

## Dimensions of Equity within Preservice Teachers' Responses to Equity Quotations

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### Abstract

Secondary mathematics preservice teachers (PSTs) in mathematics methods courses at three different universities interpreted and responded to five quotations related to issues of equity in mathematics education. PSTs engaged with the quotations both individually, in writing, and as a whole class, in an inner-outer circle discussion. We used Gutiérrez's (2009) *dimensions of equity* (access, achievement, identity, and power) to examine PSTs' responses. Along with other course work, this activity created a space where PSTs were able to discuss issues of equity that could affect their future mathematics instruction.

### Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. Does equity have various dimensions, and if so, what might they be?
2. What aspects of equity, with regards to the teaching and learning of mathematics, would you anticipate preservice secondary mathematics teachers to be more (or less) likely to discuss and why?
3. What might make it more (or less) challenging for preservice mathematics teachers to discuss particular issues of equity related to the teaching and learning of mathematics?

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Christa Jackson and Sarah A. Roberts

It's a little overwhelming, realizing just how much I hadn't thought about when it comes to the education and well-being of my future students. More and more, I feel like the majority of my focus in teaching should be addressing the different backgrounds and the different needs of my students. With classrooms becoming more and more diverse, I have a responsibility to be as informed and prepared as possible to run and maintain a diverse classroom. (Preservice Mathematics Teacher's Written Post-Discussion Reflection)

The dominant axis attends to "preparing students to participate economically in society and privileging a status quo. The dominant axis, where access is a precursor to achievement, measures how well students can play the game called mathematics" (Gutiérrez, 2009, p. 6). Access includes resources that enable students to participate in mathematics, such as quality teachers, rigorous curriculum, and adequate supplies. Achievement includes students' participation in class, their patterns of course taking, their standardized test scores, and their participation in the mathematics pipeline.

What does it mean to have preservice mathematics teachers reflect on and discuss issues of equity within mathematics teaching and learning? Why is it important to attend to equity issues in the mathematics classroom? Researchers (e.g., Malloy, 2009) argue that as teachers attend to equity in their classrooms, they build relationships, have high expectations, and support students to maintain their identities. Teachers must be prepared to make learning relevant (Malloy, 1997) and to teach diverse learners (Gutiérrez, 2009) who have varied cultures, lives, and prior experiences. Thus, it is important for preservice teachers (PSTs) to see beyond their own experiences and to understand those of their future students in order to begin creating equitable classrooms (Milner, 2006). Therefore, the purpose of this study is to examine PSTs' conceptions of equitable mathematics teaching. More specifically, the research question underlying this study is: What do secondary preservice mathematics teachers attend to when interpreting and reflecting on issues of equity in the teaching and learning of mathematics?

The critical axis, in contrast, ensures "that students' frames of reference and resources are acknowledged in ways that help build critical citizens so that they may change the game" (Gutiérrez, 2009, p. 6). Attending to identity through acknowledging the ways students are racialized, gendered, and classed gives students opportunities to draw on their cultural and linguistic resources (e.g., home language, frames of reference, etc.). Whereas, attention to power in mathematics classrooms occurs through supporting students in using mathematics to transform the world in which they live, such as through giving students voice in the classroom and through using mathematics to critique society (Gutiérrez, 2009).

### Context

This study took place in three different mathematics methods courses at three universities in the United States (Midwest, Southeast, and New England states) with 43 PSTs (> 85% were Caucasian). There were seven to nineteen students enrolled in each methods course, split almost equally between males and females, and the course was the only secondary mathematics methods course offered to students at each university and the PSTs enrolled in that course the semester prior to student teaching.

