Students should feel like the material is for them"	3
<u>Reflective Practice:</u> Acknowledges influence of pedagogical or personal views on the classroom environment as well as specific actions for EIT		
Self-reflection	Acknowledging and/or reflecting on personal biases and teaching practices; may include broad statements of what an instructor should believe or do E.g., "I had all these preconceived notions"	12
Actions	Specific actions or teaching practices teachers ascribe to themselves as beneficial for the individual student experience as well as the classroom as a whole E.g., "Bring in examples that bring up topics of racism"	9

Awareness and Consideration of Students

All thirteen participants discussed being aware of students' experiences and considering how these experiences connect with issues of equity and inclusivity in the classroom. Three subcodes emerged: Background and Learning Experiences, Access to Material Resources, and Emotions.

The Background and Learning Experiences subcode refers to a broad consideration of students' individual backgrounds and characteristics (e.g., race, culture, socioeconomic status, first generation status, marginalization, prior academic experiences, etc.). For example, Cassandra asserted no one should have an "advantage or disadvantage based on something they have no control over" referring to students' background. Emma also discussed this idea, saying

part of EIT is “accepting that your students are coming into class with different lived experiences and that affects how they interact in the classroom.” Mark’s definition of equity in the classroom included his recognition of “different levels of preparation, [...] comfort, or different prior experiences.” Some participants went further, suggesting consideration of students’ backgrounds is necessary but not sufficient for EIT. Crystal explicitly noted it is not enough to “recognize” students – EIT involves being “proactive” although she did not elaborate on what this means.

Access to Material Resources captured explicit references to financial restraints or situations possibly impacting student access to the resources necessary to succeed in class. Responses ranged from minimizing financial strain on students (Thomas) to acknowledging the impact priorities outside the classroom (e.g., having to take care of siblings) have on student capacity to learn in and outside the classroom (Cassandra and Shea). There was significant overlap between the Access to Material Resources subcode and other subcodes under Awareness and Consideration of Students; five of the six participants whose excerpts were coded the former were double-coded with another subcode in this code. For example, Cassandra described how “you shouldn’t be made to feel that your questions or answers or situation is somehow your fault or an indicator that you do not belong because of your financial background, because of what you look like, because of any physical or emotional issues that you may be dealing with,” which involves both students’ backgrounds and their access to material resources. Participants in this category are making connections between a student’s background experiences and how they affect student access to materials.

Eleven out of 13 participants considered students’ emotional health and comfort level in class. The following excerpts describe the major ideas of this subcode: that students “shouldn’t be made to feel like [their] questions or answers or situation is somehow [their] fault or an indicator that [they] do not belong because ... of any physical or emotional issues” (Cassandra) and that when in the classroom, students “feel like they can be their whole selves” (Shea). Seven participants explicitly used the keywords “safe”, “welcoming”, and “belonging” when describing their ideal classroom environment. In addition, several participants also made the distinction between “for all” and “for each” instruction, implicitly linking their responses to equity. Thomas observed that students with certain characteristics connect with teachers and peers “if they’re lucky”, while Crystal wanted “everyone in [her] classroom to feel valued and feel heard.”

Student Engagement

All participants mentioned providing student opportunities to engage and participate in the classroom as part of EIT, with a common theme of making sure certain groups of students were not “overlooked” in the classroom. The Participation subcode focuses on response excerpts focused on student participation and additions to the classroom; as Aadaya stated, “equitable and inclusive means that I’m not, you know, overlooking some students or kind of leaving them out of a discussion. So this is the participation aspect.” Thomas related student participation to his own experiences: “So I would want to involve students like me who, you know, who don’t mind working on their own. I want to make sure that the quiet ones, which is, I guess, how I characterize myself, are not overlooked.” In addition, Camila described inclusive teaching as “reaching out to the students in class, making sure that they participate in the class and again that it’s not dominated by one group versus another.” Crystal also discussed giving students who are “marginalized” opportunities to participate:

One aspect is like recognizing everybody that’s in the room, like the people who are marginalized. I want to be able to recognize and give them a chance to participate and have

them feel valued and seen as well as the more confident students who sit in the front of the room and participate all the time.

Some participants addressed wanting students to feel safe in the classroom, but Crystal's excerpt goes beyond this, illustrating she also wanted students to feel safe to "participate all the time".

The Engagement subcode shifts perspective to excerpts where participants described wanting to ensure student access to the mathematical content and students' sense of ownership in the classroom. Robert discussed creating a classroom where "each student has not only access to whatever we're talking about through whichever entry point, but then also them feeling empowered and safe to speak up in class." Similarly, Mark described wanting students to "feel like the mathematics is there meeting some need or meeting some interest, or like it's something that is presented for them ... that they have some sense of ownership." Mark then elaborated: "I would say that they're not kind of feeling alienated from [the mathematical content], or that they're like trespassing somehow on a domain that the property belongs to someone else. That [the material], it's for them."

