Unit 1, Data and Descriptive Statistics

Content Area: **Math**
Course(s): **Statistics**
Time Period: **SeptOct**
Length: **32 Days , Grades 11,12**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Statistics A, Grades 11,12

Unit 1- Descriptive Statistics

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

Prepared by: Annamaria Contella

Dr. Richard Tomko, Ph.D., M.J., Superintendent of Schools

Ms. LucyAnn Demikoff, Director of Curriculum and Instruction K-12

Ms. Nicole Shanklin, Director of Elementary Education K-8, ESL Coordinator K-12

Mr. George Droste, Director of Secondary Education

Board Approved:September 23, 2019

Unit Overview

In this unit, students will analyze quantitative and qualitative data. Histograms, stem-and-leaf displays, dot plots, measures of center (mean, median, mode), distribution shapes (uniform, symmetric, skewed), measures of spread (range, IQR, standard deviation), outliers will be examined. Categorical data will be displayed and described using frequency, relative frequency tables, bar and pie charts.

Enduring Understanding

Data can be collected, organized, sorted, represented, and analyzed in a variety of ways.

Graphs can be misleading.

Measures of central tendency can be used to describe a set of data using one number, representing the conventional value for the set.

Measures of dispersion are important in understanding and interpreting a data set in regards to its measures of central tendencies.

Essential Questions

How can statistics help us to make a decision?

What type of graph is appropriate for particular data and not misleading in its construction?

How can data be collected and organized in an effective way?

Which measure of central tendency best represents a specific set of data?

How can standard deviation help me to interpret a data set?

Exit Skills

Upon completion of this unit students should have acquired knowledge of:

The two branches of statistics.

Statistical terms.

Measurement level for variables.

Various sampling techniques.

How to read, interpret, and choose various graphical representations of data.

Frequency and relative frequency distributions.

How to create various graphs and data displays.

Measures of central tendencies(mean, median, and mode).

Measures of variation.

Measures of position.

How to create a boxplot. Calculation of a z-score

New Jersey Student Learning Standards (NJSLS)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.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.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MA.K-12.4	Model with mathematics.
MA.S-ID.B.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.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.

Interdisciplinary Connections

9.3.12.BM.1	Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
9.3.12.FN.1	Utilize mathematical concepts, skills and problem solving to obtain necessary information

	for decision making in the finance industry.
9.3.12.ED-ADM.1	Use research-based practices to develop, communicate and enlist support for a vision of success for all learners.
9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST-SM.4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
9.3.GV-REV.3	Design, develop, operate and review data analysis systems and procedures to minimize and eliminate revenue-related financial problems.
LA.9-10.W.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.

Learning Objectives

The Learner will:

Differentiate between descriptive and inferential statistics.

Distinguish between sample and population

Differentiate between discrete and continuous data .

Identify the measurement level for each variable as nominal, ordinal, interval or ratio.

Identify sampling techniques of random, systematic, stratified, and cluster sampling

Organize data using frequency distributions.

Create graphical representations of data including bar graphs, histograms, line graphs, superimposed graphs, stem and leaf plots, and circle graphs.

Summarize data using measures of central tendency.

