DATA ANALYSIS

Curriculum/Content Area: Mathematics	**Course Length: 1 term**
Course Title: Data Analysis	**Date last reviewed: 2014** Link Previous UbD
Prerequisites: Statistics	**Board approval date:** 8/2020

Desired Results

Course description and purpose: This class is designed to extend the topics that began in Statistics and give meaningful application to the mathematics learned in previous courses. Students will be asked to use a variety of analytical tools to make sense of data sets, perform hypothesis testing, and identify the relationships that exist between variables. Skills learned in this course are highly valued in mathematical, science, economic and business college and career fields.

Enduring Understandings:	**Essential Questions**:
Mathematicians make sense of problems and persevere in solving them.	a. How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem? b. How do we as mathematicians persevere in solving problems?
Mathematicians attend to precision.	How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?
Mathematicians reason abstractly and quantitatively.	How do we as mathematicians make sense of quantities and situations symbolically?
Mathematicians construct viable arguments and critique the reasoning of others.	a. How can we as mathematicians justify our answer(s)? b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?
Mathematicians model with mathematics.	a. What model(s) can we as mathematicians use to solve a problem? b. How can we as mathematicians determine an effective model to use to solve a problem?
Mathematicians use appropriate tools strategically.	What tools are available and efficient for us as mathematicians to use while solving a problem?
Mathematicians look for and make	How can we as mathematicians use and apply patterns and

use of structure	structures to solve problems?
Mathematicians look for and express regularity in repeated reasoning.	How can we as mathematicians create and apply generalizations from repeated reasoning?

Mathematical Practice Standards

The Standards for Mathematical Practice are central to the teaching and learning of mathematics. These practices describe the behaviors and habits of mind that are exhibited by students who are mathematically proficient. Mathematical understanding is the intersection of these practices and mathematics content. It is critical that the Standards for Mathematical Practice are embedded in daily mathematics instruction.

Mathematical Practice Standards		**Grade Level/Course**
Habits of Mind	MP.1 Make sense of problems and persevere in solving them	Understand the meaning of a problem and look for entry points to its conclusion. Analyze information (givens, constraints, relationships, goals. Make conjectures and plan a solution pathway. Monitor and evaluate the progress and change course as necessary Check answers to problems and ask, “Does this make sense?”
	MP.6 Attend to precision.	Communicate precisely using clear definitions. State the meaning of symbols, carefully specifying units of measure, and providing accurate labels. State the meaning of symbols, carefully specifying units of measure, and providing accurate labels. Calculate accurately and efficiently, expressing. numerical answers with a degree of precision. Provide carefully formulated explanations. Label accurately when measuring and graphing.
Reasoning & Explaining	MP.2 Reason abstractly and quantitatively.	Make sense of quantities and relationships in problem situations. Represent abstract situations symbolically and understand the meaning of quantities. Create a coherent representation of the problem at hand. Consider the units involved. Flexibility uses properties of operations.
	MP.3 Construct viable arguments and critique the reasoning of others.	Use definitions and previously established causes/effects (results) in constructing arguments. Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas.

		Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions. Listen to or read the arguments of others. Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments.
Modeling & Using Tools	MP.4 Model with mathematics.	Apply prior knowledge to solve real world problems. Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas.Use assumptions and approximations to make a problem simpler. Check to see if an answer makes sense within the context of a situation and change a model when necessary.
	MP.5 Use appropriate tools strategically.	Make sound decisions about the use of specific tools (examples might include: calculator, concrete models, digital, technologies, pencil/paper, ruler, compass, protractor) Use technology tools to visualize the results of assumptions, explore consequences, and compare predictions with data. Identify relevant external math resources (digital content on a website) and use them to pose or solve problems. Use technological tools to explore and deepen understanding of concepts.
Seeing Structure & Generalizing	MP.7 Look for and make use of structure.	Look for patterns or structure, recognizing that quantities can be represented in different ways. Recognize the significance in concepts and models and use the patterns or structure for solving related problems. View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems.
	MP.8 Look for and express regularity in repeated reasoning.	Notice repeated calculations and look for general methods and shortcuts. Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings.

Priority Standard Clusters

S-ICB Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

- **(S-ICB3):**Recognize the purposes and differences among sample surveys, experiments, and observational studies;explain how randomness relates to each.
- **(S-IBC4):** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- **(S-ICB6):** Evaluate reports based on data.

S-ICA Understand and evaluate random processes underlying statistical experiments.

- **(S-ICA1):** Understand statistics as a process for making inferences about population parameters baked on a random sample from that population.

