

## We're All Human, So Why Does Equity Matter?

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**ABSTRACT.** There is a need for mathematics instructors in higher education to have more equitable teaching practices. One way to address this need is through equity-centered professional development (PD). Using interviews across one year of professional development (PD), we describe how three immigrant mathematics instructors grapple with incorporating equity in their teaching practice using Gutiérrez (2009) four dimensions of equity. We found that the instructors focused primarily on awareness and access with respect to equity but did not understand how to infuse equity in their practice. We also found that three themes, the discipline of mathematics, all students are human, and the identities of the instructors and beliefs seem to serve as barriers for instructors' implementation of equitable practices. Future research might consider how PD could be informed to account for the themes found in this study.

“It doesn’t matter what my race is. Um, or my gender, because, you know, I’m teaching a subject that I feel is just it’s universal. So it really does not matter.” This quote came from a two-year college mathematics teacher. The statement is not surprising, and, in some cases might even be expected, as mathematics as a discipline has historically been positioned as universal, unbiased, and politically neutral. The implication is that mathematics is accessible to everyone. While this perspective is common, it is problematic as it removes any accountability or responsibility from the role that mathematics as a discipline plays in what it means to do mathematics and who can do mathematics. This perspective is transmitted to individuals who attain advanced degrees in mathematics and to the students they teach. Having this perception makes it difficult to understand why equity is important in the teaching and learning of mathematics.

In this paper we focus on three two-year college mathematics instructors who are immigrants. We sought to understand how they negotiate their perspective of mathematics, which is closely aligned with the opening quote, when trying to understand and incorporate equity in their classrooms. The research question that guides our paper is: *How do instructors think about their teaching practices while grappling with tensions around self-identities, as well as personal experiences with and beliefs about mathematics as a discipline?*

### Literature Review

Even as efforts are being made to advance STEM fields toward a more humanistic and equitable endeavor, these fields tend to resist transformation (McGee, 2020). Given that mathematics is foundational in STEM, one possible explanation for the slow change within these fields can be traced back to how mathematics is perceived in society. Leyva and colleagues (2021) argue that mastery of mathematics is often seen as a precursor to one’s social standing and frequently used as a measure for intelligence (Hatt, 2012). Similarly, Moses and Cobb (2002) liken math literacy

to civil rights, emphasizing its societal importance. Hence, when discussing mathematics as a discipline, we need to recognize the high esteem in which it is held in society and how it functions as a form of cultural capital (Williams et al., 2016).

In the pursuit of equity in mathematics education, it is crucial to examine four narratives of mathematics as a field of study: the perceived universality of mathematics, the understanding of what it means to engage in mathematical practices, the historical exclusivity of the discipline, and its inherently political nature, especially as these factors relate to the often-understudied in the context of community colleges. First, mathematics is often conceptualized as universal. That is, mathematics is often portrayed as a universal discipline, suggesting its omnipresence and accessibility to all, irrespective of race, gender, or any other identity markers (Baber, 2015; Battey et al., 2023). The second narrative to consider when thinking about equity in math education is understanding what it means to do mathematics. Understanding what it means to do mathematics is critical as there is often a misalignment between what it means to do mathematics and how mathematics is taught (Brown et al., 1989). The contrast between the two – school mathematics and the authentic practice of mathematics outside of the classroom – highlights the tension that exists between what it means to do mathematics and how it is taught in the classroom (Boaler, 2000; Williams et al., 2016). The third narrative is who is permitted to do mathematics. Historically the discipline of mathematics has been exclusive, highlighting that only certain individuals can do or are good at mathematics (Ernest et al., 1989; Hottinger, 2016; Leyva et al., 2021; Martin, 2009; Nasir et al., 2011). The fourth narrative is recognizing that mathematics is political (Gutiérrez, 2013; Stringer et al., 2022). The classroom is more than just a site for social reproduction and enculturation. Rather, it is a space where power dynamics, identity, and cultural constructs intersect. Mathematics inherently carries political aspects and power dynamics similar to other human activities. Collectively we argue these four narratives about mathematics inform instructors' teaching practices and how they conceptualize equity. Additionally, we build upon the literature by focusing on a population and context that is often understudied in mathematics education, immigrant instructors in mathematics and community colleges.