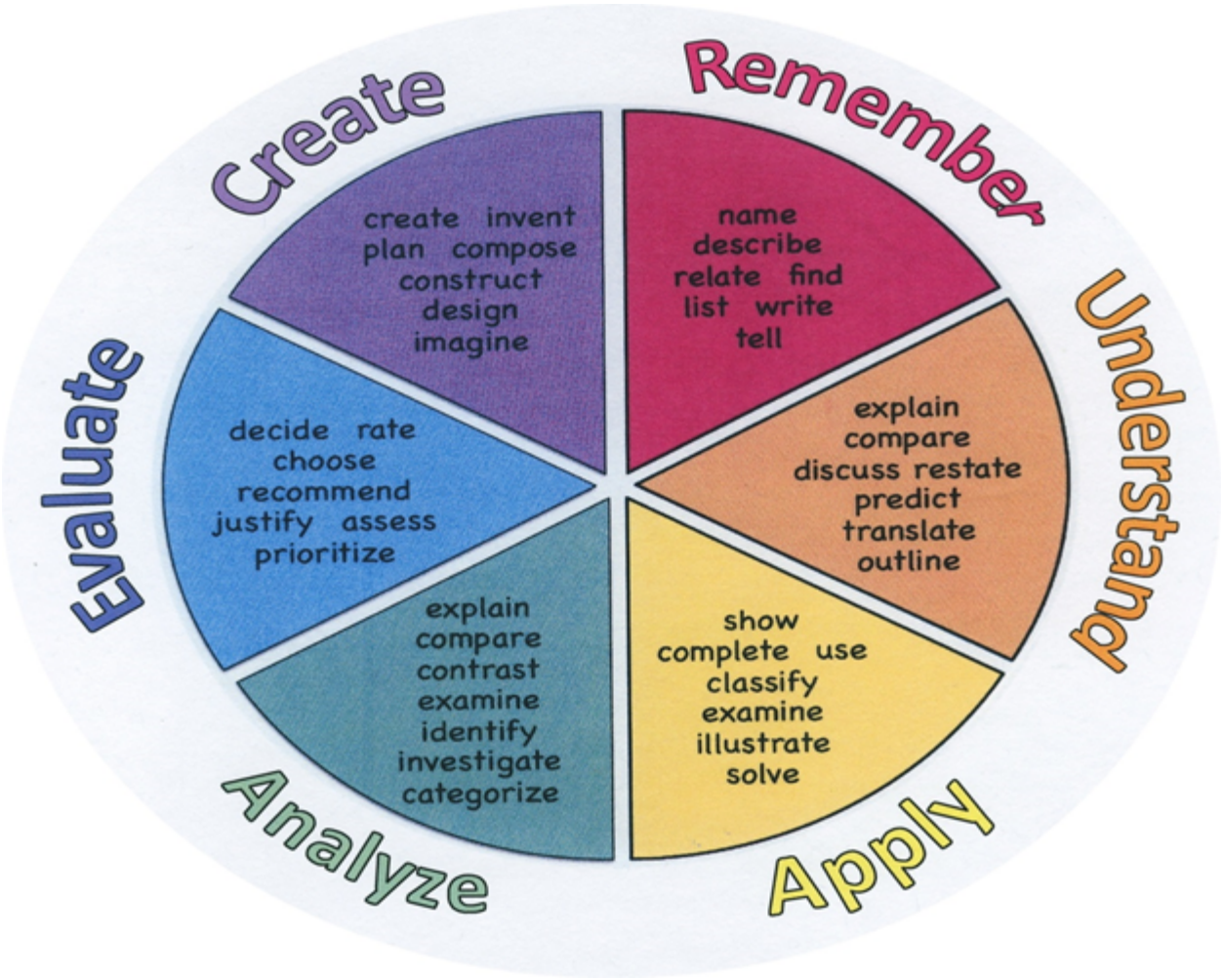
Calculate and interpret measures of dispersion including range, standard deviation, and variance.

Identify position of data values using several measures of position, including z-scores

Create and analyze a boxplot to display and discover various aspects of data.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Graphing Calculators:TI-84

Starnes, The Practice of Statistics, 5e, Student Resources(on-line textbook, study guides, worksheets)

http://www.macmillanlearning.com/catalog/studentresources/tps5e

Statistical Lesson Resources:

http://www.apstatsmonkey.com/StatsMonkey/Statsmonkey.html

Actuarial Foundation lessons:

http://www.actuarialfoundation.org/programs/youth/hs-stats.shtml

Statistic Tutorials

https://stattrek.com/

Census Bureau:

https://www.census.gov/about/what.html

Videos:

http://www.learner.org/resources/series65.html?pop=yesd&pid=140#

apstatsguy.com

American Statistical Association:

http://www.amstat.org/

Desmos.com

Assessment Evidence - Checking for Understanding (CFU)

Starnes, The Practice of Statistics 5e, Assessments (Summative)

Edulastic Formative Assessments (Formative):
https://app.edulastic.com/#renderResource/close/Mjk0MjE2ODUwOA%3D%3D

Exit tickets: Google Forms, Edulastic, paper & pencil (Formative)

Common Benchmarks on OnCourse:#1 (Benchmark)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe

- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Starnes, The Practice of Statistics, 5e textbook, ebook

