Working Through Statistics Central Tendency and Variability	**Student/Class Goal** Students will understand and interpret data sets in real life situations.
Outcome (*lesson objective*) Students will be able to calculate measure of central tendency (mean, median, mode) and variability (range, inter-quartile range, variance, standard deviation).	**Time Frame** ~6 hours
Standard *Use Math to Solve Problems and Communicate*	**NRS EFL 6**

Components of Performance (COPs)	**Activity Addresses COPs** (process)
Understand, interpret, and work with pictures, numbers, and symbolic information.	Students will enter and interpret data from a variety of charts and other sources of information.
Apply knowledge of mathematical concepts and procedures to figure out how to answer a question, solve a problem, make a prediction, or carry out a task that has a mathematical dimension.	Students will use their knowledge of mean, median, mode, range, quartiles, variance, and standard deviation to determine these values for sets of real-life scenarios.
Define and select data to be used in solving the problem.	Students will begin to recognize real-life situations in which these concepts can be applied.
Determine the degree of precision required by the situation.	Students will recognize the importance of collecting, recording, and analyzing data accurately.
Solve problem using appropriate quantitative procedures and verify that the results are reasonable.	Students will choose the correct procedure to solve statistical problems and confirm that their answers are logical.
Communicate results using a variety of mathematical representations, including graphs, charts, tables, and algebraic models.	Students will use data charts to gather and display statistical information and make educated conclusions based on the data presented.

Activity Addresses Benchmarks (content)
M.6.23, M.6.21, M.6.22, M.6.26, M.6.27, M.6.28, M.6.29, M.6.30, M.6.31, M.6.32

Materials
Production data chart (attached) showing productivity of three workers over 10 work days, attendance data charts for 15 hockey games (attached), standardized test scores for 5 tests (attached), blank data chart for three measures of central tendency, and calculators.

Learner Prior Knowledge
Addition, subtraction, multiplication, and division of positive whole numbers, decimals, and fractions. Familiarity with the use of formulas, charts/graphs.

Instructional Activities
Step 1
The teacher will introduce the topic by describing real life situations where statistics and data analysis are utilized.
- Stock Analysts use statistics to report on investments options to assist clients in making informed decisions on how to invest their money.
- Coaches utilize statistics when they gather data about players to determine strategic plays, player and team rankings, draft picks, and contract salaries.
- Business Owners use statistics when creating a business plan and when making critical decisions about their businesses.
- Clothing Buyers depend on statistics to determine consumer trends and make profitable decisions about future trends.
- Educators employ statistics to determine the success of their students and to relay that information to the public through displays and reports.

Step 2
Teacher will distribute production data chart (attached) to each student and explain the definition of mode – the number most often repeated in a number set. The teacher will discuss with the students what the mode is for each worker listed on the chart. The teacher will explain the definition and use of mean – the sum of all the values of the data divided by the number of elements in the data set. The teacher will explain the definition of median – the middle number of a data set when data are arranged in numerical order. If there is no middle number, the median is the average of the two middle numbers. The teacher will explain the definition of range – the difference between the greatest and the least values in a set of data.

Step 3
Have the students use the data in the production chart to determine the mode, median, mean, and range for each of the three workers.

Step 4
Teacher will distribute game attendance data chart (attached) to each student and explain the definition of quartiles – *boundaries* that break the data into fourths.
   • Second quartile – better known as the median
   • First quartile – median of the lower half of the data
   • Third quartile – median of the upper half of the data

Step 5
Students will determine the quartiles for the game attendance data. (Sort the data from least to greatest. Then locate the median (2nd quartile). Find the median of the upper half of the data (3rd quartile). Find the median of the lower half of the data (1st quartile).

Step 6
The teacher will distribute a data set of standardized test scores and explain the definition of variance – the mean of the squared difference between each number in the set and the mean of all numbers in the set.
V=variance   M=mean A_1, A_2, A_N=the data

$$V = \frac{(A_1 - M)^2 + (A_2 - M)^2 + \dots (A_N - M)^2}{N}$$

Step 7
Students will determine the variance of the standardized test scores.

Step 8
The teacher will explain the definition of standard deviation – the square root of the variance for the data set.

Step 9
Students will determine the variance of the standardized test scores data.

Step 10
Students will practice these skills using problems from *Number Power Algebra* and *Cord Algebra I.*
Practice problem: Research the houses that were sold in your neighborhood in the last two years. Compile the mean, median, and mode house prices and come up with a reasonable price for which you might sell your house.

Assessment/Evidence (*based on outcome*)
SAMS, teacher-made assessment

Teacher Reflection/Lesson Evaluation
Not yet completed

Next Steps

Skateboard Production Data
for Mean, Median, Mode, and Range

Worker	M	T	W	Th	F	M	T	W	Th	F
Bob	3	4	5	4	5	5	1	2	2	3
Kevin	2	3	2	7	1	6	1	2	5	3
Mike	3	2	2	7	6	5	4	2	3	2

Answer chart:

Worker:	Mean:	Median:	Mode:	Range:
Bob				
Kevin				
Mike				

Hockey Game Attendance
for Quartiles

Date:	Attendance:
November 5	246
November 6	311
November 7	305
November 12	140
November 14	265
November 15	211
November 20	195
November 21	279
November 24	242
November 30	246
December 1	272
December 2	250
December 3	209
December 9	242
December 10	296

First Quartile:	Second Quartile:	Third Quartile:

Standardized test scores for The Big Test
15   25   35   45   55

Variance:	Standard Deviation:

Answers for mean, median, mode, and range:
Bob's mean: (3+4+5+4+5+5+1+2+2+3)/10 = 34/10 = 3.4
Bob's median: (3+4)/2 = 7/2 = 3.5
Bob's mode: 5
Bob's range: 5-1 = 4

Kevin's mean: (2+3+2+7+1+6+1+2+5+3)/10 = 32/10 = 3.2
Kevin's median: (2+3)/2 = 5/2 = 2.5
Kevin's mode: 2
Kevin's range: 7-1 = 6

Mike's mean: (3+2+2+7+6+5+4+2+3+2)/10 = 36/10 = 3.6
Mike's median: (3+3)/2 = 6/2 = 3
Mike's mode: 2
Mike's range: 7-2 = 5

Answers for quartiles:

140	195	209	211	242	242	246	246	250	265	272	279	296	305	311
			Q_1				Q_2				Q_3			

Answers for variance and standard deviation:
Mean = (15+25+35+45+55)/5 = 175/5 = 35

$$\text{Variance} = \frac{(15-35)^2+(25-35)^2+(35-35)^2+(45-35)^2+(55-35)^2}{5}$$

$$= \frac{(-20)^2+(10)^2+(0)^2+(10)^2+(20)^2}{5}$$

$$= \frac{400+100+0+100+400}{5}$$

$$= \frac{1000}{5}$$

$$= 200$$

Standard deviation = $\sqrt{200} \cong 14.14$