

Pedagogical considerations for simulation-based inference in a large-enrollment introductory biostatistics course.

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Outline:

- ▶ Brief Course Description
- ▶ Pedagogical opportunities
 - ▶ Simulation-based inference (SBI)
 - ▶ Large enrollment
 - ▶ Intersection of SBI & large enrollment
- ▶ Compare/contrast approaches (i.e. informal discussion)

Brief Course Description

- ▶ STAT 250: Introduction to Biostatistics
- ▶ 225 students enroll each semester
- ▶ Lecture Mon & Fri (50 min; all students)
- ▶ Lab Wed (50 min; 3 sections x 75 students)
- ▶ Design
 - ▶ Question of the day (life science; sometimes PSU rsh)
 - ▶ StatKey + Minitab
 - ▶ In-class exams

Pedagogical opportunities: SBI

- ▶ Mathematical exposure
 - ▶ Fewer appeals to unseen mathematics (i.e. “hand waiving”)
 - ▶ Natural scaffolding
 - ▶ Tangible/tactile introduction (Ernst 2004; Rossman, 2008)
 - ▶ Permutation distribution as possible segue (Ernst, 2004)
 - ▶ Transfer tedious yet simple process to computer (Cobb, 2007)
 - ▶ Intuition built on frequencies (Gigerenzer & Hoffrage, 1995)
- ▶ Flexibility of application (Efron, 2000, p. 1294)
- ▶ Facilitates some useful conversations
 - ▶ Thinking under the null (Wild et al. 2011)
 - ▶ p-values and the nature of randomness (Rossman, 2008)
 - ▶ Why OK to sample with replacement?

Pedagogical opportunities: SBI

- ▶ Introduce key concepts using SBI; revisit with non-SBI
 - ▶ Lock et al. (2013)
 - ▶ Tintle et al. (2016)
 - ▶ Zieffler et al. (2015); Garfield et al. (2012)
- ▶ SBI students seem to perform as well or better than peers in non-SBI courses
 - ▶ Maurer & Lock (2016)
 - ▶ Beckman, delMas, & Garfield (in press)
 - ▶ Tintle et al. (2012)

Pedagogical opportunities: Large enrollment

- ▶ Large sample size for student generated data (GAISE, 2016)
 - ▶ reliable demonstrations of asymptotic properties (e.g. CLT) using data generated in-class
 - ▶ unusual observations often generated in-class
 - ▶ outliers (e.g. wrong units & typos)
 - ▶ legitimate extreme obs. (the tails are real)
 - ▶ sensitivity analysis discussions
- ▶ (Anonymous) Engagement
 - ▶ Crowd-sourced Q&A
 - ▶ Live SMS inbox
 - ▶ Clickers
 - ▶ instant feedback
 - ▶ instant run-off

Pedagogical opportunities: Intersection of SBI & large enrollment

- ▶ Example: m&m activity in lecture
 - ▶ Live capture in Google Sheet
 - ▶ class approximates a sampling distribution
 - ▶ student builds bootstrap distribution
 - ▶ tangible comparison of sampling dist & bootstrap dist
- ▶ Example: StatKey on smart phones (during lecture)
 - ▶ accessible & scalable technology integration
 - ▶ partner work (one run the app; one take notes)

References (1 of 2)

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Compare/contrast approaches (i.e. informal discussant)