

Questions

What is measurement bias, and how can we detect it?

What useful information can we get from biased measurements?

Objectives

In this activity you will see that measurement systems are often subject to measurement bias. Your awareness of potential bias in data that you analyze should be heightened as you think about possible sources of bias. Bias is a property of the measurement system; you cannot reduce it simply by taking more measurements. The only way to measure bias is to compare the measurements with an independent source of "truth" outside the measurement system you are using. **However comparisons between two sets of measurements may be little affected if the bias is the same in each.**

Activity**1. Collect the class estimates.**

Look carefully at the first string, labeled A. Without using any measurement instruments (except your eyes), estimate the length of the string to the nearest whole inch.

Write your estimate here (Length of string A = _____) and enter into the computer.

Repeat the process for the second piece of string, B. (Length of string B = _____)

2. Describing the distribution of length estimates.**String A**

- Make a dot plot and a box plot of the estimates.
- Describe the plots of the estimate (center, spread, shape)
- Which measure provides the best measure of center: mean or median? Why?
- Which measure provides the best description of variability: s.d. or IQR? Why?

String B

Same as **2a)** thru **2d)** above. Completely answer these questions separately for string B. For the second graph use the same x-axis scale as you used for string A. This will make direct comparisons easier.

3. Making comparisons

Using the two data sets, not your estimate, decide which is the longer string and by how much. Explain how you did this.

4. Determining the bias

- Ask the teacher for the correct lengths for each string. (String A: _____ and String B: _____) Plot these correct values on your graphs. What do you see?
- Does our system of estimating the lengths of string appear to have measurement bias? How do you know?
- If there is measurement bias: describe the effect of this bias on the answer to step 3?
If there is not measurement bias describe what you would see if there had been.
- If we followed this procedure for a third string, describe how we would estimate its true length for our class estimates.

Measurement Bias - Rubric

Graphs & Graphing conventions	/5
Describing Data (string A) - center($\frac{1}{2}$), spread($\frac{1}{2}$), shape(3)	/4
Which measure of center and why	/2
Describing Data (string B) - center($\frac{1}{2}$), spread($\frac{1}{2}$), shape(3)	/4
Which measure of center and why	/2
Making Comparisons: which is longer...	/5
Determining the Bias a) plot, what do you see?	/5
b)Is there bias? how do you know?	/10
c)Effect on answer to q3.	/5
d)A third string.	/10
Total:	/52