### Theoretical Framing

The four dimensions of equity is a framework as described in Gutiérrez (2009) articulates considerations for equity in mathematics education. The framework highlights four components, access, achievement, identity, and power. The components are divided into two axes—the dominant axis and the critical axis. The dominant axis represents the prevalent emphasis for equity in mathematics education which centers on access and achievement in which access precedes achievement. Access refers to ways in which students can participate in mathematics. This includes students engaging with teachers, curriculum, and resources. Indeed, access may impact achievement. Achievement attends to student outcomes such as grades and scores on standardized tests and can highlight ways in which students may demonstrate their mathematical knowledge. While the dominant axis is important, Gutiérrez acknowledges that it is only a partial view of equity in mathematics education. The second axis which is referred to as the critical axis, includes identity and power, where identity precedes power. Identity refers to the social markers of students and teachers, as well as their lived experiences, and cultural socialization. Understanding and incorporating students' identities is important to attend to equity. Power, the last component, highlights the power and agency that both students and teachers have and how teachers can use their power to ensure that classroom instruction is inclusive and attends to the identities of students.

## Methods

The Mathematics Persistence through Inquiry (MPIE) project is a five-year NSF-funded project whose goals are to 1) study a two-year college's response to a state-mandated change in gateway mathematics courses (College Algebra, Precalculus, and Trigonometry), 2) use cycles of design research to build the capacity of math instructors in the two-year college to foster student success, and 3) investigate the effects of the capacity-building effort. The use of design-based research has enabled the building, implementation, and subsequent refinement of a professional development (PD) program for two-year college mathematics instructors. The focus of the PD program is on supporting the development of inquiry- and equity-focused teaching practices. The PD program for the research participants discussed in this manuscript took place during the fall and spring semesters. The fall PD used Smith and Stein's 5 Practices for Orchestrating Productive Mathematics Discussions (2011) as a template to support teachers' practices around inquiry and equity. Additionally, PD participants had opportunities to engage in mathematical tasks, apply such task frameworks to their own teaching, and reflect on their practice. During the spring instructors met five times for one hour each. The spring PD involved the use of Equity QUantified In Participation (EQUIP) tool created by Dr. Daniel Reinholz and Dr. Niral Shah. EQUIP is a classroom observation tool designed to "illuminate patterns in student participation" (Reinholz and Shah, 2018, p. 141). EQUIP was used as a support for teachers to better understand teaching practices and reflect on how to make changes that made their teaching more inclusive and equitable. Members of the project team analyzed videos of classroom instruction and created reports that were shared with participants. The regular sharing of personal teaching reflections and experiences with each other fostered the development of a small professional community among participants, which allowed for the sharing of challenges and ideas around teaching.

Engaging in equity- and inquiry-focused PD over the course of one year allowed for participants to develop an understanding of inquiry and equity and its application to their teaching, engage in continuous refinement in their teaching, and make connections from their learned practices to their local context. In this paper we discuss participants' evolving perspectives on equity, which are connected to their own personal experiences and relationships with mathematics, and, in turn, impact their teaching practices.

**Setting and Context.** The setting of this research project and PD efforts is a two-year Hispanic Serving Institution (HSI) in the Southwestern United States. In this paper we will refer to this institution as Southwestern HSI (SHSI). SHSI serves a student population that includes a majority of students from historically minoritized communities including Latinx students (68%) and students from low-income households (70%). PD participants include SHSI instructors who primarily teach gateway mathematics courses.

