

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

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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.

Keywords: equity, identity, two-year college, community college

"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 being that mathematics is accessible to everyone. While this perspective is common, it is problematic as it removes any accountability or responsibility that the role mathematics as a discipline plays in *what* it means to do mathematics and *who* can do mathematics. This perspective is transmitted to individuals that 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, mathematics tends to resist transformation more than other fields. One possible explanation 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. 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.

In the pursuit of equity in mathematics education, it is crucial to examine four key characteristics: the universality of mathematics, the understanding of what it means to engage in mathematical practices, the historical exclusivity of the discipline, and its inherent political nature, especially as these factors relate to the often-understudied context of immigrant instructors in 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). The second characteristic 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. The third characteristic is who can do mathematics. Historically the discipline of mathematics has been exclusive, highlighting that only certain individuals can do or are good at mathematics (Ernest, 1989; Martin, 2009; Hottinger, 2016; Nasir & Shah, 2011). The fourth characteristic is recognizing that mathematics is political (Gutierrez, 2013). 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. Indeed, mathematics inherently carries political aspects and power dynamics similar to other human activities. Collectively we argue these four characteristics inform instructor's 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 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 one half 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 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 that is using design-based research to build and implement 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. Goals of the project 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. In this paper we discuss participants' 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: 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 Latino who 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 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 grew up in a large family in Tijuana, Mexico and was in the first generation in her family to attend college. She has taught a variety of courses at SHSI for more than two decades, as well as at other local colleges.

The data examined from the participants are three, one-hour interviews each across two semesters of PD. The first interview occurred after 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 author on this paper read through a set of three interviews for at least one of the three participants, so that each set of interviews were analyzed by two different researchers. 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 our research question.

Findings

These themes all arose across the three interviews from each participant that were used for data analysis. We present them in an order to help provide context for each participant, highlighting how their personal experiences and perspectives show up in their teaching practices.

Identity 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 has played a role in their teaching, impacting their practice and the way in which they interact with their students.

Paul. Paul grew up in Mexico and identifies as biracial. In Mexico he experienced racism and marginalization. Often referred to as “Gringo” or “El 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 that 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. 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 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.”

Savana. 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. 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.

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- no 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 struggle 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.

While Nhung felt opportunities were important, he recognized that giving students the same opportunities did not address the gap that existed between students. Nhung struggled with this tension stating:

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.

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. He further notes 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

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 an important description for what it means for immigrant mathematics instructors in higher education 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 and encouraging more questions and discussion from students (as they felt comfortable).

There are several factors that might contribute to this limited view of equity in the classroom. Through themes identified across Paul, Nhung, and Savana, one potential barrier seems to be their own personal identities, beliefs, and experiences. 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. As a result, this view makes it difficult for these instructors to shift their practice beyond creating opportunities and encouraging participation.

Conclusion

Math is political and it is important for instructors to understand their own identity, power, and responsibility when implementing equitable teaching practices. 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 that historical norms and beliefs about mathematics have given us a better understanding of how to reframe aspects of ongoing PD to try to get instructors to move beyond *awareness* and *access* and towards practice that also incorporates Gutiérrez's critical dimension (*identity* and *power*).

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References

- Baber, L. D. (2015). Considering the interest-convergence dilemma in STEM education. *The Review of Higher Education*, 38(2), 251-270.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Ernest, P. (1989). *Mathematics teaching: The state of the art*. Falmer Press.
- Gutiérrez, R. (2009). Framing equity: Helping students “play the game” and “change the game.” *Teaching for Excellence and Equity in Mathematics*, 1(1), 4-7.
- Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, 44(1), 37-68.
- Hottinger, S. N. (2016). *Inventing the mathematician: Gender, race, and our cultural understanding of mathematics*. State University of New York Press.
- Leyva, L. A., McNeill, R. T., Marshall, B. L., & Guzmán, O. A. (2021). “It Seems like They Purposefully Try to Make as Many Kids Drop”: An Analysis of Logics and Mechanisms of Racial-Gendered Inequality in Introductory Mathematics Instruction. *The Journal of Higher Education*, 92(5), 784–814.
<https://doi.org/10.1080/00221546.2021.1879586>
- Martin, D. B. (2009). Researching race in mathematics education. *Teachers College Record*, 111(2), 295-338.
- Moses, R. P., & Cobb, C. E. (2002). *Radical equations: Math literacy and civil rights*. Beacon Press.
- Nasir, N. I. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. *Journal of African American Males in Education (JAAME)*, 2(1), 24-45.