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## WEBQUEST: Exploring the Normal Distribution

Go to the following website:

<http://www.shodor.org/interactivate/activities/normaldistr/>

**Introduction:** A normal distribution is continuous, i.e. it is a smooth curve. Its usefulness to a scientist is stated in the website's "Learner" section:

A scientist sees normal distributions frequently. In any value where there can be measurement error, like a height, a weight, or a pH, you can make a histogram (bar graph) of the results of your trials. If you do enough trials, as scientists often do, you will start to see a normal distribution. If you measure many similar things, which have differences caused by a random variation, those results will be in a normal distribution. Examples include the heights of cornstalks in a field, the levels of a chemical like iron in different people's blood, or standardized test scores. Also, when multiple probabilities interact (like a game where you roll two dice), you get a histogram resembling a normal distribution.

**Procedure:** This applet lets you see how the results of an experiment with lots of trials might look and how the results match up with the normal distribution. Go to the "Help" section and read the instructions.

- The standard deviation is related to the spread in the data.
- The histogram is a bar graph that gives the distribution of the collected measurements. The measurements are sorted and stored in bins of a certain size, obviously called "Bin Size." Smaller bins will more closely approximate a continuous distribution than larger bins sizes.
- The number of trials is the number of measurements. The larger the number of trials, the closer the histogram should look like a normal distribution.

Do not use the histogram for questions 1, 2, and 3. Change the standard deviation to 0.1 and hit "Set." Observe what happens. Repeat for standard deviations of 0.5, 1.0, 2.5, 5.0, and 10.

1. How are the standard deviation and the shape of the graph related?

2. What value stays constant and what value changes?
3. Does the area below the curve seem to change when the standard deviation gets larger? Explain.

For #4 and #5, set the standard deviation to 1. Create a histogram with 100 trials.

4. Experiment with the bin size. Does the histogram give a better or worse fit to the normal distribution curve as the bin size increases? Explain.
5. Try the same experiment with 1000 trials, then 5000. Is the normal curve approximation more accurate for large or small samples?
6. Suppose you had only ten trials. Do you think you would get a nice, smooth normal distribution? Explain why.