

Chapter 9


Supporting Equity Through Mathematical Writing

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ABSTRACT

This chapter establishes the relationship between the National Council of Teachers of Mathematics NCTM principles to action, Gutiérrez equity framework, and mathematical writing. The chapter discusses the research that supports mathematical writing as an instructional practice that enhances opportunities for reasoning learning and equity. The chapter provides four cases of activities that embed mathematical writing in the classroom. Each case describes implementation, examples of students' work, discussion of their work, extensions, and outlines the activities connection to the equity framework. The cases are concluded with takeaways that reinforce the purpose of each activity and strategies for implementation. The chapter closes with implications to further support the use of mathematical writing in the classroom and future research direction.

BACKGROUND

The National Council of Teachers of Mathematics' ([NCTM]; 2014) *Principles to Action* shares eight empirically-based mathematics teaching practices that advance the use of effective and equity-based learning opportunities in mathematics. The eight practices highlight effective mathematics instruction that promote reasoning, problem solving, using, and understanding various representations, making connections, engaging in meaningful discourse, and demonstrating evidence of student thinking. In essence, these principles weave together what it means to be mathematically literate. Steen and colleagues (2007) define mathematical literacy as “the capacity to make effective use of mathematical knowledge and un-

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derstanding in meeting challenges in everyday life” (p. 285). Writing in mathematics has the potential to build understanding (Graham et al., 2020; Pugalee, 2004), increase metacognition (Bangert-Drowns et al., 2004), increase equity (Bieda & Staples, 2020), and support students in becoming mathematically literate. Students’ writing in mathematics can serve as a formative assessment tool that allows teachers to be intentional with their instruction.

Furthermore, infusing writing opportunities in the mathematics classroom provides pathways for learners to engage in equity-based mathematics where they have agency and autonomy to select strategies to solve mathematics tasks and then communicate about their reasoning and mathematical ideas (Gutierrez, 2009; 2012; Martin & Polly, 2019). Additionally, allowing students to write about mathematics concepts and their mathematical ideas provides opportunities for students to access and engage with mathematics concepts in multiple ways that may help develop a deeper understanding of concepts and strategies (Hattie et al., 2016). Learners develop a deeper understanding of concepts when they are able to access content in multiple ways (Hattie, 2009; Hattie et al., 2016).

This chapter examines writing in mathematics, using writing as a tool to learn, and writing to increase equity in the classroom. Once these areas are discussed, the authors present examples of how writing can be used in mathematics classrooms to discuss how these examples relate to learning, equity, and formative assessment.

FRAMING EQUITY-BASED MATHEMATICS TEACHING

As we consider how mathematical writing advances both access and equity for students in mathematics, it is beneficial to frame what we mean by access and equity. Gutiérrez (2009; 2012) described four elements of equity-based mathematics instruction (Table 1). The dominant axis consists of access and achievement. It refers to what is needed to be successful in the current environment, Gutiérrez describes the dominant access as “how well students play the game called mathematics.” The critical axis includes identity and power, this is where students’ resources are highlighted to allow them to “change the game.” Table 1 describes these elements in general, it is important to point out that in some of her writing Gutiérrez (2012) has advocated that power includes two aspects student power and agency in the mathematics classroom as well as broader systems-level view of power related to who has power related to educational and societal systems.

Table 1. Framework for equity in mathematics (Adapted from Gutiérrez, 2012)

Dominant Axis	
Access	Students have resources to support mathematics learning, such as high-quality teachers, adequate technology and resources in the classroom, a curriculum aligned to standards, and a classroom environment that invites participation from all learners.
Achievement	Students are active participants in mathematics classes; their test scores and their participation in the math pipeline of mathematics courses provide opportunities to lead to careers in mathematics.
Critical Axis	
Identity	Students view themselves as mathematicians and can see themselves in their curriculum and mathematics that they do. Additionally, the extent to which mathematics provides students with a broader view of the world.
Power	Students have a voice and agency in the classroom.

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