Studying the Relationship Between Students' Perception of the Mean and Their Understanding of Variance

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This poster explores how Introduction to Statistics students think about and compare the mean and variability of four datasets. They explored the datasets through various representations (e.g., balance beam, leveling off) and ranked them from most to least variance. When exploring the mean, the students found value in both the balance beam and leveling off representation, but preferred the balance beam for reasoning about variability. However, when reasoning about the variance using the balance beam representation, the students focused on the wrong properties and made faulty inferences. When reasoning using the leveling off representation, they focused on the correct properties and made sound inferences about the data.

Keywords: Statistics Education, Content Knowledge, Mean, Variance

A key idea in an Introduction to Statistics course is the mean as not only a measure of central tendency but as a measure of variability. Policy documents (e.g., The Gaise Report) stress the importance of students having multiple conceptions of the mean such as a measure of center and as a balance point. In this poster, we intend to explore how a student's conception of the mean influences their thinking about variation by having students view the mean through some of the popular representations and seeing what features of the representations are they attending to when trying to determine the mean and variance of a dataset. This study took place at a large four-year college in the southern part of the United States. The participants (n=7) are students who were taking an Introduction to Statistics course during the time of the interview, which took place at the end of the semester after the course ended. They engaged in an hour long video-taped task-based interview (Maher & Sigley, 2014) with two of the authors where they: (1) describe what they thought the mean and variance are, (2) identify the mean and variance of a series of histograms and then ordered the histograms in terms of least variance to most, (3) engage in a task that had them construct a distribution on a line using Unifix cubes and then move the cubes to show a distribution that would have more and less variance than the one they constructed, (4) use a program developed in Mathematica (White, Straughn, & Guyot, 2016) to dynamically explore different interpretations of the mean, (5) re-rank the initial histograms (from least variance to most) based on the different interpretations, and (6) select one interpretation they had the most trust in being correct. When viewing the mean as a balance point, the students preferred the approach, but focused on the mode and symmetry of the data around the mode when considering variability which led to faulty inferences. When focusing on the leveling off representation, the students focused on the distance of the data points from the mean, which led them to making correct inferences about variation.

References

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