Using Technology to Develop Statistical Thinking—Understanding Distributions

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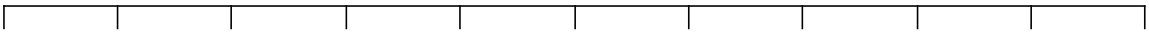
Activity 1: Histograms and Boxplots—Developing Distributional Thinking

Possible ways to generate data for this activity:

1. Pocket change
2. Number of piercings
3. Chocolate chip cookies—number of chips visible on the bottom of the cookie
4. Elapsed time—students are asked to name statistical terms (mean, median, etc.) until they think 30 seconds has elapsed, while a data recorder uses a stop watch to measure actual elapsed time. It is also interesting to repeat after students have looked at the data, as they tend to overcorrect for what they see in the first data set.

Data:

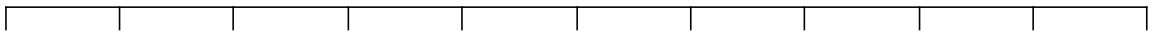
Dotplot:



Discussion points:

1. What does a dot represent?
2. What distinguishes two dots from one another?

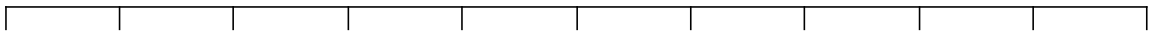
Histogram—Stacking dots



Discussion points:

1. What does a dot represent?
2. What does a stack of dots represent?
3. What does a bar in the histogram represent?
4. What does a bar with a large area represent?
5. What does a bar with a small area represent?
6. When we talk about center and spread in a histogram, what does it mean in terms of the dots (observations)?

Back to the dotplot:



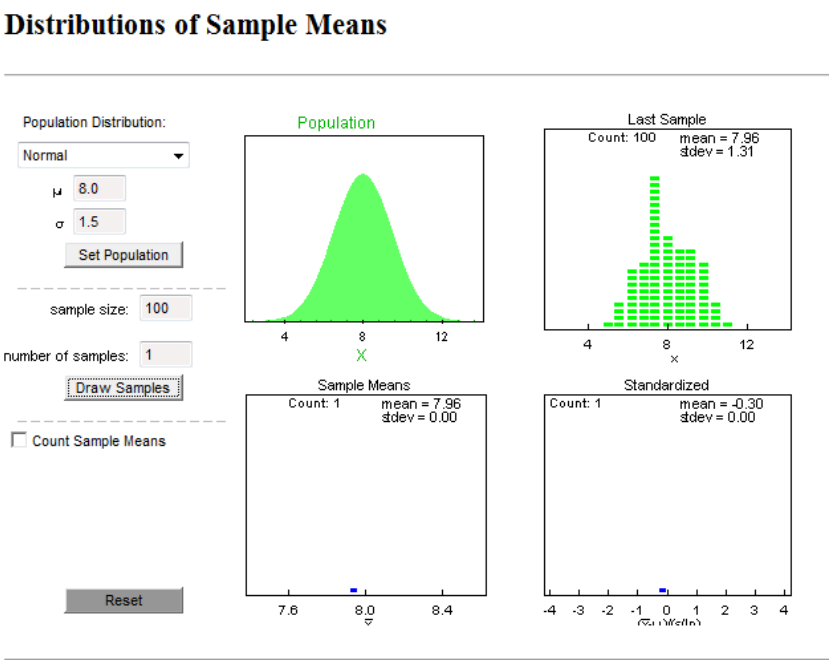
Locate median and quartiles on the dotplot.
“Box” in the middle half of the data. Add whiskers.

Discussion points:

1. What does a dot represent?
2. What does the box represent?
3. What does a narrow box represent?
4. What does a wide box represent?
5. Does a “big” area mean the same thing in a boxplot as it does in a histogram?
6. What does a short whisker represent?
7. What does a long whisker represent?

