Lessons - Statistics

COURSE: ALGEBRA
Unit 7: Statistics
Time Frame for developmental lessons: 10 days
Time Frame for Schools: 20 days

Unit Resources:

Common Core Standards for this Unit

Sample Lesson Target Sequencing

Unit Chunks:

1. Measurement variables
2. Interpreting models

Essential Qs	Core Math	Unit Resources
How do we use evidence to support arguments?	**Measurement Variables** Students should be able to summarize, represent, and interpret data on a single count or measurement variable. Students will: ● Understand that context can change data interpretation ● Utilize different measures of center (mean, median, mode) and spread (quartiles and interquartile range, standard deviation, outliers, distribution). ● Understand that different representations yield different stories and interpretations of data that can produce	**Using measures of center to interpret data:** ● Ducklings (basic intro for calculating median and mean, #3 extends to considering how individual data points impact the center) ● Suzi's Company (calculate and make comparisons between mean, median, and mode, #4 great analysis and comparison of measures of center) **Relating frequency, distribution, and range to measures of center:** ● Mean, Median, Mode, and Range (evaluates a data set through multiple representations to make sense

distinct conclusions
- ○ Select appropriate statistical representation(s) for particular types of data.
- Represent one-variable data with a variety of different ways such as frequency tables, dot plots, histograms, cumulative frequency histograms, box plots
  - ○ recognize and can interpret the IQR, overall range, and median from a box plot
- Account for possible effects of additional or extreme data points.
  - ○ make sense of bar graphs, tables, etc. where some data points occur with a frequency > 1
  - ○ understand how outliers impact measures of center
- Compare center and spread of two or more sets of data.
- Interpret differences in shape, center and spread in context
- explore standard deviation and use it to describe how range and variation are related to the mean
- evaluate a data set and use the distribution to consider and justify where other data points may lie in relation to the mean

SWBAT describe work by using these terms appropriately and consistently:
independent, dependent, random, sample, categorized, summarized, statistics, measures of center, mean, median, mode, range, outlier, interquartile range, box plot, stem and leaf plot, histogram, frequency, distribution, density, standard deviation

of different statistical measure)
- Understanding the Standard Deviation (Illustrative Mathematics, conceptual emphasis on supporting students in thinking about the relationship between variability, range, and density of data in relation to the mean)
- Representing Data 1: Using Frequency Charts (MARS Formative Assessment Lesson, explore frequency graphs to identify a range of measures and make sense of this data in a real-world context)

Consider how to represent data and make sense of statistical diagrams:

- NCTM Advanced Data Grapher—an applet for graphing data.
- A New Car (interpret and create box plots)
- Archery (interpret and create box plots, consider range and distribution of data points)
- NCTM Box and Whisker/Mean and Median applet—an applet that compares box plots with data sets
- TV Hours (interpret stem and leaf plots, interpret shape and center)
- Representing Data 2: Using Box Plots NCTM Histogram Plotter—an applet for creating histograms.

Comparisons between statistical representations:

- Obstacle Course (#4 great opportunity for multiple representations of data with histograms, box plots, stem and leaf, etc., possibly good for re-engagement throughout unit)
- Temperatures (interpret features of different graphs and models to compare similarities and differences of data)

Essential Qs	Core Math	Unit Resources
How do we interpret evidence in order to support arguments?	**Interpreting Models** Students should be able to use a variety of different statistical tools to understand relationships between two variables. Students will: ● summarize categorical data for two categories in two-way frequency tables 　○ identify characteristics: joint, marginal and conditional relative frequencies ● interpret relative frequencies in context ● represent bivariate data on a scatter plot and describe how variables are related 　○ investigate patterns shared by several data points in a set 　○ make predictions about other reasonable points that could be included in the data set ● interpret the parameters of the function, especially for linear functions, in the context of the data. ● recognize associations and trends in data presented in a variety of different ways ● create a line of best fit and understand its purpose 　○ discuss different methods for drawing lines of best fit 　○ compute and interpret the correlation coefficient of a linear fit. (using technology) 　○ explain what the line of best fit represents for the scatter plot ● estimate data values either within the range of the data set (interpolation) and outside of the range of the data (extrapolation) 　○ recognize possible problems with extra and interpolation	**Making Sense of Frequency Tables:** ● Musical Preferences (Illustrative Mathematics) ● Support for a Longer School Day (Illustrative Mathematics) **Creating scatter plots and analyzing its features:** ● Presidents (plot data points, analyze data in context, consider relationship between variables to interpret data) ● Snakes (analyze patterns of a data set and use them to determine if additional data points belong in the set) ● Homework, TV, Sleep (read and create scatter plots by using the relationship between variables to analyze and interpret individual data points within a set) ● "The Hand Squeeze" (activity for collecting data that can be modeled with a linear model, create a graph and interpret features of the data set, great transition to generating lines of best fit) **Drawing Lines of best fit and using them to interpret patterns and make predictions for a data set:** ● Pizza Sales (create line of best fit for data, analyze the relationship of variables using the line of best fit and use to predict other possible data points) ● Scatter Plot (relating variables in a data set and creating a line of best fit to interpret the situation) ● Population (reading features of a scatter plot, making sense of the relationship between variables of using a linear model) ● Machines ● Taxi Times

	- fit an appropriate function to the data informally using residuals - count the number of points on either side of the line, informally "measure" the distance of points from the line, and use functions fitted to data to solve problems in context - calculate and discuss the difference between actual data points and predictions using the line of best fit - Distinguish between correlation and causation. *SWBAT describe work by using these terms appropriately and consistently*: bivariate, joint frequency, marginal frequency, conditional relative frequency, density, line of best fit, residual, residual plot, correlation, causation, interpolation, extrapolation, independent, dependent, statistics, measures of center, mean, median, mode, range, outlier, interquartile range, box plot, stem and leaf plot, histogram, frequency, distribution, density, standard deviation	- NCTM Line of Best Fit estimator—an applet for estimating a line of best fit for a set of bivariate data **Analyzing the Line of Best Fit:** - Restaurant Bill & Party Size (Illustrative Mathematics, parts A-F builds and re-engages with the core math of the unit and parts G-I focuses specifically on residuals) - Best Buy (using the line of best fit and its rate of change to make comparisons between data points and interpret features of the data set) - Media Surfing (using the line of best fit to predict other data points, #5 supports thinking about correlation and causation) - Bird's Eggs (using the line of best fit to compare data points, #2 supports thinking about correlation and causation) - House Prices (consider correlation for line of best fit, creating a function to model the line of best fit, analyzing the relationship between variables in relation to the line of best fit) - Scatter Diagram (use the line of best fit for interpreting other data points, analyzing features about the scatter plot in relation to the line of best fit)

Common Core Learning Standards:

Summarize, represent, and interpret data on a single count or measurement variable.
- **S-ID 1** Represent data with plots on the real number line (dot plots, histograms, and box plots).
- **S-ID 2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- **S-ID 3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Summarize, represent, and interpret data on two categorical and quantitative variables
- **S-ID 5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data

- **S-ID 6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
  - **S-ID 6a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models*
    - Clarification: includes the use of the regression capabilities of the calculator
  - **S-ID 6b** Informally assess the fit of a function by plotting and analyzing residuals
    - Clarification: includes creating residual plots using the capabilities of the calculator (not manually)
  - **S-ID 6c** Fit a linear function for a scatter plot that suggests a linear association.
    - Both correlation coefficient and residuals will be addressed in this standard

Interpret linear models
- **S-ID 7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **S-ID 8** Compute (using technology) and interpret the correlation coefficient of a linear fit.
- **S-ID 9** Distinguish between correlation and causation.