The MPIE PD program is a two-semester program running through the fall and spring terms. The participants discussed in this paper participated in the MPIE PD during the fall 2021 and spring 2022 semesters. All were math instructors at the SHSI, most of whom taught a variety of courses including gateway mathematics courses. The fall semester PD focused on inquiry-based teaching and learning with participants meeting six times, two hours each (for a total of 12 hours). In the spring, the PD shifted to an equity and inclusive emphasis, with participants meeting 4 times, 1 hour each (for a total of 4 hours). The reduced PD session time in the spring allowed for individual classroom observation and debrief sessions.

**Data.** For this paper we present three case studies from the same cohort of teachers: Paul, Nhung, and Savana. We selected them as cases because they are all immigrants with unique experiences that seemed to have shaped their beliefs about and ultimately their teaching of mathematics. The beliefs they shared highlighted a tension between their perspectives on what it means to do mathematics, what mathematics affords as a discipline, and the role of equity in disrupting their perspectives. Below is a brief description of each participant.

- Paul is a full-time mathematics instructor who grew up in Tijuana, Mexico and identifies as a Hispanic or LatinX. However, he has been perceived by others as white in some spaces and Latino in others, which has created a complex, dual identity for himself. He has taught a variety of courses at SHSI for more than two decades.
- Nhung is a full-time mathematics instructor who identifies as Vietnamese with Chinese Ancestry. He spent the first 11 years of his life in Vietnam before coming to the United States as a refugee. He has taught a variety of courses at SHSI for more than a decade.
- Savana is a part-time mathematics instructor who identifies as Hispanic. She grew up in a large family in Tijuana, Mexico and is a first generation college graduate. She has taught a variety of courses at SHSI for more than two decades, as well as at other local colleges.

**Table 1.** PD Participant Demographics Information and Employment Status at SCHSI

Participant	Gender	Self-Identified Race/Ethnicity	Status
Paul Martinez	Male	Hispanic or LatinX	Full-time
Nhung Tran	Male	Vietnamese with Chines Ancestry	Full-time
Savana Sanchez	Female	Hispanic	Part-time

The data examined from the participants are three, one-hour interviews each across two semesters of PD. The first interview occurred toward the end of the fall PD, the second interview occurred before the start of the spring PD, and the third interview occurred after the conclusion of spring PD. Each interview was semi-structured and designed to capture information around the instructor's teaching background and style, mathematics experiences, equity beliefs and practice, and inquiry beliefs and practices.

**Analysis.** Each set of interviews were analyzed by two different researchers. The first round of coding involved members of the research team writing memos so that common themes regarding equity and identity could be identified, with Gutiérrez's four dimensions of equity as a guiding framework. After discussion, the themes of *self-identity*, *math as unbiased/universal*, *we are all human*, *awareness*, and *access* were identified as themes that appeared in each participant's data. Below we unpack how these themes address the research question: *How do instructors think about their teaching practices while grappling with tensions around self-identities, as well as personal experiences with and beliefs about mathematics as a discipline?*

## Findings

All themes were present in each set of interviews. In the subsequent sections we highlight how participants' personal experiences and perspectives show up in their teaching practices. For example, instructors found ways to connect to their students through shared lived experiences.

**Educational Experiences and Identities Impacting Practice.** All three participants identified as immigrant teachers - each grew up in another country and then became a teacher in the United States. Their unique experiences growing up and becoming immigrant teachers have played a role in their teaching, impacting their practice and the way in which they interact with their students. Below we briefly unpack each participant's educational experiences individually - highlighting significant stories as they relate to their identities in the context of teaching and learning.

Paul grew up in Mexico and identifies as biracial. In Mexico he experienced racism and marginalization. Often referred to as "Gringo" or "Blanco", he struggled to fit in or feel like he belonged in his high school classes. As a 15-year-old, he took a difficult physics class which he ended up failing. During a class period towards the end of the term his Physics teacher stated in front of the class that "The American white boy failed physics. So now he's going to learn what it is to be oppressed and what it is to be privileged." This experience was "hurtful" to Paul and has impacted his choices and values as a teacher. As a teacher at an HSI on the border with Mexico, he knows that there will be students in his class who will likely have an identity or experiences like his own. Having such students in his class is an opportunity for him to connect and provide the support students might need. He is fluent in Spanish and will share his identity with his students to let them know that he also has experienced challenges in his education.

