11.5 PROJECT

IN THE BLINK OF AN EYE

In Section 11.5, you learned that confidence intervals can be constructed using sample data in order to estimate a population parameter with a certain level of confidence. In this project, you will work with your classmates to collect sample data and construct confidence intervals for the number of times a person blinks in one minute in various circumstances.

Blinking our eyes is something we never think about until, well, we think about it. So let's think about it. Various sources maintain that an individual will, on average, blink somewhere between 15 and 20 times per minute unless they are either engaged in a conversation or focusing intently on a task. When carrying on a conversation, blinks per minute (bpm) tend to increase to between 19 and 26. The rate of blinking decreases to approximately 4.5 when focusing intently.

The goal of this project is to randomly select ten classmates, record how many times they blink in one minute for each of the three scenarios mentioned above, construct 95% confidence intervals from the data collected, and see if the reported average blinks per minute for each scenario falls within the interval you construct.

To do so, complete the following steps.

1. Form a group that consists of at least ten classmates.
2. For each classmate selected to have their blinks counted, have one group member observe, count, and record the number of blinks, while another group member watches a timer to start and stop the one-minute count. (Multiple experiments should be taking place within the group until the data collection is complete.)
3. Repeat this process until you have ten data points for each of the following three scenarios.
   a. Have the classmate relax and casually glance around the room, look at their fingernails, flip through a book, etc.
   b. Have the classmate carry on a conversation with another classmate.
   c. Have the classmate focus on something, such as playing a game on a cell phone. Tetris is an excellent choice, but any game will work.
4. Using the numbers of blinks per minute that your group observed, calculate the sample mean for each of the three scenarios.
5. Calculate the standard deviation for each sample either by using technology or by applying the following formula, where $\bar{x}$ is the sample mean and x_i is the ith value in the data set as i ranges from 1 to 10. Round each value to the nearest ten thousandth.

$$s = \text{sample standard deviation} = \sqrt{\frac{\sum_{i=1}^{10}\left(x_i - \bar{x}\right)^2}{9}}$$

6. Using the following formulas, construct a confidence interval for each scenario (relaxed, during conversation, and playing a game). You may use a TI-83/84 Plus calculator or the following formulas. (**Note:** If you use a calculator, be sure to find the TInterval, not the ZInterval.) Round each endpoint to the nearest hundredth.

$$\text{Lower Endpoint: } \bar{x} - \left(2.262 \cdot \frac{s}{\sqrt{10}} \right)$$

$$\text{Upper Endpoint: } \bar{x} + \left(2.262 \cdot \frac{s}{\sqrt{10}} \right)$$

7. Do the reported averages (15–20 bpm when relaxed, 19–26 during conversation, and 4.5 while focused) fall within the confidence intervals you found? If not, list some factors that you think may have contributed to the reported average being outside of your confidence interval.

8. Do you think the experiments used to produce the data for this project are valid ways to measure the numbers of blinks per minute for people at rest, in conversation, and while focusing? Why or why not? In what ways do you think the method of data collection used in these experiments might result in inaccurate estimates of the population parameters?

9. Draw a general conclusion from your results.