

## **LEARNING FROM VARIABILITY IN STUDENTS' MATHEMATICS CLASSROOM PARTICIPATION**

Megan Franke  
UCLA

Educators, researchers, and policy makers recognize that student participation in classroom mathematics conversations, especially explaining one's own thinking and engaging with others' ideas, can promote students' mathematics learning. Two central ways of participating that support learning involve: articulating one's own ideas and engaging with the ideas of others. Researchers have detailed ways to understand these forms of participation as well as how to support them in classrooms (i.e. Mercer, Hennessy, & Warwick, 2019, Michaels, O'Connor, & Resnick, 2008). Accumulating empirical evidence supports the link between these ways of participating in mathematical conversations and learning outcomes (Forman, Ramirez-DelToro, Brown, & Passmore, 2017; Howe, 2017; Webb et al., 2014). However, we also know that the nuances in how students participate and how teachers support them matters for student and teacher learning (Webb et al., 2009; Webb et al., 2014)). We also are learning there is tremendous variability in how students choose to participate, in what spaces and aspects of the lesson they participate and in how teachers take up students' varied forms of participation. Focusing on variability affords us the opportunity to not only understand what enables participation but also open up spaces to see different approaches to participation as productive for students.

Over a series of studies we found that the relationships between participation and learning outcomes were dependent upon the mathematical details embedded within student contributions (Webb et al., 2009). These details were critical for students and teachers. Students explaining the details of their ideas and engaging in the mathematical details of others' ideas supported their participation and learning (Webb et al., 2014). Teachers' specific follow up questions that referenced details of students' ideas were often necessary to support students to detail their thinking and engage with the mathematical details of their peers (Franke et al., 2009; Webb et al., 2009). Our recent studies delve into the specifics of student and teacher participation and provide evidence of the variability in both when and how students participate and how teachers take up and support students' varied participation (Webb et al., 2019; 2021). Teachers are using different phases of the lesson (warm up or share out) and different classroom structures (turn and talk or whole class discussion) to support student participation and finding ways to leverage the details of students' ideas whether complete or incomplete. The variability we are capturing has implications for how we characterize student participation around explaining and engaging with other's ideas, how we position students in relation to their participation and whose participation counts, how we support teachers as well as how we capture and make claims about participation.

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