Developing Students' Conceptions of Variation: An Untapped Well in Statistical Reasoning

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The conjecture driving this study is that if statistics curricula were to put more emphasis on helping students improve their intuitions about variation and its relevance to statistics, we would be able to witness improved comprehension of statistical concepts (Ballman, 1997). Both the research literature and previously conducted research by the author indicate that variation is often neglected, and its critical role in statistical reasoning is under-recognized.

A nontraditional approach to statistics instruction that has variation as its central tenet, and perceives learning as a dynamic process subject to development for a long period of time and through a variety of contexts and tools, is laid out in this thesis. The experiences and insights gained from adopting such an approach in a college level, introductory statistics classroom are reported.

The prevailing methodology employed by researchers examining conceptions of data and chance of taking snapshots of students' thought processes by posing cognitive tasks to them in order to catalogue their misconceptions, provides little guidance as to how one might systematically research conceptual change. The conjecture-driven research design (Confrey and Lachance, 1999) employed in this study, which sees research and practice as interwoven, and advocates curriculum construction based on an ongoing process of development and feedback, offered an alternative path. It allowed finding similarities and differences between students' informal intuitions and formal statistical reasoning, and working with students' intuitive notions to help them develop ways to map new and richer concepts onto the ones that they already possessed.

The results of the study point to a number of critical junctures and obstacles to the conceptual evolution of the role of variation, including the following: (1) Understanding of histograms and other graphs; (2) Familiarity with abstract notation and with statistics language; (3) Appreciation of the need to be critical of data and always examine the method it was collected; (4) Distinguishing between population distribution, distribution of a single sample, and sampling distribution; and (5) Understanding of the reason behind finding confidence intervals when producing an estimate of some parameter based on a sample.