The applet for this activity is found at: http://www.math.usu.edu/~schneit/CTIS/SD/index.html

Standard Deviation

Goals: Students will:

- understand that the standard deviation is a measure of the spread of the data
- realize the standard deviation is affected by outliers (extreme data points)
- understand how the standard deviation and mean are affected when new data points are added

Prerequisite:

This activity is an introduction to "Standard Deviation." No algorithmic skills are required.

Lesson Plan / Possible Uses:

This activity could be used in whole or in part as homework, small group work at one computer per group, or individual activity in a computer lab.

Parts one and two could be used as separate lessons. Part one focuses more on describing the data. Part two with the homework guides students create their own understanding and concept of the standard deviation.

Instruction for applet use:

The teacher may need to introduce the applet and show how to use it – but this does NOT require a lecture. Click on boxes in the grid to create a distribution of numbers. Clicking on the topmost colored box in any column clears the column. Clicking on any unfilled box in the column fills the column to the selected row. The numbers of rows and columns can be varied using the spinners at the top. The mean of the distribution is indicated by the green triangle and the size of the standard deviation by the blue bar. The mean and standard deviation indicators can be toggled on or off using the check boxes at the top.

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NAME:_____

Instructions for the Applet:

Click on boxes in the grid to create a distribution of numbers. Clicking on the topmost colored box in any column clears the column. Clicking on any unfilled box in the column fills the column to the selected row. The numbers of rows and columns can be varied using the spinners at the top. The mean of the distribution is indicated by the green triangle and the standard deviation by the blue bar. The mean and standard deviation indicators can be toggled on or off using the check boxes at the top. You can also view the exact values of the mean and standard deviation by selecting the check box at the bottom of the applet labeled "Show Values".

Part I: Guided activities

Sample Data:

Open the applet in two separate viewing windows so that you can view two sets of data at the same time. Increase the number of columns to 10 in both windows. Check the 'show values' check box. Enter the following two data sets into their own viewing window and answer the following questions about the mean and the standard deviation.

Set 1:
1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7

Set 2:
4, 5, 5, 6, 6, 6, 7, 7, 7, 7, 8, 8, 8, 9, 9, 10

1a. What is the mean for set 1? Set 2? _____

b. What is the standard deviation of set 1? Set 2? _____

2. How do the mean and standard deviations from each data set compare? Are they the same? Are they different? What do you think the reasons for this are?

3 What do you think the mean is telling us about the data?

Often we may want to know the spread of the data or in other words how the data is arranged. We could describe the spread of the data as clustered together vs. scattered apart, symmetric vs. asymmetric, even vs. weighted etc.

4a. How would you describe the spread of the first data set?

b. How would you describe the spread of the second data set?

The standard deviation tells us about how far the data is spread from the mean, it tells us that about 2/3 of the data lies in the interval mean ± the standard deviation. Interpret the standard deviations from both data sets.

5. In your own words what do you think the standard deviation is telling us about the data?

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Part II: Discover Relationships:

Instructions:
Play with the applet to discover answers to the following questions, and any other relationships that you might find. Please begin with the standard window (6 rows and 6 columns) then try changing the number of rows and columns to see if you can get "better" results or if doesn't make a difference.

Can you create a data set with a standard deviation of 0? If so, what does it look like? If not, why not?

What is the largest standard deviation you can create? Describe the spread of the data.

Now, try changing the number of rows and columns. What is the largest standard deviation you can create? Describe the spread of the data.

Return to the standard viewing window (6 rows and 6 columns). Using data in only two columns, what is the smallest standard deviation you can get? (for example, put data only in columns 2 and 4). Describe your data set and its spread.

Now, using the as many rows and columns as you would like, attempt the same challenge as in the last question. Does changing the number of rows and columns affect the results from the previous question? What effect does it have?

Can you create a data set where the standard deviation is *larger* than the mean? If so, what does it look like? If not, why not?

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Name:_____

Homework: For this homework assignment you can use the applet listed above or you can compute the mean and standard deviation by hand to answer the following questions.

Pull-Up Data:
The following data was observed by a gym teacher, of the number of pull-ups by seventh graders at Mount Pleasant Middle School. Use the Standard Deviation Applet to record this data. Once you have entered the data record the mean and standard deviation:
2, 3, 4, 3, 2, 5, 5, 6, 6, 6, 9, 4, 10, 3, 2, 1, 9.

Mean:_____ Standard Deviation:_____

Six of the school football players were gone the day that the pull-up test was given, their results are 7, 7, 8, 10, 10, 9. Add these points to your bar graph. How did these points change the mean? How did these new data points change the Standard Deviation?

Car Data:
The following data was observed by the city planner of Mount Pleasant. The city planner recorded the number of cars that went through an intersection for each green light. The following is his data set on a given hour:
4, 5, 3, 6, 7, 8, 5, 6, 7, 2, 3, 6, 4, 4

Mean:_____ Standard Deviation:_____

Deciding that he didn't have enough data from his first set of observations the city planner decided to go back to the intersection and observe a few more data points. The results of this data are:
5, 9, 7, 3, 2. Add these data points to your existing graph.

What are the mean and standard deviation now? How did they change?

Analysis:
What is the relationship between the spread of the data and the standard deviation?

Create a definition of **standard deviation** that makes sense to you, and compare your definition with that of your colleagues.