

# **GRADE 4 – 6 STUDENT CONCEPTIONS AND UTILIZATION OF INFORMAL AND FORMAL VARIABLE REPRESENTATIONS ACROSS MATHEAMTICALLY EQUIVALENT TASKS**

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## **ABSTRACT**

This study reports how 24 grade 4-6 students in one elementary and middle school interpreted formal (e.g.,  $x + y = 12$ ) and informal representations of variables (e.g.,  $\square + \triangle = 12$ ). While interpretations for variables represented as letters (e.g.,  $x$  and  $y$ ) have been well established for students in algebra classes and beyond, little research into elementary school students' initial interpretations of variables exists.

The students were consistent in their meaning of various representations of variables presented in equations, but did not parallel normative algebraic solutions. For example, students treated the representation of the variables as different variables and consistently produced multiple solutions for each variable (e.g.,  $y + y = 12$ ;  $a + b = 12$ ; and  $\square + \triangle = 12$ ). Further, the common misconception that different variables can only take on different values was not a typical response for these students (Fujii, 2003).

When these same tasks were presented as word problems, students treated variables in an algebraically normative way. In other words, the students were more “successful” solving the word problems (Koedinger & Nathan, 2004). Students attended to the syntactic and semantic structure of the word problems to determine meanings for the variables that were not evident in the equations.