Name: **Key**   Hour: _____ Date: _____

## Learning Targets
- Interpret a confidence level in context.
- Describe how the sample size and confidence level affect the margin of error.
- Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.

## Lesson 8.1: Day 2: What does "95% confident" mean?

In this Activity, you will use the *Confidence Intervals* applet to learn what it means to say we are "95% confident" that our confidence interval captures the true proportion.

1. Use the *Confidence Intervals* applet. Set the population proportion to 0.5, the confidence level to 95% and the sample size to 75.

2. Click "Sample" to choose an SRS and display the resulting confidence interval. The confidence interval is displayed as a horizontal line segment with a dot representing the sample proportion in the middle of the interval. The true proportion (p) is the green vertical line.
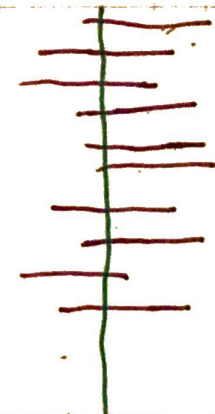
   .00  .10  .20  .30  .40  .50  .60  .70  .80  .90  1.0

   Did the first confidence interval capture the true proportion?

   **Yes**

   Repeat this 10 times and sketch what you see to the right. How many of the intervals capture the true proportion?

   **10/10**

3. "Reset" and then take a total of 100 confidence intervals (sample 25 four times). How many out of 100 captured the true proportion? Is this surprising? Why?
   **(97%) Answers vary, should be about 95%.**

4. Watch your confidence intervals as you drag the confidence level from 95% to 99% (don't "Reset). What happens to the intervals when the confidence level is increased? Why does this make sense? **As you increase confidence level, the intervals get wider so we hit p=0.5 more often.**

   **Increase ↑ confidence level, Increase Margin of Error ↑**

5. "Reset", then sample 100 times at an 80% confidence interval. What percent of the intervals capture the true proportion?
   **(73%) (should be getting close to 80%)**

   Interpret the **confidence level**:

   **If we make many 80% confidence intervals, we expect about 80% will capture the true proportion.** ✚ STATS MEDIC

6. Now we will see what happens when we adjust the sample size. Change the sample to 20 and sample for 1 interval. Then change it to 250 and sample for 1 interval. What happens to the interval when the sample size is increased? Why?

Increase ↑ Sample Size

Decrease Margin of Error ↓

The interval narrows (gets shorter). As sample size goes up, we expect less variability (smaller S.D.)

## Lesson 8.1 Day 2– Interpreting Confidence Level

**Important ideas:**

**L.T. #1 Interpreting Confidence Level**

If we make many ____% confidence intervals, we expect about ____% to capture the true $p/\mu$
  parameter

**L.T. #2 What Affect Margin of Error?**

↑ Confidence Level, ↑ M.O.E.

↑ Sample Size, ↓ M.O.E.

**L.T. #3** Margin of Error <u>Never</u> accounts for bias.

(Practical difficulties such as undercoverage, nonresponse, the way in which a survey or experiment is conducted can account for bias)

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# Check Your Understanding

As part of a project about response bias, Ellery surveyed a random sample of 25 students from her school. One of the questions in the survey required students to state their GPA aloud. Based on the responses, Ellery said she was 90% confident that the interval from 3.14 to 3.52 captures the mean GPA for all students at her school.

(a) Interpret the confidence level.

*If we make many 90% confidence intervals, about 90% will capture the true mean GPA.*

(b) Explain what would happen to the length of the interval if the confidence level were increased to 99%.

*The length of the interval would widen because the margin of error increases when confidence level is increased.*

(c) How would a 90% confidence interval based on a sample of size 200 compare to the original 90% interval?

*A 90% confidence interval based on sample size of 200 would be narrower compared to the original because an increase in sample size decreases the margin of error.*

(d) Describe one potential source of bias in Ellery's study that is not accounted for by the margin of error.

*Students might lie about their GPA.*