**Total Time needed 45 minutes**

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| **Handouts:**   * Exploring Variability Task | **Materials:**   * TI-Navigator * TI-Nspires * ***Exploring Variability.tns*** * Nspire QuickPoll documents ready to go. |

**Objectives**:

Students will create conjectures that explain the relationship between the mean, standard deviation, and shape of a data set. Students will explain the difference between the typical residual, mean absolute residual, and standard deviation to others.

**Introduction (10 minutes)**

Tell students they will use the Nspire to explore the relationship between the mean and standard deviation for data sets.

Send the associated Nspire file to students, giving them **10 minutes** to make conjectures for question 2. Send an open response **Quickpoll** to students to collect their conjectures.

***Open the TI-Nspire document Exploring Variability.tns***

*Page 1.2 displays 15 data points. Using this data, study how the mean and standard deviation behave. The mean of the data is indicated by μ and the vertical line. The standard deviation is indicated by σ and the horizontal line. Dragging the points will change the shape of the distribution, μ and σ.*

1. *What does it appear that σ measures?*
2. *After dragging points in* ***many*** *different ways to create a variety of data sets, create a list of conjectures that describe relationships between the mean, standard deviation, and shape of a data set. The following sentence structure is often useful in formulating conjectures: If \_\_\_\_\_, then \_\_\_\_.*

Anticipated Responses:

1. If all the data values are close to the mean, then the standard deviation is small.
2. If the mean is large, the Standard Deviation is large. (Include this and the two below as possible “sample student” conjectures).
3. If we know the standard deviation, we have no idea that the mean is.
4. If we know the standard deviation, we can know the mean.

Give students **10 minutes** to explore page 2.2 and then random name call students to answer the “What is a residual?” and “How might we find a typical residual?” questions. During the discussion, lift out the problem of averaging the positive and negative residuals.

*Page 2.2 displays the amount of snowfall for one winter month in a given year for the six largest cities in a Midwestern state.*

1. *Drag points in the bottom window to change the distribution, and carefully observe the changes in BOTH windows. After exploring, create a list of observations below. Include in your observations what you believe a residual is and how we might find the value of a "typical" residual.*

Give students **10 minutes** to explore page 3.2 and then random name call students to answer the two questions on the sheet. During the discussion, be sure to note the difference in measure for the AR and standard deviation. Ask students if they know how to conceive of the standard deivation in this situation. Help students visualize squares built on each residual and understanding population standard deviation as the mean square size. Show students the formulas for standard deviation and ask them to relate the formulas to the residuals.

*On Page 3.2, drag the data set values to explore the relationships that exist on the page.*

1. *How is studying the absolute residuals (AR) different from studying the residuals? How does the mean AR compare to the standard deviation?*

Give students **15 minutes** to answer Question 5 and send an open response **Quickpoll** to obtain responses to Question 5.

1. *Return to your conjectures in Question 2 above. Does it appear your conjectures hold true? If not, revise your conjectures here. Write any new conjectures you may have here.*

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