FST 3-3 Notes
Topic: Translation of Data
GOAL:
Emphasize the parallel ideas of translating graphs and translating data. Investigate the effects of adding a constant to each data value on the displays of those values, on measures of center, and on measures of spread.

SPUR Objectives
H Use translations to describe and analyze data and statistics.

Vocabulary
invariant – unchanged by a particular transformation

Warm-up

1) Find the range and mean of the data set:

L1 = 101, 102, 103, 104, 105, 106, 107, 108, 109, 110

Max - Min
range = 9

$\bar{x}$
mean = 105.5

2) Find the range and mean of the data set:

L2 = 136, 137, 138, 139, 140, 141, 142, 143, 144, 145

Max - Min
range = 9

$\bar{x}$
mean = 140.5

3) How do the values in data set #1 compare to the values in data set #2?

Each value in data set #2 is 35 units more than each value in data set #1

4) Explain how the answers from #1 can be used to determine the answer to #2.

The range is the same,
The mean is just 35 units more

5) How do the IQR, standard deviation and variance compare? They are the same

Data Set 1	Data Set 2
Q3-Q1 IQR = 5	IQR = 5
s_x = 3.03	s_x = 3.03
Var = $(3.03)^2$ = 9.18	Var = 9.18

Activity

In the United States, the passage of the 19th amendment to the Constitution in 1920 gave women the right to vote. This activity compares the year in which women earned the right to vote in the U.S. to the year women achieved that right in other countries.

Step 1 Enter the years below into a statistics utility. Label the column `year`.

1893	New Zealand	1920	United States	1949	China	1974	Jordan
1902	Australia	1921	Sweden	1950	India	1976	Portugal
1906	Finland	1928	Britain	1954	Colombia	1989	Namibia
1913	Norway	1928	Ireland	1957	Malaysia	1990	Western Samoa
1915	Denmark	1931	Spain	1962	Algeria	1993	Kazakhstan
1917	Canada	1944	France	1963	Iran	1993	Moldova
1918	Austria	1945	Italy	1963	Morocco	1994	South Africa
1918	Germany	1947	Argentina	1964	Libya	2005	Kuwait
1918	Poland	1947	Japan	1967	Ecuador		
1918	Russia	1947	Mexico	1971	Switzerland		
1919	Netherlands	1947	Pakistan	1972	Bangladesh		

Source: New York Times

1) Enter the years in L1.

2) In L2, Calculate L2 = L1 – 1920.

3) Calculate the 1-variable Statistics of L1 and L2. Record the results.

L2 data: Mean, Media, Mode are 1920 units less than L1 data

	L1 data		L2 data
$\bar{x}$	Mean	1947.02	Mean 27.02
	Median	1947	Median 27
	Mode	1918, 1947	Mode −2, 27
Max-Min	Range	2005 − 1893 = 112	Range 85 − −27 = 112
Q3-Q1	IQR	1969 − 1918.5 = 50.5	IQR 49 − −1.5 = 50.5
S_x	Standard Deviation	29.16	Standard Deviation 29.16

(Measures of Spread)

4) Which values are the same? Which values are different?

Same = Standard deviation, IQR, range

(measures of center)

Different = Mean, Median, Mode

Additional Example

At a martial arts tournament, the 20 fighters weighed in before the tournament. All the fighters made weight and a statistician computed the following statistics:
mean = 191.125 lb,
standard deviation = 29.7 lb,
median = 194.5 lb,
IQR = 35.5 lb.
After finishing her calculations, it was brought to the statistician's attention that the scales were not correctly calibrated. The starting weight was set at 0.25 lb, not 0. Find the correct values for the mean, standard deviation, median, and interquartile range for the 20 fighters.

(Change) Mean = 191.125 − 0.25 = 190.875 lbs
(Same) S_x = 29.7 lbs
(Change) Median = 194.5 − 0.25 = 194.25 lbs
(Same) IQR = 35.5 lbs

Measures of Center of Translated Data

Theorem (Centers of Translated Data)

Adding h to each number in a data set adds h to each of the mean, median, and mode.

Measures of Spread of Translated Data

Theorem (Spreads of Translated Data)

Adding h to each number in a data set does not change the range, interquartile range, variance, or standard deviation of the data.

Invariant Unchanged by a particular transformation.