Although the PSTs at each university take a multicultural education course as part of their teacher preparation program, those courses do not connect explicitly to

### Framework

Attending to issues of equity is key to transforming "mathematics education in ways that privilege more socially just practices" (Gutiérrez, 2009, p. 4). Gutiérrez (2009) argues there are four dimensions of equity, which lie on two axes: the dominant axis (*access* and *achievement*) and the critical axis (*power* and *identity*).

education course as part of their teacher preparation program, those courses do not connect explicitly to mathematics education. Therefore, to prepare teachers adequately to teach mathematics through an equity lens, we structured our methods classes to attend to and focus on equity issues throughout the course. During our methods courses, the PSTs read and reflected on mathematics equity-related articles (see Appendix for a complete list of the equity-related articles PSTs read during the course) and also discussed equity in the context of the other key components of mathematics teaching and learning (e.g., within the context of assessment, lesson planning, and promoting classroom discourse). Equity was not a single-day lesson in the course, but instead was embedded in the day-to-day work of the class.

### Equity Quotations Task

To examine secondary mathematics PSTs’ conceptions of equitable mathematics teaching, we collected written responses to five quotations (see Table 1) during the sixth week of the semester. The five quotations were selected

because they were representative of viewpoints our PSTs would encounter in their current and future practice. Prior to responding to the quotations, the PSTs did not read the articles and/or books from which the quotations were taken. All the PSTs responded to Quotation 2 and were randomly assigned to respond to two other quotations, for a total of three quotations each. The PSTs were asked to respond to three quotations to provide them an opportunity to delve more deeply and reflect more on their responses. We purposefully selected Quotation 2 for all the PSTs to respond to because teachers’ expectations were paramount in the discussions at all three universities, and we wanted to provide a window to further explore those conversations. For each assigned quotation, the PSTs had to (1) interpret the meaning of each quotation in 1-2 paragraphs, and (2) discuss their reactions to each quotation (What do you think about the quotation?) in 1-2 paragraphs. We acknowledge that thinking about one quotation might affect how the PSTs considered others. However, we believe we selected a range of quotations that broadly represented the thoughts and ideas related to equity in mathematics education.

Table 1  
*Equity Quotations with Number of Preservice Teacher Responses per Quotation*

Equity Quotation	PSTs’ Responses
1. “Minority and linguistically diverse students have not been construed as visible players within mathematical discourse either in or out of schools.” (We adapted this quotation from González, Andrade, Civil, & Moll, 2001.)	21
2. “Teachers have different expectations of their students based on their students’ ethnic and socio-economic backgrounds.” (This quotation is based on expectations literature, e.g. McKown & Weinstein, 2008.)	43
3. “The way teachers teach mathematics does not send any messages; mathematics is free of context.” (We wrote this quotation as a negation of the following text: “Simply put, teaching math in a neutral manner is not possible. No math teaching – no teaching of any kind for that matter – is actually ‘neutral’” (Gutstein & Peterson, 2006, p. 6).	23
4. “I thought math was just a subject they implanted on us because they felt like it, but now I realize that you could use math to defend your rights and realize the injustices around you... now I think math is truly necessary and, I have to admit, kinda cool. It’s sort of like a pass you could use to try and make the world a better place” (Gutstein & Peterson, 2006, p. 1).	22
5. “Students can connect math with their own cultural and community histories and can appreciate the contributions that various cultures and people have made to mathematics” (Gutstein & Peterson, 2006, p. 2).	20

After completing their responses, the PSTs participated in a videotaped discussion using a discussion structure called inner-outer circle, an adaptation of a Socratic Seminar (e.g., Thompson & Radosavljevic, 2014). The students with the same quotation discussed their interpretation and reaction to it in the “inner circle” for ten minutes. The PSTs who did not respond to the quotation listened to the discussion in the “outer circle,” and after the inner circle’s discussion, they had five minutes to discuss their thoughts on the discussion and the quotations. The use of the inner-outer circle structure allowed the PSTs to extend their thinking about all the quotations with their peers.

Following the inner-outer circle discussion, the PSTs individually reflected on the discussion by giving written responses to these prompts: (1) What are you thinking about after the discussion of the equity quotations? (2) What are you thinking about related to your own beliefs and experiences about mathematics teaching and learning? (3) What are you thinking about related to your teaching, your future classroom, and your future students?

