

Chapter 1

Framing Our Understanding of Mathematical Writing

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ABSTRACT

In this chapter, the authors situate mathematical writing within the context of discourse, define mathematical writing, describe the classroom environment that fosters mathematical writing, and share experiences engaging elementary students in mathematical writing. At their core, the types of mathematical writing are defined by the purposes for which students write in the mathematics classroom. The authors further describe the types of mathematical writing teachers prompt and are nurtured by the classroom environment. The insights shared draw from the authors' previous and current research endeavors, advancements in curriculum development, collaborations with mathematics coaches, and experiences teaching elementary students and supporting preservice and inservice teachers. They end the chapter by highlighting some directions for future research to expand our understanding of this crucial area in mathematics education.

INTRODUCTION

Our collective intrigue about mathematical writing began many years ago at the University of Connecticut in the United States when our paths crossed during several ventures. The one that most influenced our work in this area was when we collaborated on the Elementary Mathematical Writing Task Force that

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was convened in 2016 with funding from the National Science Foundation (Grant No. 1545908, *Task Force on Conceptualizing Elementary Mathematical Writing: Implications for Mathematics Education Stakeholders*). The task force aimed to define more robust notions of mathematical writing because it was not yet fully realized in the research and practitioner literature. We invited educators with various backgrounds, experience, and expertise to help ensure the outcomes were comprehensive and would attend to all students' needs. The task force members included researchers, mathematics coaches, curriculum developers, assessment developers, and teachers with experience and expertise in mathematics and writing education; elementary, secondary, and tertiary education; and regular, special, and gifted education.

Tutita led the Elementary Mathematical Writing Task Force, Maddie participated in the discussions and gathered data as a doctoral graduate assistant, and Fabiana enhanced the task force's work by sharing her insights as a mathematician about writing within the discipline. We have since expanded on this project and continued to advance the research base that has demonstrated that engaging students in mathematical writing benefits their learning (e.g., Bangert-Drowns et al., 2004; Bicer et al., 2018; Casa et al., 2017; Cohen et al., 2015; Cross, 2009; Gavin et al., 2009; Gavin, Casa, Adelson et al., 2013; Gavin, Casa, Firmender et al., 2013; Graham et al., 2020; Kostos & Shin, 2010; Pugalee, 2004; Tan & Garces-Bascal, 2013). We are honored to have the opportunity through this book, *Illuminating and Advancing the Path for Mathematical Writing Research*, to promote other scholars' work in this area. Following Graham's (2019) lamentation that "many students do not receive the writing instruction they need or deserve" (p. 277), it is essential for mathematics educators to coalesce around the definition of mathematical writing for students to accrue the greatest benefits from research and practice.

The purposes of this chapter are to situate mathematical writing within the context of discourse, expand on the types of mathematical writing that are prompted by teachers or nurtured by the classroom environment, describe the classroom environment that supports students' engagement in all types of mathematical writing, share some experiences supporting elementary students, and suggestions for future research. The insights we share draw from our previous and current research endeavors. We too build off our efforts in developing curriculum materials that involved collaborating with mathematics coaches, guiding preservice and inservice teachers, and teaching elementary students.

BROADENING NOTIONS OF DISCOURSE

Educators may readily agree with the notion that "discourse practices warrant the attention of mathematics educators because discourse is the primary medium of education" (Wagner, Herbel-Eisenmann & Choppin, 2012, p. 1) if they envisage speaking mathematically. Researchers have long documented the benefits of such talk on student's learning of mathematics (cf., Cobb et al., 1997; Kazemi & Stipek, 2001; Stein et al., 1996; Wood et al., 2006). Subsequently, teachers have been able to capitalize on this research base by drawing from quality instructional resources (cf., Chapin et al., 2009; Kazemi & Hintz, 2014; Kersaint, 2015; Smith & Stein, 2011) to benefit their students.

The National Council of Teachers of Mathematics' (NCTM) seminal definition of discourse presented in the *Professional Standards for Teaching Mathematics* (1991) suggests that discourse comprises more than talk:

The discourse of a classroom—the ways of talking, agreeing and disagreeing—is central to what students learn about mathematics as a domain of human inquiry with characteristic ways of knowing. Discourse

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