Crooks, Noelle. (2014). Does Comparison Promote Gains in Conceptual Learning? The Case of Learning about Confidence Intervals.

Abstract

Recent reforms in statistics education have called for a shift away from the traditional emphasis on procedures and calculations, to a more balanced emphasis on both conceptual and procedural knowledge. Although little research has addressed ways to promote conceptual learning of statistics, it may be possible to adapt ideas from research on mathematical thinking to develop methods for fostering knowledge of statistics concepts. Building on research on mathematics learning, the current study explored two factors hypothesized to affect students' acquisition of conceptual knowledge in statistics: the order in which related concepts are introduced, and the opportunity to compare related concepts. This dissertation investigated these factors in the context of a lesson on confidence intervals (CIs), which are a difficult statistical concept that require both procedural and conceptual knowledge. The lessons focused on two ways to interpret CIs: one based on estimation, which emphasized underlying concepts, and one based on null hypothesis significance testing (NHST), which emphasized the procedure for determining significance. Participants were randomly assigned to one of four lesson conditions, which differed in the order in which the two approaches to CIs were presented (NHST-first vs. estimation-first) and the presence/absence of concept comparison. Participants completed a pretest measure of CI knowledge and then viewed their assigned lesson. After viewing the lessons, participants completed a posttest knowledge assessment. I predicted that participants would have low levels of baseline conceptual knowledge. Further, I predicted that, if order of presentation mattered, participants seeing NHST presented first would learn less than participants seeing estimation presented first. Finally, I predicted that comparison would positively affect learning. As expected, students had poor pretest conceptual knowledge. After viewing the lessons, participants made significant gains on the posttest measures. There was no effect of the order in which the information was presented. Comparison influenced learning of some CI concepts; specifically, those explicitly referenced during the comparison. These findings extend past research on comparison in learning to a new domain (statistics), a new type of comparison (between interpretations), and to instructor-led comparisons. The current study suggests that comparison may be a valuable tool for fostering conceptual statistics knowledge.