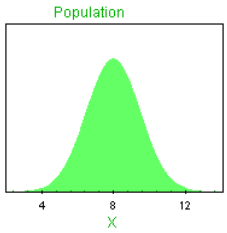
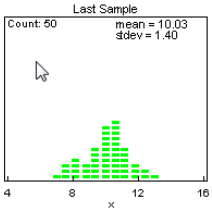
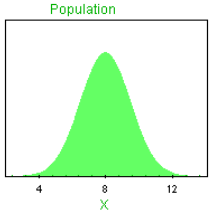
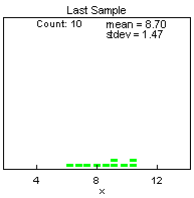
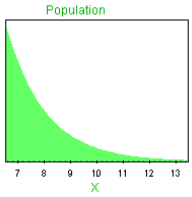
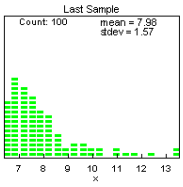
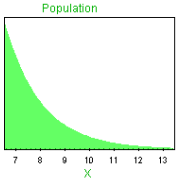
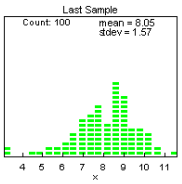
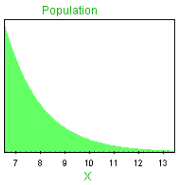
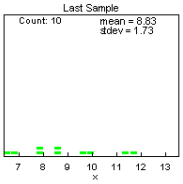
Activity 2: Population Distributions and Sample Distributions

Technology reference:
http://www.rossmanchance.com/applets/SampleMeans/SampleMeans.html



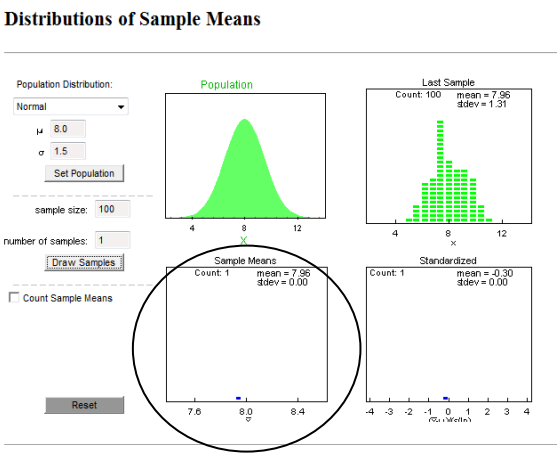
Have students focus just on the top two graphs and experiment first with samples of size 100, then reset and experiment with samples of size 50, then reset and experiment with samples of size 10. You can also have different groups of students choose different population shapes. (If you don't have access to a computer lab where students can do this themselves, you can do this as a class demo.)

Would you be surprised if…
(If you aren't sure, go back to the applet and experiment.)

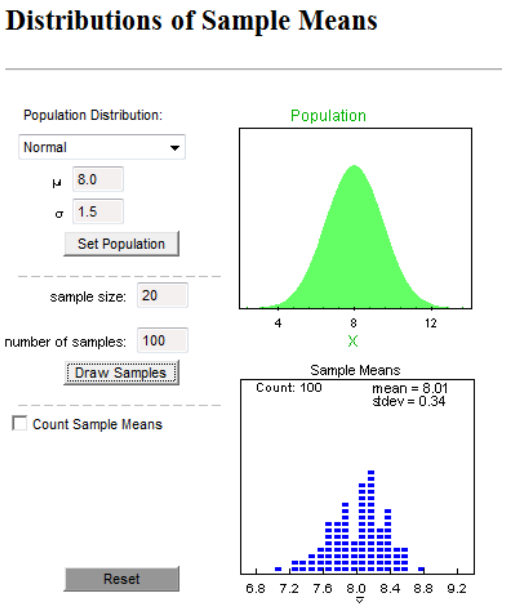
A sample looked like this	but the population looked like this?
	