To analyze the PSTs’ responses to the quotations, we coded each student’s written responses to the quotations based on Gutiérrez’s (2009) dimensions of equity (access, achievement, identity, power). The two co-authors coded 20% of the data independently to establish reliability. We discussed our disagreements and agreed to whether an item belonged with a particular code. We then used the discussion to independently code another 20% of the data. We achieved a Cohen’s Kappa of 82.6%. We used the inner-outer circle discussion and the post-reflection responses to triangulate the data.

**Preservice Teachers’ Responses to the Equity Quotations**

We categorized and aggregated the PSTs’ written responses according to Gutiérrez’s (2009) four dimensions of equity. Table 2 provides an overview of these written PST responses to the quotations, which occurred prior to the inner-outer circle. We discuss each dimension in the following subsections.

Table 2  
*Classification of Responses (from 43 PSTs) by Gutiérrez (2009) Equity Dimension*

Quotation	Access	Achievement	Identity	Power
Quotation 1	40%	21%	36%	3%
Quotation 2	57%	14%	28%	1%
Quotation 3	75%	6%	15%	4%
Quotation 4	24%	4%	2%	70%
Quotation 5	19%	1%	76%	4%

**Access**

Our PSTs discussed access most often in relation to providing opportunities for all students to learn mathematics and to having high or the same expectations for all students. In terms of providing opportunities to learn, one PST argued during the inner-outer circle discussion that if teachers were not teaching all students and giving them opportunities to learn, they were not doing their jobs. Another PST provided an example of having students in class who did not understand English. She emphasized that teachers must do “their part” to make sure the English learners know and understand mathematics vocabulary and how to explain and use it to solve word problems. Although this PST did not discuss how she would attend to language development in her mathematics classroom, she claimed it was “our responsibility” to figure out how to modify instruction in ways that support English learners in the classroom.

The second focus PSTs discussed in relation to access was providing either high or the same expectations for all students. For example, many PSTs reacted in their written responses to Quotation 2 by saying that they would have high standards and encourage all students in the mathematics classroom. To explore why high expectations were so important, during the inner-outer circle discussion one PST asked: “If a teacher has low expectations for his/her students, but is not vocal about it, how would the students know?” A peer responded,

There’s a lot of different ways it can come across. First of all, it can be by the type of assignments you are giving them. If you don’t think they can do higher-cognitive level tasks, then you won’t even give them

the option of learning it. Other ways you can do that is by not providing them time to explore or think mathematically. So you just don't provide them the opportunities for them to learn. So it's not like you're telling them "I don't think you can do this," but you're not giving them the opportunities to do so. Like the second they start struggling with something, instead of letting them struggle, you say "Oh this is too hard, let me give you something easier," or "Here's the answer."

Low expectations, according to our PSTs, lessened access to opportunities to learn mathematics.

The PSTs wrote a number of recommendations about how they would provide access to their students, beyond more generally creating opportunities to learn and having high expectations: (a) relate mathematics content to students and their lives, (b) create a safe learning environment, (c) use tools to create access, and (d) learn how to adapt lessons to make students of color "visible players" in the mathematics classroom.

### **Achievement**

Achievement is often what results from students having or not having access to rigorous mathematics (Gutiérrez, 2009). The PSTs noted this symbiotic relationship between access and achievement. For example, a PST commented during the inner-outer circle discussion, "If you have lower expectations for those students that you don't think are going to do as well in your class, then they aren't going to do well, because they know you don't expect a lot out of them." Another PST in this discussion mentioned this interconnection between access and achievement: "Assumptions...You know their ethnic background. You know their SES. So you make an assumption about it... If you only expect them to perform at a certain level, and if they hit that level, that's all you expected out of them."