Nhung spent his childhood in Vietnam. He was 11 years old when his family moved to the United States (US). Growing up speaking Cantonese, he knew very little English at the time. Thus, as a student in US schools, he struggled in his classes and had multiple uncomfortable experiences when being called on during class. The language barrier made it hard to "verbalize" his thinking and these negative experiences impacted his confidence and learning processes. Mathematics classes usually did not pose the same level of difficulty for him, given the reduced amount of English vocabulary. However, he did struggle to read and interpret contexts presented in mathematical word problems, which made it difficult to apply the appropriate mathematics. These past experiences impact how Nhung teaches. For one, he never wants to put students in a position where they feel singled out and uncomfortable, and Nhung mentions "cold calling" as a strategy he disliked as a student and does not do. And second, he wants to be available to help students if they are struggling and need additional support. He goes further to say "I feel like I can relate to students better because... the adjusting to classrooms in the United States is just something that I have a little bit more appreciation maybe for what they have to go through." However, this responsibility lies with the student, as Nhung does not typically engage with a student unless they take initiative (e.g., vocalize specific questions or demonstrate engagement with the content).

Savana was born and raised in Mexico. She was the youngest of 13 children and grew up in a traditional household. Neither of her parents were formally educated, so learning and writing were unfamiliar to them. Her father believed that the priority for women was to focus on family, children, and the home, but her mother viewed education as important despite not having the opportunity to attend school herself. Savana embraced both values in her own life - family and education. Thus, Savana attended school through community college in her hometown of Tijuana, and then moved to the US to pursue her dream of becoming a teacher. This was not easy. She did not speak English, but she was motivated. She had a "dream... [to] teach math", and even though she did not know the language, noting that it "was really, really challenging", she strived to follow her dream. This aspect of Savana's identity is a big part of who she is and

impacts how she interacts with students. She wants students to know and understand that pursuing an education (especially when not in your native language) is “not easy, but it can be done. If we work hard.” Savana shares this story with her students, hoping it will motivate them to continue pursuing their education.

These instructors understood and could relate to the challenges that learning a new language or educational system posed to students in their courses. Instructors shared these challenges with students and saw themselves as potential role models (e.g., Savana). Further, these instructors internalized experiences in a way that influenced how they interacted with students, empowering them to employ teaching practices that countered what they experienced as learners. In Paul’s case this meant trying to provide additional support. However, in Nhung’s case he often centered his own negative experiences, which reinforces inequities in the classroom by unintentionally excluding students from participating during classroom instruction.

**Mathematics is Universal and We’re All Human.** An interesting theme that arose across the interviews was the idea that anyone can do mathematics and that mathematics is a neutral subject. In fact, Nhung felt that mathematics is “unbiased”, and that success is achieved with enough “time and effort”. He went further to note that that was one of the motivating reasons for joining a PD that had a focus on equity - he wanted to understand how such a neutral subject could have inequities.

The notion that mathematics is a neutral subject was also intertwined with the idea that “we are all human”. When asked about how she thought about race, Savana stated that she did not think about race and went further to say: “We are all the same. We’re all human beings. We’re all the same.” While Paul had a similar sentiment, he situated it in the classroom setting about engaging with mathematics and promoting student success. Paul noted the sameness in which he wants to support students while still monitoring biases he may have:

I’m trying to break the stereotype by, by trying to be okay now we can... be the same with everybody. Be the example, communicate the same way with everybody, treat everybody with the same level of respect, communicate with the same level of acknowledgement of respect. Don’t focus on only a handful of students or one gender. Everybody’s the same, everybody’s equal. We all belong to one to race the human race. If I, if I make sure that everybody to me is a human, that right there is helping me keep myself in check and avoid falling into those biases, those stereotypes. And if they see that I’m doing that and, and it’s encouraging them to succeed.