	
	
	
	

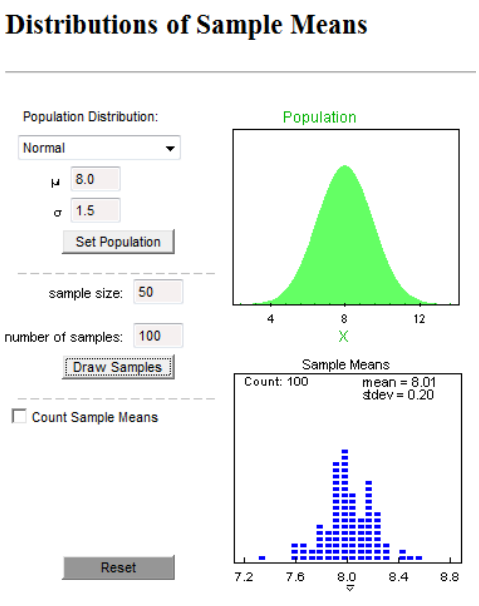
Activity 3: Sampling Distributions

Technology reference:
http://www.rossmanchance.com/applets/SampleMeans/SampleMeans.html



What is going on in the lower left graph??

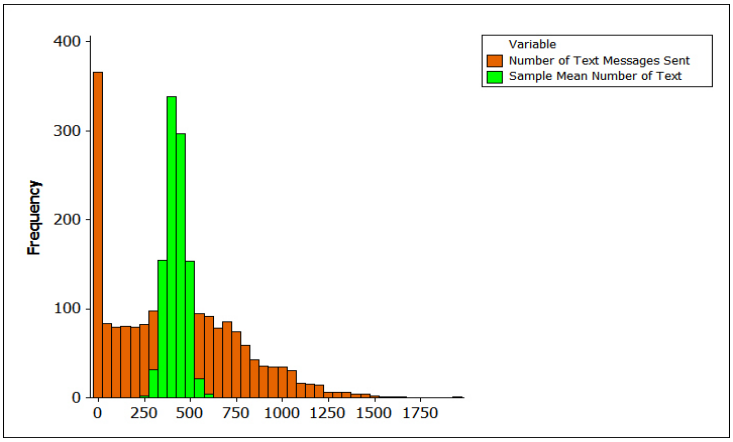


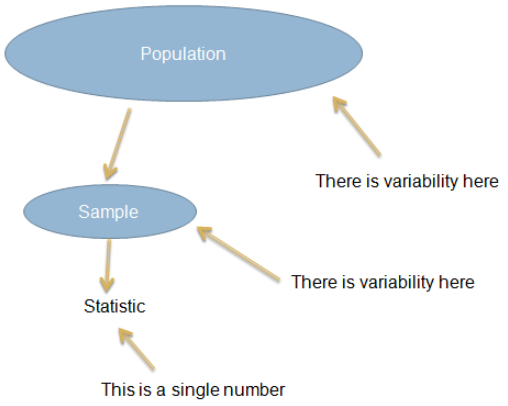


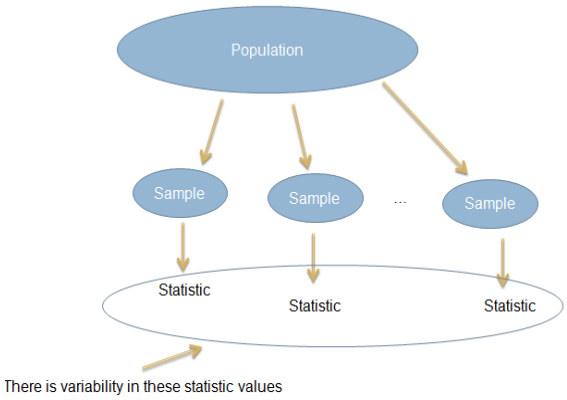
What do these distributions tell us?
Would you be surprised if the population looked like… and the sample mean was?

Reverse the reasoning…
Would you be surprised if the sample mean was… and the population looked like this?

Some important pictures:







Distributions describe variability

- Variability in a population
  - Population Distribution
- Variability in a sample
  - Sample Distribution
- Sample-to-sample variability in the values of a statistic
  - Sampling Distribution