College Algebra Students’ Understanding of the Concept of Variable

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Dissertation Abstract

The concept of variable is a central idea in mathematics at all levels. Understanding of this concept provides the basis for the transition from arithmetic to algebra, lays the foundation for the understanding of functions and all advanced mathematics, and is necessary in real-world problem solving. However, research indicates that students have difficulty understanding the concept of variable.

The purpose of this study was to develop a better understanding of college students’ conception of variable. The research questions that guided this study were: (a) What are students’ conceptions of variable? (b) What effect do the choices of literal symbol have on students’ performance” (c) What roles of variables do students use? and (d) How do students actively change from one definition of role of variable to another within the same problem?

This study was based on three frameworks. Philipp (1992) presented a categorization of literal symbols: labels, constants, unknowns, generalized numbers, varying quantities, parameters, and abstract symbols. Usiskin (1988) provided a framework to examine the different uses of variables in relation to the purpose for teaching algebra and the conception of algebra. This study also used Hiebert and Carpenter’s (1992) framework for thinking about understanding.

Thirteen students enrolled in a college course (algebra or precalculus) were asked to answer a set of problems using a think-aloud procedure. In-class observation and analysis of the textbook, assignments and exams were used to categorize the set of problems.

I found that students recognized and used, with little difficulty, variables as unknowns and as generalized numbers. This result is related to the roles of variable that students learned in the classroom. I also found that students’ level of confidence in approaching standard algebra problems was higher for familiar type of problems than for non-familiar type of problems. Thus,
students need to be exposed to more situations that involve the different aspects of the concept of variable.

As expected, the more advanced math course, the more sophistication on the solutions, and less difficulty on using variables. Also, students talked more about their reasoning and were more articulate in their explanations for their solutions. I also present a model of solving word problems and a framework for algebraic variables.