Throughout PD, Nhung struggled with the idea of inequity existing in the mathematics classroom:

I just have always seen myself as I’m just a math teacher. Right. It doesn’t matter what my race is. Um, or my gender, because, you know, I’m teaching a subject that I feel is just it’s universal. So it really does not matter.

Although all participants had this idea of mathematics being universal or we are all human, they each acknowledged the inequities that they themselves had experienced as students or inequities

they recognized as being present in mathematics as a discipline. These inequities shaped their identity as mathematics teachers, and, in turn, impacted how they interact with students.

**Getting Stuck: Awareness and Access.** Throughout the interviews it was clear that Paul, Nhung, and Savana increased their understanding and awareness of classroom equity issues as they progressed through the PD. Participants seemed to think about equity as access to opportunities. An instance that captures such awareness that was developed early on is when participants were provided with an image, which is now ubiquitous, showing two cartoon panels. In one panel, there are three children trying to look over a fence to see a baseball game. The children are of different heights, and each child is standing on the same type of box to try to look over the fence. Although each has a box to stand on, not all can see over the fence. In a second panel, each child is standing on a different size box that will allow for them each to see over the fence. Although this image does not capture equity as a concept in its entirety, it provides an entry point to a conversation about equity, especially for those who are new to having such discussions. It was this image that gave Paul clarity about equity in the classroom for the first time:

And they showed the [cartoon description] and I thought to myself, by the way, please forgive me if I if I release a colorful metaphor, because I really get worked up about this. But I was thinking, “God damn w- we’ve been doing this all along! We’ve just been giving everybody the same box!” But hey look- there’s tutoring, whoopie! Hey look- we have workshops, yee haw! But if students have different needs, how can we bring them up to the same level instead of just giving everybody the exact same opportunity? That’s when it clicked, that’s how it’s done.

Paul realized that giving all students the same opportunities was not what it meant to attend to equity. He worked to meet the students where they are, and part of this process was allowing students to participate in ways that they feel comfortable. This notion of opportunity and comfort was also reflected in Nhung’s and Savana’s interviews.

Nhung felt that being equitable was giving “students the opportunity to learn” through group activities guided by “leading questions”. He believed that each of his students were capable of the same achievement with enough practice, time, and effort. However, Nhung began to struggle with his definition of equitable teaching once he began to realize the varying levels of preparedness in his students, which impacted their ability to take advantage of such opportunities. He noted:

Well, when you interact with students when you recognize that they are not as prepared to take advantage of those opportunities. Right? And now I see where some of it is falling short. But I don’t really know how to address it yet... Right. But it’s not just equal opportunity. Right. Because if you start further up than someone else, and both of you are presented with the ... same opportunities, you are going to rise or at least you have the opportunity to rise, um, at a greater rate than someone else who started way behind.

While Nhung felt opportunities were important, he recognized that giving students the same opportunities did not address the gap that existed between students. This tension caused Nhung

to shift his perception of equitable teaching slightly, adding the caveat that students who entered his class with gaps in prerequisite knowledge just needed more chances to work one-on-one with him as the teacher.

Nhung also shared that if students “elect to not interact with” him, he will leave them alone and not “bother them”. From Nhung’s perspective one-on-one attention was a way to elevate students to a level commensurate with their classroom peers. Savana had similar sentiments stating that equity “means being able to provide every student what they need”, which may be unique to each student. Ultimately Nhung viewed issues related to equity as access issues and students just needed opportunities to engage with mathematics. Savana, like Nhung, recognized that students were at different ability levels and felt that support needed to be customized based on a student’s specific needs. However, while Nhung struggled to attend to students’ needs because one-on-one help during class was difficult to accomplish for all students, Savana expressed not knowing how to begin to attend the issue:

How do I help the student that, um, you know, uh, that has, I don’t know, anxiety and, and, and, and just being asked to, to talk in front of the class, you know, makes just asking that person, a question, you know, uh, may block him and, and not be able to, you know, to, to, to follow, you know, what I’m doing. So it’s, so it’s so, uh, challenging.

