

Community College Students' Definitions of and Experiences With Equity in College Algebra Classrooms

Camden Collins
Oregon State University

Irene Duranczyk
University of Minnesota

Mary Beisiegel
Oregon State University

In mathematics classrooms, equity has been researched, defined, and reported by those who have the ability and authority (professional organizations, instructors, state and federal educational agencies, local administrators, universities, and teaching faculty). However, the students who are susceptible to these definitions have not been asked for their perspectives of what equity would look like or what would remove the inequities they experience in their mathematics classes. Our goal is to center community college students' experiences with and definitions of equity as they reflect on their mathematics' learning journey, significant moments that shaped their engagement in mathematics, how they thought about equity, and whether and how they had experienced equity or inequities specifically in College Algebra. We found that participants' understandings and definitions of equity varied significantly, as did their experiences in mathematics classes. Additionally, we found that participants situated their understanding of equity in features of their identities.

Keywords: Equity, college algebra, student experiences, classroom practices

Introduction

In 2000, the National Council for Teachers of Mathematics published the *Principles and Standards for Teaching Mathematics*. One of the five key principles was equity. Since that time, researchers have argued for more robust understandings of equity in the context of mathematics teaching and learning (e.g., Cobb & Hodge, 2002; Gutiérrez, 2002) and many studies have been published about equity in the context of mathematics education. In conjunction with this movement, more professional organizations also began to focus on equity as a critical component of mathematics instruction and mathematics communities (e.g., American Mathematical Association of Two-Year Colleges, the Mathematical Association of America *Instructional Practices Guide*, 2018), noting that equity and equitable teaching practices have the ability to diversify the field of mathematics, create more inclusive spaces, and, as a result, enrich the field of mathematics.

For our work, we aimed to understand how equity was conceptualized in mathematics education research. In a review of 177 papers (Boeck et al., 2024) that focused on equity in mathematics teaching and learning, we found that only 21 explicitly defined and/or operationalized equity. Some of the earliest definitions of equity included Gutiérrez: “develop proficiency in dominant mathematics, contribute towards and develop critical stance and new perspectives on relationship between mathematics and society” (2002, p. 174) and Esmonde: “Fair distribution of opportunities to learn or opportunities to participate” (2009, p. 249). We observed in our literature review that many researchers relied heavily on Esmonde (2009) and Gutiérrez (2002) as the basis for their studies. However, we found that the definitions in the 21 articles were mostly created out of the researchers' understandings and interpretations of educational contexts and that student voices appeared to be absent in the literature.

The goal of our research is to add student voices to the mathematics education research literature focused on equity. Our focus is on community college students because they play an important role in the preparation of the next generation of STEM majors, the rise in the

percentage of students taking courses at community college to complete requirements for their undergraduate majors, and community colleges are well positioned to contribute to the diversification of the STEM workforce. In this preliminary research report, we share findings from the first of four interviews exploring community college students' experiences with mathematics generally and College Algebra specifically. Our inquiry focuses on students' definitions of and experiences of equity in College Algebra classes. We aim to answer the questions: (1) What are community college students' definitions and understandings of equity? (2) What do students' voices add to our understanding of equity?

Methods

We recruited participants from community colleges across four diverse states by announcing the study to classes of students, posting flyers in public spaces on community college campuses, and asking community college mathematics faculty to share the recruitment flyer through an announcement on the learning management system for the course. If students expressed interest in participating, we asked them to first answer survey questions about: the amount of time and the number of mathematics classes they had taken in community college; their work and family obligations; their past experiences with mathematics courses; and their definitions and experiences of equity. We chose students based on the survey responses, using a few criteria: age 18+, experiences with College Algebra, prioritizing those who intended to continue their academic studies after community college – looking for diverse backgrounds across the participants. This process resulted in a total of 37 participants across the four states. We then conducted interviews with the participants on zoom, asking questions about their current mathematics classes, including: How do the students in your class interact with each other?; Please describe a moment when you feel supported or motivated (or not supported or motivated); Have you had an experience in a college math class in which you or a classmate were either highlighted/singled out/ignored based on race, ethnicity, religion, gender, accent, or other identity? Based on their answers to the intake survey, we asked more questions about equity.

- | | |
|--|---|
| Questions based on intake survey about equity (question a, b, c and/or d were chosen depending on participants' survey responses) | (a) In the intake survey you said that you have heard the term equity used. How and where have you heard it being used?
(b) In the intake survey you said that you have used the term equity. How have you used it?
(c) In the intake survey you said that you have defined the word equity before. What is your definition for equity?
(d) In the intake survey you said that you have explained to others what the term equity means. Can you please share the explanation you used? |
|--|---|

- | | |
|---|--|
| Questions about equity in mathematics classrooms | What would equity look like in a college math class?
<ul style="list-style-type: none"> ● Can you describe specific examples of how your math instructors supported equity (e.g., representation, topics, perspectives)? ● Can you describe specific examples of how your math instructors do not support equity (e.g., representation, topics, perspectives)? ● What specific actions or approaches would support equity in your math classroom? (either by instructors or peers) |
|---|--|