Reflective Practice

All 13 participants mentioned something about the role of the teacher, specifically a self-reflection and/or a specific teacher action for EIT. We use this section to discuss categories.

Twelve out of 13 of participants' responses were coded with Self-reflection. This subcode captured responses that indicated the importance of self-reflection to teach equitably and inclusively, as well as responses in which participants engaged in self-reflection about their own teaching practices. For example, Shea shared that as an instructor, she needs to "sit with the discomfort of knowing" that even if she thinks an activity is going well "that doesn't necessarily mean that it is inclusive or equitable," suggesting that EIT requires reflection on how students and teachers may experience the classroom differently. Other participants further discussed how reflections about student experiences should inform practice. Ryan shared the importance of "meeting students where they are and not having students meet you where you are" in EIT. In this example, Ryan acknowledged that his practice of teaching should change even if he did not include a specific way to enact that change. Of note is the specificity of some reflections. Aadaya discussed her realization that despite self-characterizing as "approachable", she possesses many "preconceived notions" regarding "this is how all students are." She concluded by linking a specific focus on being "vulnerable to understanding" students and their backgrounds as part of her definition of EIT.

We used the subcode Actions when participants described something specific that a teacher did or could do in connection with EIT. If the action was general, like "be more open," then it was not included. Nine out of the 13 participants' responses included a specific task or practice including pointing students (especially students with less access) to specific resources, purposefully including topics of racism or environmental change into the classroom, coordinating sections to be more comparable to one another, making sure that "everyday life problems" are inclusive, making an effort to pronounce names correctly, intentionally asking identity-related questions (e.g., "What pronouns do you use?"), making sure that the grading system aligns with letting students grow and be their whole selves, not reacting negatively to students who do not follow academic social norms because they might not have access to them (e.g., "not being insulted when students communicate with me in a way that is not academic"), and learning and changing teaching practices to help with student needs and disabilities (e.g., try to not talk while facing the board for students who read lips). Most of these specific actions were described as EIT practices instructors should do.

Discussion & Implications

Each of the participants' responses is categorized by at least one subcode from the overarching codes: Awareness and Consideration of Students, Student Engagement, and Reflective Practice. This suggests participants view EIT in terms of who students are, how that impacts their engagement in the classroom, and what the instructor can do to affect that engagement. Connecting to Gutiérrez's (2002) definition of equity, several participants expressed the belief that students should not be disadvantaged based on their backgrounds, including characteristics such as race, as well as students' academic experiences and access to material resources. This includes a belief that it is the instructor's responsibility to make sure students are not disadvantaged, or feeling alienated, by the dominant, sociomathematical norms of postsecondary mathematics classrooms. This reflects Gutiérrez's (2012a) notion of the importance of addressing students' access to resources for learning.

Many participants also reflected on their actions as teachers, specifically on their personal biases and practices. In particular, responses indicate that identifying areas of growth, maintaining flexibility, and leaning into the discomfort of change are necessary to create equitable classrooms. As Tuitt et al.'s (2018) state, instructors engaging in EIT practices must be resilient, as EIT involves a significant amount of discomfort and emotional labor. Additionally, this reflective practice (Schön, 1983) is central in all teaching, but in EIT this reflection involves thinking about how students experience the classroom differently than oneself and acting accordingly. Some participants mentioned efforts in their teaching to consider how students experienced their classrooms and recognize that experience differs from their own.

While some discussed the importance of including what Gutiérrez's (2012a) calls mirrors in the curriculum, or, as Tuitt et al. (2018) describe, opportunities for students to personalize content by seeing examples from their cultural or lived experiences, as well as the importance of including topics such as racism, most participants did not stress EIT as a tool for social and political change. This is unsurprising given how difficult instructors find it to create mirrors for their students in the classroom (e.g., Rubel, 2017). Yet, most participants view EIT as important in addressing students' emotional wellbeing, aligning with more humanizing pedagogies which encourage students to embrace their whole selves in the classroom, as well as desire to have students take ownership over their learning.

Our findings can help researchers and department leaders engaged in change for EIT see what topics in EIT are being consumed and what topics might need emphasis or introduction. The participants were connecting EIT with being aware of a variety of aspects about students, but we did not see many responses explicitly mentioning how these aspects relate to power. Yet power is an integral part of EIT and needs to be better understood. Who has the power in EIT? How do you distribute power in EIT? What role do departments have in distributing power within and outside classrooms? Additionally, participants often connected student participation with EIT, but there is an opportunity for emphasizing how students are feeling when they are participating. How are teachers supposed to learn how to attend to student learning, student feelings, and their own learning about EIT? How can departments help support their teachers learning this level of attention?

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