

“IS THIS SAMPLE UNUSUAL?”: AN INVESTIGATION OF STUDENTS EXPLORING
CONNECTIONS BETWEEN SAMPLING DISTRIBUTIONS
AND STATISTICAL INFERENCE

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Abstract

This study explores the reasoning that emerged among eight high school juniors and seniors as they participated in a classroom teaching experiment addressing stochastic conceptions of sampling and statistical inference. Toward this end, instructional activities engaged students in embedding sampling and inference within the foundational notion of *sampling distributions*—patterns of dispersion that one conceives as emerging in a collection of a sample statistic’s values that accumulate from re-sampling.

The study details students’ engagement and emergent understandings in the context of instructional activities designed to support them. Analyses highlight these components: the design of instructional activities, classroom conversations and interactions that emerged from students’ engagement in activities, students’ ideas and understandings that emerged in the process, and the design team’s interpretations of students’ understandings. Moreover, analyses highlight the synergistic interplay between these components that drove the unfolding of the teaching experiment over the course of 17 lessons in cycles of design, engagement, and interpretation. These cycles gave rise to an emergent instructional trajectory that unfolded in four interrelated phases of instructional engagements:

Phase 1: Orientation to statistical prediction and distributional reasoning;

Phase 2: Move to conceptualize probabilistic situations and statistical unusualness;

Phase 3: Move to conceptualize variability and distribution;

Phase 4: Move to quantify variability and extend distribution.

Analyses reveal that students experienced significant difficulties in conceiving the distribution of sample statistics and point to possible reasons for them. Their difficulties centered on composing and coordinating imagined objects with actions into a hierarchical structure in re-sampling scenarios that involve: a population of items, selecting items from the population to accumulate a sample, recording the value of a sample statistic of interest, repeating this process to accumulate a collection of data values, structuring such collections and conceiving patterns within and across them in ways that support making statistical inferences.