Demonstration of WISE Sampling Distribution of the Mean Applet

Understanding the sampling distribution of the mean (SDM) is fundamental to understanding the logic of traditional inferential statistics. The relationships between three distributions are displayed in the WISE SDM Applet: population, sample, and the sampling distribution of the mean. The applet can be found at: http://wise.cgu.edu/sdmmod/sdm_applet.asp.

1. Display the WISE Sampling Distribution of the Mean Applet

    a. You may wish to increase the size of the display as described in WISE Stuff.
       1) Right-click on the desktop (not on any icon) and select **Properties.**
       2) In the Display Properties window, select the **Settings** tab.
       3) Slide the **Screen resolution** slider to the left to enlarge the applet.
       4) Click **Apply**. If prompted to confirm the changes, click **Yes**. Click **OK**.

    b. Select:

- Population "**Normal** (**Mu=500; Sigma=100**)."
- Sample size "**N=100**."
- "**Show sample data**" (in black).
- "**Show population**" (in blue; no other "**Show**:" items selected for now).

2. Introduction, N=100 example

    a. Review the concepts of the normal distribution and random sampling as needed.

    b. Begin with a scenario that will be of interest to the students. For example:

> "A friend of yours plans to use a scale to measure Life Satisfaction. For the population of American adults the scale has a normal distribution with a mean of 500 and a standard deviation of 100. She plans to measure Life Satisfaction for various groups of people, and she is very interested in knowing how accurate her sample means are likely to be depending upon the size of her samples. She will come to you for advice."

    c. Describe the population distribution on the display, the sample size (N=100) and the button that can be used to draw a random sample.

    d. Click "**Draw a sample**." Note that the black boxes indicate the sample, the red arrow indicates the mean, and the data box indicates the value of the last mean.

    e. Ask students to write down the mean, or you can write it down on the board.

    f. Click "**Draw a sample**" and record the mean nine more times.

    g. Ask: How many of the 10 sample means are within 30 points of the population mean? That is, how many of the 10 sample means are between 470 and 530?

    h. An important concept is that each sample mean is a member of a distribution of possible means for samples with N=100. Click "**Show obtained means**" to show

the distribution of obtained means.

i. Click "**Draw 100 samples**" to show the distribution of 100 means. Do that several times. Describe this distribution again as representing the distribution of possible sample means when N=100.

j. Note that these samples come from an actual distribution of possible means. Click "**Show sampling distribution of the mean**" to display that distribution.

3. N=5 example

a. Our friend Bumble says, "I don't think we need such a large sample. It would be much better to take a sample of only five people because such a sample mean also will give us an estimate of the population mean." Is this good advice? How accurate is a sample mean as an estimate of the population mean if we use a sample with N=5? If a small sample works well, we can save time and energy.

b. Click "**Show sample data**" and unclick "**Show sampling distribution of the mean**"; select Sample size**: N=5**.

c. Click "**Draw a sample**," note the sample markers and the mean, and ask students to record the mean or record it on the board.

d. Draw nine more samples, recording each mean.

e. Ask: How many of the 10 sample means are within 30 points of the population mean? That is, how many of the 10 sample means are between 470 and 530?

f. Click "**Show obtained means**" and describe.

g. Click "**Draw 100 samples**" and describe. Click "**Show sampling distribution of the mean**" and describe.

4. Summary and Integration

If desired, other sample sizes can be explored. Samples with N=25 can be used to show the pattern of increasing accuracy with larger sample sizes.

Ask students questions that require integration:

- How is sample size related to accuracy of a sample mean? Why?
- Is a sample of N=5 large enough? (Under some circumstances it may be!)
- Is a sample of N=100 large enough? (Better than N=5, but not necessarily good enough. It depends on how much precision we need.)

In anticipation of the lesson on the Central Limit Theorem, the importance of the sampling distribution of the means can be emphasized. Although the sampling distribution of the mean of the mean is not observed directly, our knowledge of this distribution allows us to determine how accurate a sample mean is likely to be, and thus make inferences about the value of the population mean.