

UNDERGRADUATE STUDENTS' INFORMAL NOTIONS OF VARIABILITY

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ABSTRACT

A robust understanding of variability is key to deeper conceptualization of other major statistical ideas, but many students have only naive notions of variability. Researchers have identified some of these informal notions, but existing research is limited with regard to how students reason when their preexisting informal notions are not applicable. Therefore, I investigated undergraduate students' reasoning about variability when datasets or distributions to be compared (a) have equal ranges, (b) do not include extreme values, and (c) have approximately the same number of different values; and the ways, if any, providing a context supports students' reasoning about variability in the preceding situations.

Following the premises of the knowledge-in-pieces epistemological perspective (diSessa, 1993), I designed statistical tasks and used them as homework questions. I analyzed students' responses to homework questions following Arnold's (2013) distribution framework. In addition, I conducted two or three task-based interviews with students using the similar statistical tasks. Using Powell, Francisco, and Maher's methodology (2003), I analyzed four of these students' video recorded interviews.

The analysis of the homework data showed that the students addressed variability considerably less frequently than they addressed the shape of a given distribution. In addition,

the students often provided limited responses in their homework questions. The interview data showed that three of the participants had informal notions of variability and employed them inconsistently across the tasks. Overall, the students' reasoning about variability was often contingent upon the particular and more prevalent characteristics of the questions on which they were asked to work. Lastly, although the use of contextual information by the interviewed students was minimal, student responses to homework questions suggested that availability of context in a statistical question changed students' choices from among the incorrect answer options.

The study presents multiple directions to frame future research. The most pressing areas are exploring how statistical terms such as *variability* are used in introductory statistics courses, creating practical intervention tasks that could be used to underline the normative meaning of *variability*, and suggesting instructional designs to exploit students' preexisting statistical notions in developing a more robust statistical knowledge.

INDEX WORDS: Understanding variability, Teaching and learning statistics, Undergraduate statistics instruction.