

Points of Emphasis in M111

In a typical instructional unit on one-variable statistics, students might engage heavily with lists of numbers either devoid of real-world meaning or associated with an artificial context. (For example, students might be asked to find the median of $\{1,1,2,3,3,3,3,4,4,5,5,5,5,5\}$ without any description of what these numbers are meant to signify.) In contrast, in M111 students should understand measures of center and variability as tools that aid in statistical modeling; they should reason, calculate, and interpret using real data as much as possible.

Specifically, students in M111 should:

- regularly encounter real-world contexts and be given opportunities to develop and investigate statistical questions (LP 1).
- engage with multiple parts of the modeling cycle (see above), especially using tools such as measures of center and variability, data displays, and sampling to answer questions about the world (LP 1).
- be able to choose questions and tasks that are organized around different scientific, social, or other topics that connect to one-variable measurement data, allowing students to have agency in their learning (LP 4).
- frequently collaborate and share their questions, models, calculations, and conclusions (LP 2).

Typically, in a course on one-variable statistics, students might be asked to repeatedly apply rules for computing the mean, median, or mode. In fact, the opposite should be true. In M111, students should develop understanding of the meanings of measures of center and variability and have significant experience interpreting them and using them as modeling tools. Students should spend as much time understanding and working with measures of center as they do with measures of variability. Similarly, instead of unduly focusing on the technical aspects of drawing data displays manually, students should spend ample time interpreting, analyzing, and reasoning about box plots, histograms, and other data visualizations.

Specifically, students in M111 should:

- regularly engage with tasks that do not require any computation, but instead focus on understanding and reasoning. For example, students should:
 - draw inferences and make comparisons based on measures of center and variability;
 - explain the contextual meaning of measures of center and variability;
 - describe characteristics of data sets by examining visual representations;
 - choose appropriate measures of center and variability and explain their choice;
 - use a visual data display to draw conclusions about populations (LP 3).
- have opportunities to share their reasoning with partners or in groups, allowing for practice sharing, critiquing, and revising their arguments and including social interaction as part of the learning process (LP 2).

Instead of focusing only on the applications typically associated with statistics in school (e.g., height or test score distributions), students should also be given opportunities to understand and reflect on the ways that statistical modeling can authentically involve real-world situations and create compelling arguments for change (LP 6). Some contexts to consider include:

- income inequality, including the racial wealth gap;
- climate change;
- racism and other forms of marginalization in social policy and other fields.

Often, coursework with one-variable statistics is focused on performing computations by hand. Instead, students should be given frequent opportunities to use spreadsheets and other software to aid in calculating measures of center and variability. In addition, students should use programs that can generate line plots and other data displays to allow students to focus on understanding, explaining, and reasoning about data (LP 7).