

# Inquiry as an Access Point to Equity

Joint Mathematics Meetings  
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## Introduction

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### ■ Claim

inquiry can provide a pathway towards equity

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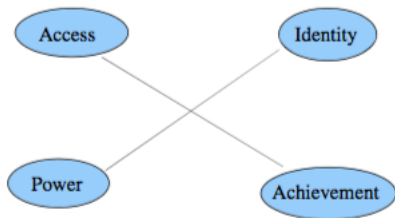
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  - Student Success – “better alignment with how people learn which leads to increased student success” (Cook et al., 2016; pg. 2)

## Dimensions of Equity

- Equity teaching promotes a mindset where all students are capable of learning mathematics (Bullock, 2012; Gutiérrez, 2002; Jett, 2012)

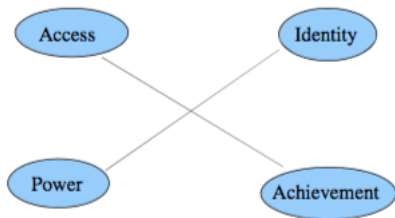
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  - Access, Achievement, Identity & Power



# Access

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- Inquiry invites and encourages all students’ participation in doing, discussing, and presenting mathematics (*Peer Involvement*).
- When all students are given opportunities to be active participants in the classroom (*Doing Math*), students are given an additional access point to learn

# Achievement

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- participation in IBL courses does increase student performance as well as other measures related to this definition of achievement (Laursen, Hassi, Kogan, & Weston, 2014)

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- The instructor is an expert participant (Levenson, 2013) that guides students to generate, create, and develop their own knowledge (*Student Ownership*)



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- “[W]ell I’m a really shy person so **I don’t really like talking in class and this class I was actually forced to** like, get up. ... Like my group would know like, “do you understand something” ... and then I kinda wanna say no and like, “I’m actually kinda confused on this”. And they would, like, taught me like “oh, you would do this” and ... we’d go up on, on the white boards and they’d let me, like, okay like try this. And like, **I was able to understand it cause I was actually doing at the same time.**” (*Student Ownership & Access*)

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- Another step would be to frame inquiry in terms of culturally responsive pedagogy
  - Hernandez, Morales & Shroyer (2013) reviewed literature and found five main themes within the research
- Educators can integrate content that uses mathematics to critically analyze the ways in which students are gendered, classed and raced

Bullock, E. C. (2012). Conducting “good” equity research in mathematics education: A question of methodology. *Journal of Mathematics Education at Teachers College*, 3(2).

Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. Nassir & P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom*. (pp. 105-117). New York, NY: Teachers College Press.

Cook, S., Murphy, S., & Fukawa-Connelly, T. (2016). Divergent definitions of inquiry-based learning in undergraduate mathematics. In *Proceedings of the 18th Annual Conference on Research in Undergraduate Mathematics Education*, 18(1).

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.

Gutiérrez, R. (2007). Context matters: Equity, success, and the future of mathematics education. In *Proceedings of the 29th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1-18). Stateline (Lake Tahoe), NV: University of Nevada, Reno.

Gutiérrez, R. (2009). Framing equity: Helping students “play the game” and “change the game”. *Teaching for Excellence and Equity in Mathematics*, 1(1), 5-7.

Hernandez, C. M., Morales, A. R., & Shroyer, M. G. (2013). The development of a model of culturally responsive science and mathematics teaching. *Cultural Studies of Science Education*, 8(4), 803-820.

Jett, C. C. (2012). “Don’t Just Talk About It; Be About It”: Doing Equity Work in Mathematics Education. *Journal of Mathematics Education at Teachers College*, 3(2).

Laursen, S. L., Hassi, M. L., Kogan, M., & Weston, T. J. (2014). Benefits for women and men of inquiry-based learning in college mathematics: A multi-institution study. *Journal for Research in Mathematics Education*, 45(4), 406-418.

Levenson, E. (2013). Tasks that may occasion mathematical creativity: teachers' choices. *Journal of Mathematics Teacher Education*, 16(4), 269-291.



Thank You!

*Questions?*

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