

Abstract

Recommended learning goals for students in introductory statistics courses include the ability to recognize and explain the key role of randomness in designing studies and in drawing conclusions from those studies involving generalizations to a population or causal claims (GAISE College Report ASA Revision Committee, 2016). The purpose of this study was to explore introductory statistics students' understanding of the distinct roles that random sampling and random assignment play in study design and the conclusions that can be made from each. A study design unit lasting two and a half weeks was designed and implemented in four sections of an undergraduate introductory statistics course based on modeling and simulation. The research question that this study attempted to answer is: *How does introductory statistics students' conceptual understanding of study design and conclusions (in particular, unbiased estimation and establishing causation) change after participating in a learning intervention designed to promote conceptual change in these areas?* In order to answer this research question, a forced-choice assessment called the Inferences from Design Assessment (IDEA) was developed as a pretest and posttest, along with two open-ended assignments, a group quiz and a lab assignment. Quantitative analysis of IDEA results and qualitative analysis of the group quiz and lab assignment revealed that overall, students' mastery of study design concepts significantly increased after the unit, and the great majority of students successfully made the appropriate connections between random sampling and generalization, and between random assignment and causal claims. However, a small, but noticeable portion of students continued to demonstrate misunderstandings, such as confusion between random sampling and random assignment.