

Meeting: 1003, Atlanta, Georgia, MAA CP V1, MAA Session on Research on the Teaching and Learning of Undergraduate Mathematics

1003-V1-881 **Jennifer A Kaminski*** (kaminski.16@osu.edu), 1961 Tuttle Park Place, Center for Cognitive Science, Ohio State University, Columbus, OH 43210-1201, and **Vladimir M Sloutsky** and **Andrew F Heckler**. *What symbols facilitate learning and transfer of mathematical concepts? College students' performance on learning instantiations of Abelian groups.*

A goal of successful learning is transfer, or the ability to apply acquired knowledge outside the learned situation. When presenting a new mathematical concept to students, what factors hinder or facilitate transfer? The goal of this research was to investigate learning and transfer across isomorphic systems. Of particular interest was the effect of concreteness. College undergraduates learned the mathematical concept of an Abelian group of order three. This concept was instantiated in domains of varying concreteness. In order to eliminate potential confounds stemming from prior mathematical knowledge or expectations, artificial domains were constructed. Concreteness of the domains was manipulated by increasing the perceptual richness of symbols denoting entities in each domain. In experiments 1 and 2, transfer from more abstract to more concrete was greater than the reverse. The results of experiment 3 were that the use of concrete, perceptually rich symbols hindered learning. This research argues that concreteness may have substantial learning and transfer costs, whereas abstractness may have benefits. The implications for the teaching of mathematics are that there are advantages to introducing concepts to students in an abstract, generic form. (Received September 30, 2004)