Based on our literature review (Boeck et al., 2024), we created an analytic codebook using the definitions and operationalizations described in the 21 articles, which we then used for deductive coding of the interviews. For example, one of our codes relied on Esmonde's definition of equity as the "fair distribution of opportunities to learn" (2009, p. 249). Another code was based on Gutiérrez's (2002) notion that students should develop proficiency in dominant mathematics. Other codes included: relational equity among students (Sengupta-Irving, 2014), agency (Gutiérrez, 2002), and opportunity to learn quality mathematics (Gregson, 2013), among others. For many of the codes, we created more nuanced categories; for example, for "fair distribution of opportunities to learn" we added the categories *unfair* and *occurred*, for "students' sense of agency," we added *lack of*, *exhibits*, and *struggling with agency*. Cleaned transcripts were uploaded to Dedoose qualitative software program and we independently applied the codes to the transcripts. We then reconciled the students' statements that we had captured with the different codes, refined our descriptions of each code, found examples for each of the codes to assist with future coding, and coded additional transcripts. For the purpose of this preliminary report, we focus on our analysis of students' definitions of equity and how they described what equity would look like in mathematics classrooms, providing examples from a diverse group of five participants.

Findings

From the codes that centered around equity, we analyzed students' statements to further understand the contexts in which students use the word equity in a college mathematics classroom and their functional definitions. Findings are derived from analyzing interviews with a team of three researchers. We first share different ways the participants defined equity, confounding equity and equality, and how they described equity in a mathematics class. Finally, we explore how the participants situated equity in their identities and their experiences.

Defining Equity Was Difficult for Some and Students' Definitions of Equity Varied

There were significant differences across participants' definition of equity. Below we provide examples for the different types of thinking and definitions.

- *Defining equity was difficult for some:* Will stated "I struggle with it, I think. Maybe more than either diversity or inclusion. And I struggle with all of them" while Elena was very unsure and asked if she could look up the definition of equity during the interview.
- *Some students thought of equity in a financial context:* George said equity is "the amount of money you possibly gain like an income like for a house", and Althea said "I think I would define it as, like, equal or, like, money wise, like a part of a business, but, or like the value you have issued in a business."
- *Some confounded equity and equality:* Will acknowledged that he "struggles to parse out equity, equality, and fairness," and Elena stated "equality, I mean is, we're all treated the same. We're all treated with the same, you know, we don't, you know, look at anyone different, treat in that sense as far as equality," while Althea remarked "sometimes equity and equality kind of, like, combine in my head." Althea suggested that teachers should give each student the same attention and further implied the teacher was unfair as they "sectioned us out, like there was, like, like, the smart people that, like, don't really need help. I don't really need to focus on them too much. I have to focus on the people who don't understand that much or like it.

- *Some participants provided more concrete definitions of equity:* As one example, Ayami said “I think equity is having the tools there to make it possible for all of us to work together [...] deep equity looks like, is that those tools aren’t uh... aren’t either forced on us or like and uh... an intrusive presence. Like, they’re just part of the way things are.”

Students’ Descriptions of What Equity Looks Like in a Mathematics Classroom

We also heard a variety of responses to the question “what would equity look like in a mathematics classroom?” Below are some examples of their responses:

- *Varied understanding of equity in the classroom:* George answered “In the math classroom. I don’t really know. I don’t really know the word equity yet. I’m equity enough to say that,” while Will stated “equity in a college classroom focuses on student needs and accommodations for academic success, over comparative treatment for all students.” Althea defined equity as “everyone gets the same opportunity to understand the coursework and the way, like the teacher is teaching.”
- *Personal and social identities are taken into consideration when considering what equity in the classroom:* Ayami provided a very in-depth conception of equity in the classroom that incorporated how both students and teachers could promote equity: “I think for classmates it’d just be more so, kinda being willing to help versus like being very closed off. Not really like, you know, just being willing to help someone if they ask, and then, in the sense and like kind of kind of fostering a non-judgmental zone... because, you know, when it comes to like things like neurodivergency, or like struggles it can be embarrassing to kind of like, talk about it, or like reach out for help, so kind of providing and creating a nonjudgmental zone.”
- *Students identified meaningful interactions with their peers surrounding mathematics as a form of equity:* When asking for specific actions or approaches that would support equity in each participant’s mathematics classrooms, there was a high frequency of students desiring meaningful interactions with their peers surrounding mathematics. For example, Ayami described her experiences in study groups as negative: “It wasn’t really like the study group conversation of trying to learn math together.” This implies that social interactions with teachers and students help define whether or not a space is equitable. Other examples of specific actions or approaches that would support equity that were provided included giving extra time to students, providing multiple resources to learn from, and adjusting for different learning styles. Ayami explained that the role of a teacher is to “guide the way. Not really dictating [...] I feel like also kind of exploring different kinds of learning styles, cause I feel like it’s very rigid.”

