Chapter 5
Dialogically Focused Secondary Mathematics Teachers' Orientations Toward Mathematical Writing:
A Multiple-Case Study

Ethan P. Smith
Washington State University Tri-Cities, USA

ABSTRACT

Because mathematics classrooms entail expectations for students to communicate understanding through both writing and spoken discourse, it is important to consider the place of writing in the context of such discourse. This chapter details a case study centered around three dialogically focused high school mathematics teachers and their orientations toward mathematical writing. Teachers in this study were first asked to describe their orientations toward mathematical writing. Then, they were asked to reflect on samples of student writing and recordings from their classrooms to further understand how they orient toward students' mathematical writing. Findings suggested that these teachers' orientations toward mathematical writing are embedded in broader views that they hold toward discourse, feedback, and student and teacher self-efficacy around writing. Findings also indicated the value of using the construct of teacher noticing to help investigate and strengthen teachers' orientations toward mathematical writing.

INTRODUCTION

Fostering students' effective communication of mathematical ideas is a critical goal of mathematics education. For instance, The National Council of Teachers of Mathematics (2000) describes the importance of challenging students "to think and reason about mathematics and to communicate the results of their thinking to others orally or in writing" (p. 60), while the Common Core State Standards Initiative (2010) includes an explicit call for mathematically proficient students to be able to "Construct viable arguments

DOI: 10.4018/978-1-6684-6538-7.ch005

and critique the reasoning of others" (p. 6). Ultimately, students must grapple with multiple language demands in the math classroom that extend and connect across different modes of language, including reading, writing, speaking, and listening (Aguirre & Bunch, 2012). This suggests the importance of mathematics teachers attending to both written and spoken language in the classroom.

Although math students do grapple with both written and spoken language, attention toward spoken discourse in the classroom has been more prevalent in mathematics education research (Morgan, 1998; Pugalee, 2004). Additionally, many mathematics teachers are unfamiliar with even the idea of writing-to-learn mathematics and associated writing activities (Teuscher et al., 2015). Indeed, one of the most prominent instructional models in mathematics education has been referred to as *dialogic instruction*, which emphasizes the importance of student exploration with and discourse around novel mathematics tasks (Munter et al., 2015). However, even mathematics teachers whose instruction is dialogically focused often center their classroom discourse around the perceived strength of students' written work (Smith, 2021), so it is not as if students' writing and speaking in school mathematics are diametrically opposed. To this end, understanding the orientations of dialogically focused mathematics teachers could better situate the role of mathematical writing in such classrooms.

This chapter focuses on how a group of three secondary mathematics teachers with dialogically focused instruction oriented themselves toward mathematical writing. Using a multiple-case study approach (Yin, 2018), I drew on interview data and recordings of classroom instruction to better understand how these teachers described their orientation toward mathematical writing, and how such descriptions related to their broader views on teaching and learning mathematics. By using video clips from these teachers' classrooms, I also address how these teachers interpreted samples of students' written work in order to shape (van Es & Sherin, 2021) their noticing of student thinking. I employed these approaches in order to answer the following two questions: (1) How does a group of secondary mathematics teachers with dialogically focused instruction describe their orientation toward mathematical writing? and (2) What are some of the ways that these teachers use students' mathematical writing to help shape their understanding of student thinking?

BACKGROUND

Dialogic instruction (Munter et al., 2015) is a prevalent approach toward mathematics instruction that emphasizes the importance of discourse and mathematical talk in supporting students' learning of mathematics. Because classroom discourse can support students' engagement with each other's ideas and learning in mathematics (Webb et al., 2014), dialogic instruction offers promise in addressing the language demands of the classroom and supporting broader educational policy goals around fostering communication in mathematics. Such instruction entails the use of high cognitive demand tasks, opportunities for students to discuss different strategies or representations, and student discourse (Henningsen & Stein, 1997; Munter et al., 2015), but the role of mathematical writing in the context of such classrooms is less understood. Indeed, classroom spoken discourse has long received more attention compared to students' written work in mathematics education research (Morgan, 1998; Pugalee, 2004).

This lack of clarity in the literature on the role of writing within the context of dialogic instruction gives rise to concerns about how mathematical writing is understood and addressed by educators in the classroom. Mathematical writing can consist of not only the written word (e.g., the construction of words, phrases, and sentences) but also mathematical symbolism and visual imagery (Casa et al.,