Unit 6: Modeling with Data and Understanding Bias

Content Area: **Mathematics**
Course(s):
Time Period: **February**
Length: **3 weeks**
Status: **Published**

Unit Overview:

In this unit students will build a prioritization model to create a ranking. In this process, students will decide what they value, collect variables based on their values, gather and clean data, create functions to combine variables, normalize data, and create a weighting system for prioritizing their data. Students will do a sensitivity analysis on their weighting system. During this process, students will discuss how bias impacts mathematical models. They will use reasoning, justifications, and visualizations to explain their decisions. During this unit students will use Google Sheets, Google Data Commons, and Tableau.

Essential Questions:

How can I build a prioritization model that will create a ranking of the best places for me to live in?

Enduring Understandings:

- Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon.
- Apply mathematics to solve problems arising in everyday life, society, and the workplace.

Standards/Indicators/Student Learning Objectives (SLOs):

	Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MATH.9-12.N.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the

	scale and the origin in graphs and data displays.
MATH.9-12.N.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MATH.9-12.N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MATH.9-12.A.SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MATH.9-12.A.SSE.A.1.a	Interpret parts of an expression, such as terms, factors, and coefficients.
MATH.9-12.A.SSE.A.1.b	Interpret complicated expressions by viewing one or more of their parts as a single entity.

Lesson Titles:

- 6.1 Bias
- 6.2 Data collection and cleaning
- 6.3 Normalization and weighting of data
- 6.4 Forming mathematical models
- 6.5 Sensitivity analysis
- 6.6 Writing reports and communicating findings

Career Readiness, Life Literacies, & Key Skills:

WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections:

CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

Equity Considerations

Holocaust Mandate

Topic:

Materials Used:

Addresses the Following Component of the Mandate:

- Bias
- Bigotry
- Bullying
- Holocaust Studies
- Prejudice

LGBTQ and Disabilities Mandate

Topic (Person and Contribution Addresses):

Christina Papadimitriou - Recipient of Spring 2019 Paul Fasana LGBTQ Studies Fellowship for her research using data science for LGBTQ equality and rights

Christina Papadimitriou - 2019 Fellowship

Materials Used:

Discussion on bias in data gathering in connection to individuals from the LGBTQ community.

Addresses the Following Component of the Mandate:

LGBTQIA+

- Economic
- Political
- Social

Climate Change

Asian American Pacific Islander Mandate

Topic (Person and Contribution Addresses):

Materials Used:

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Summative Assessment:

In this assignment, students will analyze the bias of a published list of best places to live. Students will analyze the attributes that publishers value. Students will then create their own ranking and prioritization. Students analyze data available via the Google Data Commons “application programming interface” (API) to create a list of criteria for what is most important to them regarding the place(s) in which they would like to live. This will be an inquiry driven unit of study. They will then use those key characteristics along with Data Commons and Google Sheets to gather, analyze, and prioritize that data to formulate a model through which they will generate a set of countries or cities wherein they might choose to live.

- Build a Portfolio - Unit 6 City Ranking Project

Benchmark Assessments

- Project-Based Assessment
- Skills Based Assessment

Alternative Assessment

- Journal Reflections
- Performance tasks
- Portfolios
- Presentations
- Project-based assignments

Formative Assessment:

- Data Talks/ Class Discussions
- Individual. Partner & Group Exploration Activities
- Jigsaw Assignments
- Math Journals

Resources & Materials:

This curriculum will introduce students to the main ideas in data science through free tools such as Google Sheets, Python, Data Commons and Tableau. Students will learn to be data explorers in project-based units, through which they will develop their understanding of data analysis, sampling, correlation/causation, bias and uncertainty, probability, modeling with data, making and evaluating data-based arguments, the power of data in society, and more! At the end of the course students will have a portfolio of their data science work to showcase their newly developed abilities.

- Data Sets & Visuals
- YouCubed High School Data Science Curriculum

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Collect and clean data in Google Sheets using Google Data Commons
- Communicate results in a compelling way for a specific audience
- Conduct and consider the results of a sensitivity analysis
- Design a weighting system to model priorities
- Design equations that combine variables to numerically represent a value
- Interpret a prioritization model and express its strengths and limitations
- Select appropriate variables to create a ranking model
- Understand the impact that bias in the design process has on the results of a model
- Use normalization as an aid in comparing values

Modifications

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests

- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions

- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Technology Materials and Standards

- Chromebooks
- CODAP
- Edublocks
- Google Colab
- Google Jamboard

- Google Sheets
- Google Slides
- Promethean Board
- Tableau

Computer Science and Design Thinking Standards

CS.6-8.DA	Data & Analysis