REASONING ABOUT INFERENCE USING TRADITIONAL AND SIMULATION-BASED INFERENCE MODELS

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2016

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

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December 2016

Chair: Tim Jacobbe
Major: Curriculum and Instruction

At the recommendation of prominent statistics educators, most notably George Cobb (2007), simulation-based inference methods have begun to replace or complement traditional inference methods in a number of introductory courses, including statistics courses at the high school level (Rossman & Chance, 2014). Developers of curricula that employ simulation-based inference as the primary means of teaching inference have published studies comparing their students' understanding to students in traditional courses (e.g., Garfield et al., 2012; Tintle et al., 2012, 2011). However, these studies, which feature quantitative analysis of student performance on summative assessments, have not provided theory to explain how novices employ the tools and representations of traditional and simulation-based inference models. The existing literature also fails to illuminate student conceptions of inferential topics in courses that employ both traditional and simulation-based methods to introduce the logic of inference.

Traditional inference methods and simulation-based inference methods are two models (and corresponding representational systems) used to express the logic of inference. Using the models and modeling theoretical perspective (Lesh & Doerr, 2003),

this dissertation explores the following central research question: How do students use traditional inference models and simulation-based inference models to understand inference?

The data for this study were collected in an AP Statistics course that employed both traditional and simulation-based inference methods. The data include student responses to targeted formative assessments, exam items, and survey items; daily field notes and journal entries written by the teacher-researcher; and transcripts of individual and group interviews. Data analysis involved a process of systematic coding, following the guidelines for grounded theory provided by Charmaz (2014).

The findings of this study are presented as three scholarly articles. The first examines how students use inferential models, representations, and tools as they reason about a statistical inference task. The second identifies common errors associated with simulation-based inference and characterizes the statistical conceptions underlying those errors. The third illustrates the connections that students make between approaches and offers recommendations for a course that includes both traditional and simulation-based models in instruction.