S-ID-C Interpret linear models.

- **(S-IDC7):** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **(S-IDC8):** ICompute (using technology) and interpret the correlation coefficient of a linear fit.
- **(S-IDC9):** Distinguish between correlation and causation.

S-ID-B Summarize, represent, and interpret data on two categorical and quantitative variables.

- **(S-IDB5):** 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-IDB6):** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related:
    - A. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.
    - B. Informally assess the fit of a function by plotting and analyzing residuals
    - C. Fit a linear function for a scatter plot that suggest a linear association

Unit 1: Vocabulary Review, Sampling Techniques, Confidence Intervals

Essential Questions:

1. How are inferences and conclusions made using statistics?
2. How can statistics help us make inferences about a population?
3. What is a confidence interval?
4. *How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?*
5. *How can we as mathematicians evaluate and question whether a mathematical argument is accurate?*

Unit Standards

Priority Standards

S-ICB Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

- **(S-ICB3):**Recognize the purposes and differences among sample surveys, experiments, and observational studies;explain how randomness relates to each.
- **(S-IBC4):** Use data from a sample survey to estimate a population mean or proportion;

develop a margin of error through the use of simulation models for random sampling.
- **(S-ICB6):** Evaluate reports based on data.

S-ICA Understand and evaluate random processes underlying statistical experiments.
- **(S-ICA1):** Understand statistics as a process for making inferences about population parameters baked on a random sample from that population.

Learning Targets

A. Identify common statistics vocabulary
    - I can name, define, and apply commonly used terms in statistics (sample, population, parameter, statistics, qualitative data, quantitative data).
B. Sampling Techniques
    - I can explain the difference between experiments and observational studies.
    - I can recognize bias due to voluntary response samples and other inferior sampling methods.
    - I can identify and appropriately use various sampling methods.
    - I can use the random digit table to select a random sample.
C. Sampling Distributions and the Central Limit Theorem
    - I can find the probability of a given interval under the normal curve, with and without a sample population.
D. Confidence Intervals for (One-Sample) Mean and Population Proportion (6.1-6.3)
    - I can construct and interpret a confidence interval for a population mean and proportion and use it to communicate a proper inference.
    - I can recognize and explain the effect of both sample size and confidence level on a confidence interval estimate.

Assessment Evidence

Performance Assessment Options
May include, but are not limited to the following:

- Summative assessments- written or oral
- Feedback & Scoring Rubric based on Priority Standards
- Performance based assessment- project or problem-based

Other assessment options
May include, but are not limited to the following:

Formative Assessments
- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
- Think/Pair/Share

Digital Tools & Supplementary Resources

TI-84 calculator or higher

Unit 2: Hypothesis Testing (One Sample)- Chapter 7

Essential Questions:

1. What is the value in testing hypotheses when trying to validate a claim?
2. How are inferences made using hypothesis testing?
3. *How do we as mathematicians make sense of quantities and situations symbolically?*

Unit Standards

Priority Standards

S-ICA Understand and evaluate random processes underlying statistical experiments.

- **(S-ICA1):** Understand statistics as a process for making inferences about population parameters baked on a random sample from that population.

Learning Targets

A. Hypothesis Testing For Mean (Using Z and T)
   - I can perform and interpret a hypothesis test for a population mean and use it to communicate a proper inference.
   - I can describe and interpret the probability of both Type 1 and Type 2 errors in a hypothesis test.
   - I can compare the z and t distributions and recognize their proper use.

B. Hypothesis Testing for Proportion
   - I can perform and interpret a hypothesis test for a population proportion and use it to communicate a proper inference.

C. Hypothesis Testing for Standard Deviation/Variance
   - I can perform and interpret a hypothesis test (using Chi-square test) for a population standard deviation and variance and use it to communicate a proper inference.

Assessment Evidence

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May include, but are not limited to the following:

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- Performance based assessment- project or problem-based

Other assessment options

May include, but are not limited to the following:

Formative Assessments

- Quick Writes
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Digital Tools & Supplementary Resources

TI-84 calculator or higher

Unit 3: Hypothesis Testing (Two Samples)- Chapter 8

Essential Questions:

1. How do hypothesis testing vary? How are appropriate hypothesis testing determined?
2. How are confidence intervals and hypothesis tests performed and interpreted? How are inferences made?
3. *How can we as mathematicians determine an effective model to use to solve a problem?*
4. *How can we as mathematicians create and apply generalizations from repeated reasoning?*

Unit Standards

Priority Standards

S-ICA Understand and evaluate random processes underlying statistical experiments.