When the PSTs discussed issues focused specifically on achievement, they repeatedly mentioned students' performance in mathematics and on standardized tests. One PST articulated in her written response, "A student who is a minority or a student who is diverse and maybe is not a native speaker of the English language is not seen

as an excelling student within or out of the classroom." With regards to current mathematics assessments, a PST expressed in her written response, "[S]tandardized tests seem to be [the] clearest exemplar of [the] dominant Anglo culture's ability to subjugate minority and ELL [English language learner] learners." By and large, PSTs noted that all students are capable; however, PSTs raised the concern that not all will often be seen as such in their teachers' eyes or on standardized assessments.

### **Identity**

We found that when PSTs discussed identity, they related it to: 1) how teachers align particular characteristics or traits with groups of individuals and 2) how teachers lower expectations for particular groups of students. In attending to groups of people aligned with particular traits, one PST, whose response was representative of other PSTs' written equity quotation responses, suggested, "Students who experience diversity either linguistically or as a minority are not often thought of as people who will be prominent figures in their math classes while they are in school." The PSTs indicated these beliefs about characteristics of students often lead to lower expectations for students from non-dominant backgrounds, and often as a result of these lower expectations, teachers generally perceive these students as less capable. For example, a PST stated, "People assume that since [students] do not speak the language or do not have the same backgrounds as the general population, they do not have the ability to work with mathematics."

Most of our PSTs distanced themselves from such attitudes. As one of the PSTs explained during the inner-outer circle discussion, "You still want to get them to that eventual same place as everyone else, but you can use their individual identities, their ethnicity, their gender, etc. and use those to your advantage to help plan how you are going to get them there." Several PSTs argued the importance of teachers attending to students' identities during mathematics instruction. In particular, one PST explained why ignoring students' identities is detrimental to their mathematics learning: "We can't expect them to learn something if we're not considering their backgrounds or their culture in general... And we're

holding them back if we don't try to change our lesson plans to try to fit their needs." PSTs made the case that teachers can and must use students' cultures and identities to engage students in mathematics classrooms. However, as a PST suggested, this requires teachers, not students, to do the work: "Instead of making them adapt to us, [we must] adapt to them."

## Power

Power involves social transformation through students' use of mathematics (Gutiérrez, 2009). While very few PSTs attended to power, a few did note the role of mathematics in attending to social injustices, in that mathematics "can give one the ability to identify social injustice and the means to address these issues." The following dialogue helps illustrate the PSTs' challenge with discussing power during the inner-outer circle discussion:

PST1: I guess when I first read [Quotation 4], I was really surprised, because I never really thought of math as this... sword of justice that you would use to defend your rights... And I started to understand how you could say that. And understanding why things are happening in the world and the reasons for that and whether that is right or wrong, and using the logic and the reasoning that you learn in math and applying those to those kinds of situations as to whether this is right. It kind of opened my mind up to how you would think about it.

PST2: And I think, like you said, the key elements that we teach in math classes, the critical thinking and the problem solving, they're the best ways that we can fight things, like the racism and the intolerance that a lot of our students face.

Here the PSTs were starting to make sense of how they and their students could attend to issues of power using mathematics.

Some PSTs suggested that their students could use mathematics to understand the world, which we categorized as attention to power. One student illustrated this idea, saying, "Mathematics is an invaluable tool for

studying our world so the understanding of society can be deepened." In addition to understanding the world, students could use mathematics to affect the world. One PST explained, "Being able to master certain skills and understanding how to manipulate numbers and/or variables can give you the ability to have more of an impact on the world around you." These were practical pathways PSTs suggested for attending to power.

## Discussion

Overall, we found that PSTs were able to engage with the quotations across multiple learning contexts in both private (individual written responses in the initial quotation responses and in the post-discussion reflections) and public ways (inner-outer circle discussion) that allowed them to think about both the dominant and critical axes. While many of the PSTs' responses focused on the dominant axis, some PSTs recognized some issues of identity and power, such as combating stereotypes, using students' culture and background when developing their lessons, and teaching mathematics for social justice.

