

## Here's What You Do: Personalization and Ritual in College Students' Algebraic Discourse

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*We present results of a discourse analysis focused on college algebra students' uses of personal and impersonal language, references to endorsed mathematical routines, and inferences about mathematical objects in responses to a small-group problem-posing activity. We analyze students' responses with respect to selected dimensions of the arithmetical discourse profile of Ben-Yehuda et al., and provide evidence of a positive association between impersonal language and the presence of object-level mathematical statements and precise uses of algebraic terminology.*

*Key words:* College Algebra, Discourse Analysis, Mathematical Routines

Students' comprehension of mathematical ideas is inextricably linked to their processes of communication (Wittgenstein, 1953; Sfard, 2007). Ben-Yehuda et al. (2005) developed the *arithmetical discourse profile* as a tool for describing and analyzing students' use of words, mediators, and routines (Sfard, 2007; 2016) when communicating about mathematical tasks. Statements in mathematical narratives can be classified as *personal* (involving a human actor performing mathematical operations) or *impersonal* (describing mathematical structure without personalization) (Ben-Yehuda et al., 2005). Empirical studies have suggested a negative correlation between the use of personalized language, such as "I" and the past tense, and achievement levels in young children (Bills, 2002). Statements in mathematical narratives can additionally be classified into *object-level* statements about mathematical objects, and *meta-level* statements about the discourse itself (Sfard, 2007). In this study, we explore college algebra students' uses of language in mathematical narratives; in particular, we investigate associations between impersonal descriptions of routines and other features of literate mathematical discourse, such as correct uses of algebraic terminology and object-level statements (such as that when the division  $P(x) / (x - a)$  leaves a remainder of zero,  $a$  is a zero of  $P(x)$ ).

For this study, students in three large sections of college algebra (total enrollment 327 students) participated in a small-group activity in which each group wrote an open-ended problem that could be used to review for an upcoming exam, and worked together to produce a written solution to the problem they created. Students were permitted to write a problem on any topic covered by the upcoming exam; however, most problems dealt with polynomial functions and their zeroes. We found that students' written solutions were largely governed by routines prescribed by the course text (Abramson, 2012) and endorsed by guided notes published by the course instructors; however, students' descriptions of these routines varied in their use of personal and impersonal language and in their uses of mathematical terminology and reasoning. We hypothesize that in some cases, the use of personal language was dictated by the topic selected for the problem; for example, narratives of synthetic division relied heavily on descriptions of human actions on mediators (e.g., "Make sure to bring down the first coefficient."). For many other topics, uses of personal language by students appeared to mimic uses of personal language in the textbook and guided notes. However, some topics led to greater variation in uses of personal and impersonal language. Our poster will report on this variation and present examples of both personal and impersonal descriptions of algebraic routines, and illustrate instances in which impersonal discourse is associated with greater precision in uses of mathematical terminology and algebraic reasoning.

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