- **(S-ICA1):** Understand statistics as a process for making inferences about population parameters baked on a random sample from that population.

Learning Targets

A. Hypothesis Testing For Two Samples
   - I can perform and interpret a confidence interval and a hypothesis test comparing population means and use it to communicate a proper inference.
   - I can perform and interpret a confidence interval and a hypothesis test comparing population proportions and use it to communicate a proper inference.
   - I can find statistical significance in calculating confidence intervals between two samples.
   - I can perform and interpret a hypothesis test comparing two dependent samples.

Assessment Evidence

Performance Assessment Options *May include, but are not limited to the following:*	**Other assessment options** *May include, but are not limited to the following:*
• Summative assessments- written or oral	Formative Assessments • Quick Writes • KWL Chart - (What I Know, Want to know,

• Feedback & Scoring Rubric based on Priority Standards • Performance based assessment-project or problem-based	Learned) • Marking Text • Learning Log Reflection - Daily/Weekly • I-Chart - Gather/Organize Information on a topic • Focused Note Taking • CSG - Collaborative Study Groups • Socratic Seminar • Philosophical Chairs • Think/Pair/Share
Digital Tools & Supplementary Resources	
TI-84 calculator or higher	

Unit 4: Examining Relationships between Quantitative Variables - Chapter 9

Essential Questions:

1. How is the relationship between two quantitative variables represented?
2. How are a variety of models interpreted? How are predictions made about the data?
3. *How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem?*
4. *What model(s) can we as mathematicians use to solve a problem?*

Unit Standards

Priority Standards

S-ID-C Interpret linear models.

- **(S-IDC7):** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **(S-IDC8):** ICompute (using technology) and interpret the correlation coefficient of a linear fit.
- **(S-IDC9):** Distinguish between correlation and causation.

S-ID-B Summarize, represent, and interpret data on two categorical and quantitative variables.

- **(S-IDB5):** 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-IDB6):** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related:
    - A. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.
    - B. Informally assess the fit of a function by plotting and analyzing residuals
    - C. Fit a linear function for a scatter plot that suggest a linear association

Learning Targets

A. Scatterplots and Correlation
   - I can construct and interpret a scatterplot and interpret the correlation of the relationship.
   - I can calculate and interpret the correlation coefficient and the coefficient of determination.

B. Least Squares Regression
   - I can apply the method of Least Squares Regression to determine a Linear model for a data set.
   - I can interpret the Linear model in the context of the problem and use it to make predictions.
   - I can calculate and interpret the residuals and a residual plot of a Least Squares Regression.

C. Correlation and Regression
   - I can explain the effects of influential observations and outliers in regression.
   - I can explain the caution in using extrapolation in predictions.
   - I can use models appropriately to make predictions.

Assessment Evidence

Performance Assessment Options
May include, but are not limited to the following:

- Summative assessments- written or oral
- Feedback & Scoring Rubric based on Priority Standards
- Performance based assessment- project or problem-based

Other assessment options
May include, but are not limited to the following:

Formative Assessments
- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
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Digital Tools & Supplementary Resources

TI-84 calculator or higher

Unit 5: Inference for 2-way Tables- Categorical Variables- Chapter 10

Essential Questions:
1. How is which hypothesis test to run determined?
2. How are hypothesis tests performed and results interpreted? How are inferences made

regarding the data?

3. How can you analyze the relationships between categorical variables?

4. *How can we as mathematicians determine an effective model to use to solve a problem?*

5. *How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem?*

Unit Standards

Priority Standards

S-ICA Understand and evaluate random processes underlying statistical experiments.

- **(S-ICA1):** Understand statistics as a process for making inferences about population parameters baked on a random sample from that population.

Learning Targets

A. Chi-Square Test for Goodness of Fit
   - I can apply Chi-Square procedures to test "the fit" of a distribution of a categorical variable as compared to a model.

B. Chi-Square Test for Independence
   - I can apply Chi-Square procedures to test for an association (independent or dependent) between two populations on a categorical variable.

C. F- Distribution
   - I can perform and interpret a hypothesis test comparing two variances or standard deviations using the F-distribution, and use it to communicate a proper inference.

D. One Way Analysis of Variance- ANOVA
   - I can perform and interpret a hypothesis test comparing three or more means and use it to communicate a proper inference.

Assessment Evidence

Performance Assessment Options
May include, but are not limited to the following:

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- Feedback & Scoring Rubric based on Priority Standards
- Performance based assessment- project or problem-based

Other assessment options
May include, but are not limited to the following:

Formative Assessments

- Quick Writes
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