The Practice of Statistics digital resources

Ancillary Resources

TI-84 Graphing Calculator

ALEKS

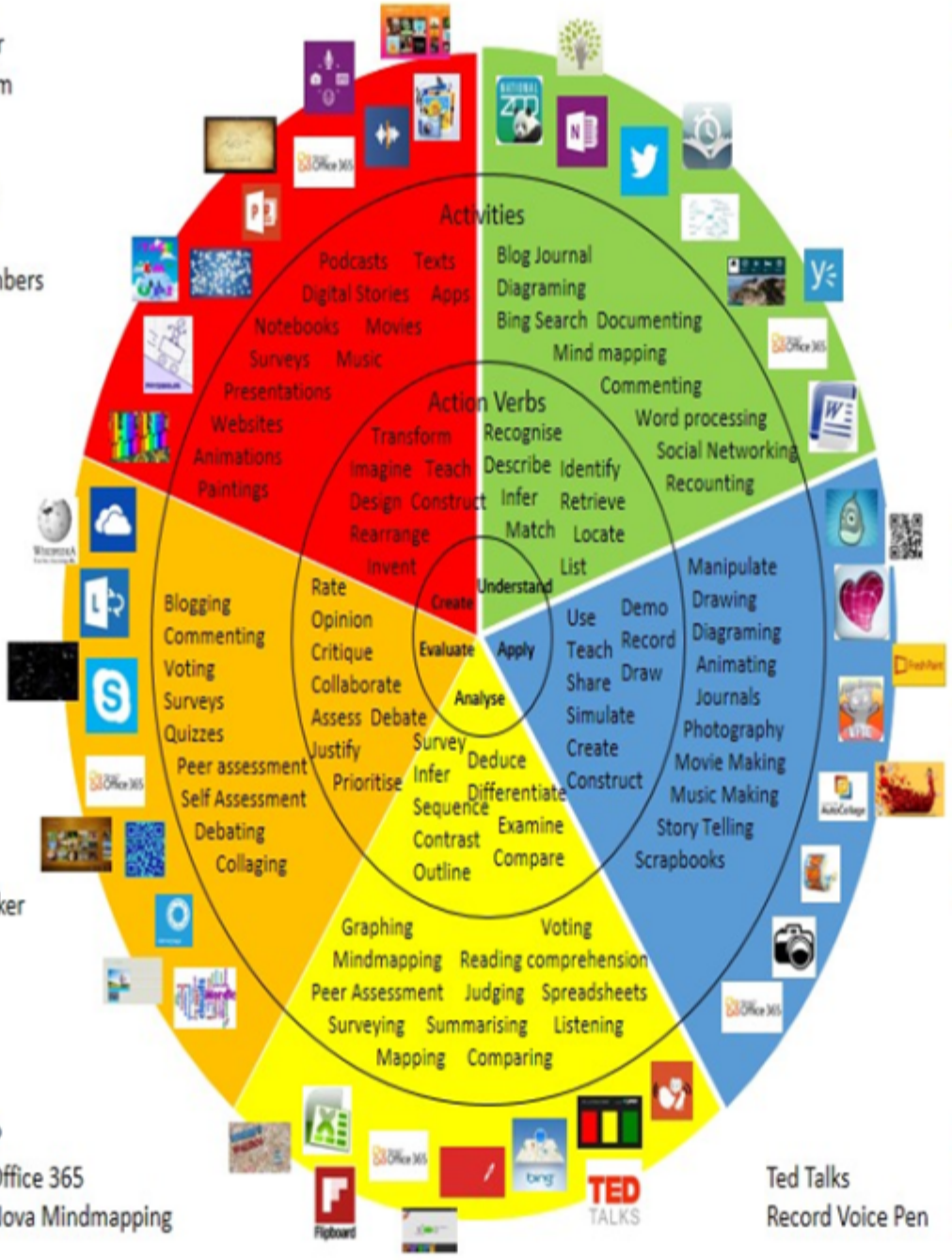
Technology Infusion

- Youtube
- Khan academy
- Google Classroom
- GSuite
- Kutasoftware
- PodCasts
- Skype
- Twitter
- Ted Talks
- ALEKS
- QR Barcode Generator
- Calculator/Graphing calculator
- Flipgrid
- Peardeck
- Edulastic
- McGraw-Hill Education
- Desmos.com
- Geogebra.org
- Kahoots

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, Civics, and Economics;
- Technology;

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
TECH.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.

21st Century Skills/Interdisciplinary Themes

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies/Economics;
- Technology

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Graphing calculator(Ti-84) introduction

Differentiate assignments giving choice of data based on student interest

Alternative assessments

Flexible grouping

Study Guides

Khan Academy statistics lessons

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe

- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Graphing calculator(TI-84)

Khan Academy statistics lessons

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

Choice of real-life data

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Graphing calculator(TI-84)

Khan Academy Spanish website https://es.khanacademy.org/math/probability

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

Choice of real-life data

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Graphing calculator(TI-84)

Use of manipulatives and "hands-on" activities

Differentiate assignments giving choice of data based on student interest

Khan Academy Statistics lessons

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Graphing calculator(TI-84)

Offer activities and problems that extend beyond the current assignments

AP assignments

Differentiate assinments giving more challenging one; or a task in which data is tailored to students' interests

Statistics software:

https://www.statcato.org/

Data:

http://www.statcrunch.com/

Khan Academy Statistics lessons

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Descriptive Statistics

NJSLS:

Interdisciplinary Connection:

Statement of Objective: The learner will estimate percentiles and individual values using a cumulative relative frequency graph

Anticipatory Set/Do Now: Create a human dotplot, copy dotplot to board discuss measures of central tendencies.

Learning Activity: In groups discuss percentiles using data acquired during anticipatory set and how each piece of data compares to the group as a whole. Discuss in class .Create ranges of heights and tally. Use this data to create a cumulative relative frequency graph. Present vocabulary, create cumulative relative frequency for ages of US presidents,

Student Assessment/CFU's: Present using peardeck or edpuzzle or google form and embed self assessments & exit ticket in lesson

Materials: Preactice of Statistics textbook/digital resources, graphing calculator, chromebook,

21st Century Themes and Skills: Information Literacy, Critical thinking and Problem Solving

Differentiation/Modifications: flexible grouping, graphing calculator, , think-pair-share, aleks

Integration of Technology: graphing calculator, chromebook, peardeck or nearpod or edpuzzle, powerpoint, google slides

MA.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.