The inner-outer circle discussions created a space for PSTs to talk through ideas with their peers and allowed them to develop more nuanced thinking about equity in their future mathematics classrooms. The discussion structure permitted the PSTs to extend their own thinking and to broaden other's thinking. The PSTs noted in their post-discussion reflections that they found the inner-outer circle helpful; they appreciated listening to each other's thoughts and opinions. From the discussions, the PSTs were able to negotiate a shared understanding of what various quotations meant and were better able to articulate their interpretations of the quotations.

We found that our equity quotation activity sparked conversations and opened a space for PSTs to think about how they could affect students' lives positively through their mathematics teaching. The PSTs' ability to articulate and engage in such powerful conversations across all three campuses leads us to believe that the combination of the structure of this activity and the prior work with readings and an explicit equity focus supported PSTs with developing an equity lens for their teaching.

We want to highlight that we did not see many, if any, deficit perspectives in the PSTs' responses both in their written and verbal work. We attribute this both to how we structured this assignment and to our focus on equity, with key exercises, throughout the course. During the course, our PSTs read and reflected on articles focused on equity, and our conversations related to equity occurred weekly and not during a single "equity week." However, even with the "right" kind of discourse, we hoped our students would go even deeper in their discussions of equity in mathematics teaching and learning. We believe we just got them to touch the surface as they were thinking about the dimensions of equity. But, we do believe that as our PSTs engaged in these activities we moved them closer to addressing equity and social justice issues in a coherent way within our mathematics methods course (Koestler, 2012). Our next step will be to see how our work with PSTs translates into their classroom practice and instruction as student teachers and inservice teachers.

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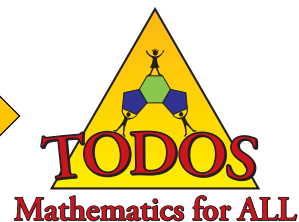
### References

- González, N., Andrade, R., Civil, M., & Moll, L. (2001). Bridging funds of distributed knowledge: Creating zone of practice in mathematics. *Journal of Education for Students Placed at Risk*, 6(1&2), 115-132.
- Gutiérrez, R. (2009). Framing equity: Helping students "play the game" and "change the game." *Teaching for Excellence and Equity in Mathematics*, 1(1), 4-8.
- Gutstein, E. & Peterson, B. (2006). Introduction. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers* (pp. 1-6). Milwaukee, WI: Rethinking Schools, Ltd.
- Koestler, C. (2012). Beyond apples, puppy dogs, and ice cream: Preparing teachers to teach mathematics for equity and social justice. In A. A. Wager & D. W. Stinson (Eds.), *Teaching mathematics for social justice: Conversations with educators* (pp. 99-111). Reston, VA: National Council of Teachers of Mathematics.
- Malloy, C. E. (1997). Including African American students in the mathematics community. In J. Trentacosta & M. J. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 23-33). Reston, VA: National Council of Teachers of Mathematics.
- Malloy, C. E. (2009). Instructional strategies and dispositions of teachers who help African American students gain conceptual understanding. In D. Martin (Ed.), *Mathematics teaching, learning, and liberation of the lives of Black children* (pp. 88-122). New York: Routledge.
- Martin, D. B. (2009). Does race matter? *Teaching Children Mathematics* 16(3), 134-139.
- McKown, C., & Weinstein, R. S. (2008). Teacher expectations, classroom context, and the achievement gap. *Journal of school psychology*, 46(3), 235-261.
- Milner, H. R. (2006). Preservice teachers' learning about cultural and racial diversity: Implications for urban education. *Urban Education*, 41(4), 343-375.
- Stiff, L. V., Johnson, J. L., & Akos, P. (2011). Examining what we know for sure: Tracking in middle grades mathematics. In W. F. Tate, K. D. King & C. R. Anderson (Eds.), *Research and practice pathways in mathematics education: Disrupting tradition* (pp. 63-75). Reston, VA: NCTM.
- Thompson, A., & Radosavljevic, A. (2014). Fostering mathematical discourse With Socratic Seminars. In M. Civil & E. Turner (Eds.), *The Common Core State Standards in mathematics for English language learners: Grades K-8* (pp. 81-94). Alexandria, VA: TESOL International Association.

