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Mathematical Modeling and Classroom Discourse: A Case for Modeling-specific Discussion Strategies

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Mathematical modeling has become increasingly pertinent to mathematics education due to its benefits on student learning and engagement (e.g., Blum & Niss, 1991; Lesh, Hoover, Hole, Kelly, & Post, 2000; Zbiek & Conner, 2006). One integral aspect of mathematical modeling is mathematical discourse (Lesh et al., 2000), which activates and builds students' background knowledge (Henningsen & Stein, 1997). Productive mathematical discourse promotes the sharing of ideas, expands upon student thinking, clarifies understandings, and fosters credible argumentation (Smith, Steele, & Raith, 2017). While research has been sufficiently conducted on classroom discourse (Boaler & Brodie, 2004; Chapin & O'Connor, 2007; Chapin, O'Connor, & Anderson, 2003; Reinhart, 2000), little is known about discourse and teacher discussion strategies unique to mathematical modeling. This study aims to answer the question, "What discussion strategies specific to mathematical modeling promote students' diverse thinking and facilitate productive mathematical discourse associated with mathematical modeling problems?"

The study examined the implementations of three mathematical modeling activities with 21 middle-grade students. We analyzed the video transcripts of classroom interactions and students' written work using analytical-inductive methods, which included a-priori codes from literature on discourse (e.g., Chapin & O'Connor, 2007; Chapin et al., 2003; National Council of Teachers of Mathematics, 2014) and new codes for mathematical discourse developed using the constant comparative method (Glaser, 1965).

Preliminary Findings

Analyses and coding of the lesson transcripts demonstrated a toolkit of discussion strategies which harnessed the unique aspects of mathematical modeling. Teachers facilitated discourse by relevantly recontextualizing the problem, probing students' responses for assumptions, encouraging multiple perspectives, stimulating students' decision-making, emphasizing students' reasoning, promoting common language, and prompting revision of students' thinking. Students presented diverse thought processes within the mathematical discourse, as well. Specifically, analysis of students' written solutions and the transcript showed diversity in students' mathematical approaches, which resulted in manifold, valid solutions. Further, the use of these strategies generated productive mathematical discourse; that is, students shared their ideas, expanded on each other's thinking, formed convincing arguments, and clarified understandings. In our session, we will present how productive discourse can be used in conjunction with authentic, open-ended tasks and report the positive student outcomes associated with discussion strategies specific to mathematical modeling.

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