

Developing a Coding Scheme to Analyze Instructor Questioning in Mathematical Discussions

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Mathematical discussion is a central feature of mathematics instruction, which is shaped by the types of questions an instructor poses and the ways that students respond. Existing literature has introduced frameworks delineating types of questions that an instructor can pose, such as open and closed questions (Sullivan & Lilburn, 2002), higher-order and lower-order questions (Brahier, 2020), and open questions not calling for reasoning (Vacc, 1993). Additional work has also looked at the types of questions that could be asked that connect to relational practices (Wood et al., 2015), e.g., “How are we feeling about this?”. Yet, we do not know how an instructor’s questions impact the way students begin to develop rich, self-prompted responses.

We aim to investigate the following research question: How can an instructor use questioning and evaluation to motivate students to autonomously contribute toward mathematical discussions in more meaningful ways? In this poster, we outline the development of our coding scheme, present preliminary findings on mathematics classroom instruction, and discuss the nuances of the coding scheme. As a theoretical framing, we adopt one of Anthony’s (1996) constructivist formulations for active learning, which characterizes students as mentally engaged in active thinking which promotes intellectual involvement (Kyriacou & Marshall, 1989). Incorporating this perspective into instructor-facilitated mathematical discussions, we assume that if a student provides a high-level response to questions posed by the instructor (i.e., by supporting an answer with details about their process or reasoning), then they are demonstrating an internalized understanding of the mathematical material.

The dataset used for this study consists of two 30-minute class recordings of an undergraduate mathematics content course for future elementary teachers taught by Author 2 taken from the middle and end of the semester. From the transcripts, each solicitation of input from Author 2 and each student’s contribution was logged using the developing coding scheme. The coding scheme was then developed through multiple iterations of data analysis. The EQUIP tool (Reinholz & Shah, 2018) served as an initial coding scheme, including codes for Solicitation Type (*What/How/Why*), Length of Talk, and Student Talk Type (*What/How/Why/Other*). After a first iteration of coding, we created codes that accounted for non-mathematical types of questions, such as personal questions fostering relationships with students and logistical questions. After a second round of coding, we created codes that accounted for whether a *What* question was *Open-Ended* or *Closed-Ended* as well as codes that allowed us to identify non-verbal ways of participation.

Preliminary findings show that students demonstrated richer (e.g., more contributions coded as *How* or *What* codes) and more extensive mathematical responses later in the semester, which featured more varied types of instructor solicitations. There were multiple instances in both segments where students provided higher-level responses than the solicitation type. Through this data, we aim to stimulate conversations about the multiple ways instructors can facilitate high-level mathematical discussion and further refine the coding scheme. Subsequent work will incorporate this revised scheme into a larger analysis of an entire semester of the course.

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