### Discussion and Reflection Enhancement (DARE) Post-Reading Questions

1. How would you respond to the equity quotations?
2. If you were to add a topic and/or discussion point to the quotations, what might it be and why?
3. In what ways, if any, do the quotations influence your thinking of your mathematics instruction and/or interactions with your students?
4. What methods would you suggest for engaging preservice teachers in thinking about equity in mathematics teaching and learning and why?
5. What additional quotations might be useful for this activity? (See, for example, quotations from the first issue of *TEEM* or from readings in the 2016-17 national equity webinar series, <http://www.nctm.org/webinars/EquitySocialJustice/>.)

**“DARE to Reach ALL Students!”**





### Appendix: Equity Readings for Mathematics Methods

- Avineri, T., Belledin, C., Graves, J., Noble, R., Hernandez, M., Robinson, D., & Teague, D. (2011). Issues of equity for advanced students. In M. Strutchens & J. R. Quander (Eds.), *Focus in high school mathematics: Fostering reasoning and sense making for all students* (pp. 37-63). Reston, VA: NCTM.
- Borgioli, G. M. (2008). Equity for English language learners in mathematics classrooms. *Teaching Children Mathematics*, 15(3), 185-191.
- Bresser, R. (2003). Helping English-language learners develop computational fluency. *Teaching Children Mathematics*, 9(6), 294-299.
- Dance, R.A., Wingfield, K.H., & Davidson, N. (2000). A high level of challenge in a collaborative setting: Enhancing the chance for success for African American students in mathematics. In M. E. Strutchens, M. L. Johnson, & W. F. Tate, *Changing the faces of mathematics: Perspectives on African Americans* (pp. 33-49), Reston, VA: NCTM.
- Dieker, L., Maccini, P., Hunt, J. & Strikland, T. (2011). Minimizing weaknesses and maximizing strengths of students with disabilities. In M. Strutchens & J. R. Quander (Eds.), *Focus in high school mathematics: Fostering reasoning and sense making for all students* (pp. 37-63). Reston, VA: NCTM.
- Gutiérrez, R. (2009). Embracing the inherent tensions in teaching mathematics from an equity stance. *Democracy & Education*, 18(3), 9-16.
- Gutstein, E., & Peterson, B. (Eds.). (2005). *Rethinking mathematics: Teaching social justice by the numbers*. Milwaukee, WI: Rethinking Schools, Ltd.
- Lovin, L. Kyger, M., & Allsopp, D. (2004). Differentiation for special needs learners. *Teaching Children Mathematics*, 11(3), 158-167.
- Martin, D. B. (2009). Does race matter? *Teaching Children Mathematics*, 134-139.
- McCulloch, A.W., Marshall, P.L., & DeCuir-Gunby, J.T. (2009) Cultural capital in children's number representations. *Teaching Children Mathematics*, 16 (3), 184-189.
- Moschkovich, J.N. (2010). Language, culture, and equity in secondary school mathematics classrooms. In J. Lobato (Ed.), *Teaching and learning mathematics: Translating research for secondary school teachers* (pp. 75-80). Reston, VA: NCTM.
- Mueller, M. F., & Maher, C. A. (2010). Promoting equity through reasoning. *Teaching Children Mathematics*, 16(9), 540-547.
- NCTM (2007, July). Research summary: The relation between reform teaching and equity in mathematics education. Retrieved from: <http://www.nctm.org/news/content.aspx?id=12906>
- Stiff, L.V. Johnson, J.L., & Akos, P. (2011). Examining what we know for sure: Tracking in middle grades mathematics. In W.F. Tate, K.D. King & C.R. Anderson (Eds.), *Research and practice pathways in mathematics education: Disrupting tradition* (pp. 63-75), Reston, VA: NCTM.
- White, D. Y., Spitzer, J. S., & Malloy, C. E. (Eds.). (2009). *Mathematics for every student responding to diversity: Grades Pre-K-5*. Reston, VA: NCTM.