Teachers’ Models of Student Responses to Middle School Algebraic Tasks

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Dissertation Abstract

Often, the difficulties of students to make the cognitive leap from arithmetic to algebra is related to instructional strategies. The way teachers make sense of their practice, in turn, informs pre-service and in-service algebraic instruction. Algebraic instruction is also of current interest due to recent national initiatives calling for all students to learn high school algebra.

The purpose of this study was to describe middle school mathematics teachers’ models or interpretations of students’ responses to middle school algebraic tasks. The research questions focused on the nature of the teachers’ developing ideas and interpretations of student responses from selected algebraic tasks involving the distributive property and equivalent expressions. The core research questions were: (a) What information do middle school mathematics teachers acquire about their students’ algebraic thinking?, and (b) How do middle school mathematics teachers interpret their students’ algebraic thinking?

A models and modeling framework guided the study’s design. Model-eliciting activities were used to perturb and at the same time reveal their thinking. These activities consisted of asking the teachers to create a “Ways of Thinking” sheet based upon students’ responses to the selected algebraic tasks, and to select, analyze and interpret samples of student work. Five teachers participated from two middle schools. Data collection included classroom observation, artifact collection from the model-eliciting activities, semi-structured interviews, and team discussions.

Two sets of findings emerged from this study. First, I concluded that the models and modeling perspective is indeed an effective methodology to elicit teachers’ models of their students’ algebraic thinking. Second, I found the following five aspects are central to teacher’s models of student responses to tasks with equivalent expressions and the distributive property.
Teachers recognized that students: (a) tended to conjoin expressions, (b) desired a numerical answer, and (c) had difficulty writing algebraic generalizations. In addition, teachers identified that (d) visual representations were highly useful as instructional tools. And finally, (e) the teachers in this study needed more experience in analyzing and interpreting student work. The findings from this study revealed consistent information across the Ways of Thinking sheets, library of student work, individual and team interviews, and classroom observations.