In the quote above we see that Savana recognized potential barriers for students’ participation and acknowledges potential consequences for different moves she might make, however this leads to paralysis in that she gets stuck in her awareness and does not try moves that might be more equitable.

By the end of the first year of PD not much had changed with perceptions of equity in the classroom. Paul, Nhung, and Savana all discussed increased awareness about equity in their teaching, but little change could be seen in the data across their interviews. All continued to see increasing access to engaging through participation in mathematics as the key piece to attending to equity in the mathematics classroom.

## Discussion

Paul, Nhung, and Savana provide important insight for what it means for community college mathematics instructors to grapple with incorporating equity in their teaching practices. Although each instructor had increased awareness with regard to what it meant to attend to equity in the classroom, at the end of their first year in PD that awareness was limited to focusing on increasing access to mathematics. This translated in their practice through their teaching by having more one-on-one interactions with students, increasing availability to students, and encouraging more questions and discussion from students (as students felt comfortable). However, in some cases, this puts the responsibility upon the student to take advantage of the additional access, which assumes that more access is what students need and that the students can accommodate more instructor access into their lives. This perspective presents a somewhat limited view of what it means to attend to equity.

There are several factors that might contribute to this limited view of equity in the classroom. Through themes identified across Paul, Nhung, and Savana, potential barriers to instructional

change seem to be their own personal identities, beliefs, educational experiences, and beliefs about how to be successful in mathematics. For example Nhung recalled how his own experiences might explain his expectations of English Language Learners or why he does not “cold call” students. In addition, the perspective that mathematics is unbiased or universal makes it difficult for the instructors to understand how shifting teaching practices beyond more “opportunities” would help attend to equity. This idea is further validated as Paul, Nhung, and Savana succeeded academically and professionally, in part because they took advantage of opportunities and were motivated. For example Savana, who is a Latina woman from Tijuana, described her upbringing as one where women stayed home and did not further their education, so her decision to pursue a math degree and learn how to speak English provided her with the perspective of “If I can do it, you can too”. Each participant had this view to various degrees and as a result, this “pulling-oneself-up-by-the-bootstraps” mentality makes it difficult for these instructors to shift their practice beyond creating opportunities and encouraging participation.

## Conclusion

Moving forward we are working with instructors as they grapple with challenges related to inquiry and equity in their classrooms. For example, Nhung has identified ways in which he can encourage student participation that is not “cold-calling”. Specifically he is speaking with students individually first before asking them to present their ideas. Getting students involved in this way helps position them as having more ownership in their engagement in the classroom. Similarly, Paul has put forth more effort to better understand and attend to his students’ needs. For example, he recognizes that helping students is not just about providing extra office hours but also understanding that students can benefit from flexibility in a course (e.g., due dates). Minimal shifts in course constraints on Paul’s end (e.g., homework due dates) can make a big difference for students who have limited resources or unique circumstances (e.g., limited access to wifi). The realization that Paul had this power occurred to him during the PD. Lastly, Savana is using small group work as a way to support students that might need the extra support. Although she recognizes that small group work might come at the expense of covering content, Savana sees it as an opportunity for students to support one another. Further, this allows for her to be more strategic in supporting students, especially those who have greater need, and ultimately meeting students where they are.

In this paper, instructors highlight a tension that exists between their own identities, beliefs, and experiences, and the common narratives that exist within mathematics (e.g., mathematics is universal). Understanding these tensions and the deep-rooted impact of experiences with and beliefs about mathematics have given us a better understanding of how to reframe aspects of ongoing PD to try to empower instructors to move beyond awareness and access and towards practice that also incorporates Gutiérrez’s critical axis dimensions – identity and power.

## Acknowledgments

This material is based on work supported by the National Science Foundation under Grant Numbers 1953713, 1953753.

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