Situating Equity in Identities, Experiences, and Broader Viewpoints

Lastly, using the participants’ examples of equity in a mathematics classroom, we observed participants provided some insight into their personal and social identities when considering equitable outcomes. Compiling a list from all participants, they expressed that race, neurodivergence, social classes, immigration status, physical health, and mental health are factors that equity should address in a college mathematics classroom. In addition, Ayami stated that “home life” itself may be enough to create inequities. It is important to note that no two participants had the same set of identities and this leads to a difference in beliefs as to what

impacts a student's experience in a mathematics classroom. Here we provide two different situations for understanding and describing equity through their identities:

- Will noted his identity as a white, middle-aged man and said: "And obviously, that's a certain amount of privilege, right? Because places aren't built to make me uncomfortable. It's very easy for me to make myself comfortable in them."
- Ayami noted her identity as a young, West Asian woman with caregiving responsibilities and part-time employment, who had recently been diagnosed as neurodivergent. Her definition of equity was rooted in her positionality: "I usually describe it. I'm trying to think of, like, a specific time that we use the word equity. I usually describe it more in a racial sense or neuro, like, in a sense that uses neurodivergency or social classes. I typically use examples to describe equity versus, like, giving like a definite, like a strict definition, because equity in general is kind of, because in order to use equity, it's like a social. It's a social construct. So, we have to like, you know, kind of give it context in order for it to seem. So, yeah, I kind of use more examples when I talk with them."

Discussion

We focused our *first research question* on hearing how students defined equity. Unsurprisingly, we found significant variation across the participants in this preliminary analysis, that equity can be conflated with equality or sameness, and a definition of equity that might suit all students does not, and likely never will, exist. That said, we found that student definitions centered around the three main ideas identified above and that these ideas varied by their ability to conceptualize equity in education vs. finance and their ability to concretize that conceptualization based on their classroom experience or their identity. With our *second research question*, our goal was to answer the question "What do students' voices add to our understanding of equity?" Our preliminary data from students highlights a number of important facets of the definitions of equity reported in the literature. Some of the terms used more frequently by the students, such as descriptions of what they would like to see in their mathematics classroom that would demonstrate equity, were related to *relational equity* as described by Sengupta-Irving (2014), which means learning to effectively communicate with one another and appreciate other perspectives. However, there were more instances of students not experiencing relational equity than reporting its occurrence, and the participants reported that their college algebra classrooms should focus more on collaborative work rather than "just a relationship between one student and the teacher." The second most coded definition of equity was Esmonde's fair distribution of opportunities to learn or opportunities to participate (2009). The occurrence of this element was almost evenly distributed between noticing that it had occurred in the classroom and noticing that it had not occurred, but would be an important element to promote equity in the classroom.

Discussion Prompts for the Audience at RUME

We have two prompts for the audience at RUME: (1) We have coded primarily looking for instances of students' reflections and utterances that resonate with definitions of equity that we found in the literature as well as what they say directly when we ask them what is equity and how would you see it in a mathematics classroom. Is there another approach for coding that comes to mind that we might consider as we move forward? (2) How might our findings inform equity frameworks as well as research studies that center student voices in mathematics?

Acknowledgments

National Science Foundation EHR Core Awards #2000602 (Michigan), #2000644 (Maricopa), #2000527 (Minnesota), and #2000566 (Oregon). Opinions, findings, conclusions or recommendations do not necessarily reflect the views of the National Science Foundation.

References

- Boeck, C., Mesa, V., Kimani, P., Duranczyk, I., Beisiegel, M., Akoto, B., Wynn, J., & AI@CC 2.0 VMQI Research Group. (2024). Conceptualizing equity in mathematics education research: 2000-2022. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). (2024). *Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education* (pp. 1191-1198). Omaha, NE.
- Cobb, P., & Hodge, L. L. (2002). A relational perspective on issues of cultural diversity and equity as they play out in the mathematics classroom. *Mathematical Thinking and Learning*, 4(2-3), 249-284.
- Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences*, 18(2), 247-284.
- Gregson, S. A. (2013). Negotiating social justice teaching: One full-time teacher's practice viewed from the trenches. *Journal for Research in Mathematics Education*, 44(1), 164-198.
- Gutiérrez, R. (2002). Enabling the practice of mathematics teachers in context: Toward a new equity research agenda. *Mathematical Thinking and Learning*, 4(2-3), 145-187.
- Mathematical Association of America (MAA). (2018). *Instructional Practices Guide*. Retrieved from https://www.maa.org/sites/default/files/InstructPracGuide_web.pdf
- National Council of Teachers of Mathematics (NCTM). (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: NCTM.
- Sengupta-Irving, T. (2014). Affinity through Mathematical Activity: Cultivating democratic learning communities. *Journal of Urban Mathematics Education*, 7(2), 31-54.