

Teacher's Name: Ticey Little

Domain: Exploring Computer Science

Date Range: March 31, 2025 – April 04, 2025

ACOS Standard:

16 - Identify laws regarding the use of technology and their consequences and implications.

32 - Use data analysis tools and techniques to identify patterns in data representing complex systems.

Student Friendly Outcome:

Unit 4: Data & Computing

I CAN define “Big Data” and its characteristics.

I CAN understand the complexities of collecting, processing, and managing large sets of data.

I CAN identify real-world applications of big data in various fields.

I CAN make connections between sustainability and technology.

I CAN analyze and discuss the value of big data.

I CAN understand big data and its characteristics.

I CAN utilize tools to analyze large data sets.

I CAN draw conclusions about the data set selected.

I CAN identify issues related to the topic or aspects of the topic of particular interest to the groups.

I CAN discuss methods of collecting and validating data.

I CAN collaborate with others to create artifacts.

I CAN understand and discuss data bias.

Monday	Tuesday	Wednesday	Thursday	Friday
Weather Day School not in session	Teacher Absent	Journal entry (5 minutes) Big Data Search (15 minutes) Big Data Search Discussion/Review (10 minutes) Google Data Center Video and Discussion (10 minutes) Data Center PDF (10 minutes) Wrap-Up Review/Discuss (5 minutes)	Journal entry (5 minutes) How to Research Preview (10 minutes) Data and Research (20 minutes) Gallery Walk (10 minutes) Possible Research Projects (5 minutes) Journal entry (5 minutes)	Journal entry (5 minutes) Merging Diverse Data Sets (25 minutes) Merging Diverse Data Sets Review (20 minutes) Journal Entry (5 minutes)

Instructional Lesson # 1. Day 1

Topic Description: This lesson is designed to introduce “Big Data” and its impact on our world. Students will investigate “Big Data” sets and analyze its characteristics, scope, and effects on our society. Government, healthcare, education and other industries rely on “Big Data.” Big data is all around us and has revolutionized the way we live and work.

Objectives

The student will be able to:

- Define “Big Data” and its characteristics.
- Understand the complexities of collecting, processing, and managing large sets of data.
- Identify real-world applications of big data in various fields.
- Make connections between sustainability and technology.
- Analyze and discuss the value of big data.

Outline of the Lesson

Segment	Reason/Purpose
Journal entry (5 minutes) Big Data Search (15 minutes) Big Data Search Discussion/Review (10 minutes) Google Data Center Video and Discussion (10 minutes) Data Center PDF (10 minutes) Wrap-Up Review/Discuss (5 minutes) Assign Data Homework See Note Below	Define “Big Data” and make real world connection Analyze the size and scope of “Big Data”. Explain the concept of Big Data. The 5 V’s of Big Data. Allow students to investigate the difference between day-to-day data and big data. Discuss ideas, conclude “Big Data” or not and discuss the benefits and challenges of data centers. Discuss career options, benefits, drawbacks and ethical consideration of data centers. Briefly summarize points of the lesson.

Student Activities

- Complete Journal Entry
- Big Data Search
- Big Data Search Review
- Data Center PDF
- Review/Discuss

Teaching/Learning Strategies

- Journal Entry: *What is Big Data? Who creates it?*
 - Students may reflect on data they use and create every day. Explain how their day-to-day data combined with vast amounts of other data creates “Big Data”. Example: Driver’s license info is personal data; however, combining everyone’s DMV data creates “Big Data”. At this point It is okay if they do not grasp the full scope of Big Data. The following parts of this lesson will go into more depth.

- Big Data Search Discussion
 - Activity should define Big Data and its characteristics. There is a difference between “Big Data” and individual data sets. Please note some items are individual data sets. Individual data sets combine to form “Big Data”. Discuss the “Five V” characteristics of Big Data: Volume, Variety, Velocity, Veracity, and Value. Students should make more connections in addition to those on the list.

Volume: Big data is immense (The number of Visa purchases per minute)

Variety: Types of data (text, images, audio)

Veracity: Data is reliable and factual

Velocity: Data is generated and processed

Value: Data is useful
 - The Big Data Search Activity (See resources.) provides real-world data examples. Students may elect to use a simple Google search, Google Gemini or any tool. Students will gather information, analyze findings, and discuss. Really, how big is “BIG Data”? Is there a difference from initial thoughts? Where is this data? Where is it stored? Does anyone manage the data?
- Google Data Center Videos
 - Show two videos. (See resources.)
 - The first video: What is a Data Center should lead to career topics and “The Cloud”.
 - Students can include data, the cloud, cookies, and careers.
 - Make sure the following questions are answered through discussion. Really, how big is “BIG Data”? Is there a difference from initial thoughts? Where is this data? Who stores it? The purpose of this activity is to create a visualization of the scope of Big Data. Discussions about careers in Data Science should be mentioned (Data Analyst, Engineer, and Data Administrator.
 - Data Center.pdf should be given after the Google Data Center Video. The discussions and findings should reinforce subjects taught in previous units and provide new revelations to the term “Big Data”. Allow students to research careers and list the pros and cons of data centers. This should broach the environmental issues as well as security and privacy.
 - The second video should invoke conversations about conservation and water use. Students should make connections between the environment and sustainability.
- Wrap-Up Review/Discuss
 - This time students should review the concepts and characteristics of “Big Data”. Review the key points discussed in the lessons.
 - Assign Data Homework See Note Below
- Homework
 - Overnight, take note of situations when you “generate data” today. We’re looking for specific moments when some activity you perform can be observed, recorded, and, possibly, combined with similar data from others. Ideally, you will carry this paper with you and take notes over your day. To start you off, think about what happens when you ride the bus, make a telephone call, or browse a website!
 - NOTE: Students are allowed to create their own way of collecting data. Some may use charts or tables. The purpose of the lesson should reveal that the collection, usage, and purpose of data differ from person to person. The realization of the purpose should come out during the discussion.

Resources

- Big Data Search Activity
- What is a Data Center? <https://youtu.be/InJsWEoppo8?si=nAVXQGygtYPv1cFo>
- Data centers seek sustainable solutions to rising water consumption
<https://youtu.be/XZmGGAbHqa0?si=v3TPvL7vWK7p6LBD>
- Data Center.pdf <https://drive.google.com/file/d/1yHf7bOAyAU0sHkg4zrPKLqN4St6A9Nh-/view?usp=sharing>

Teacher Reflection Notes

Big Data Search Activity

Complete the chart below to help determine if the data is “Big Data”

Data	Variety (Format: text, images, video)	Volume (enormous size # of users)	Velocity (Generated rapidly Y/N)	Veracity (Accuracy Y/N)	Value (potential usefulness Y/N)	Big Data (Y/N)
Google Searches (per day)						
Google Document						
Youtube (users per day)						
Siri/Alexa (daily requests)						
Personal Email						
Personal Social Media Account						
Text book						
Airport Website						
GPS App						

Instructional Lesson # 2. Days 2-3

Topic Description: This lesson provides an opportunity to analyze how data is used to solve problems. Students explore the pitfalls and challenges of combining and managing large sets of data.

Objectives:

The student will be able to:

- Brainstorm possible topics for the final project.
- Understand the key steps involved in a research project.
- Select topic for the final project.
- Identify and discuss the considerations that must be made for a large data set to be useful.
- Consider how various types of data (numbers, text, dates, etc.) lend themselves to processing.
- Collaborate with others to create, manage, and maintain a large set of data.

Outline of the Lesson

Segment	Reason/Purpose
Day 1 Journal entry (5 minutes) How to Research Preview (10 minutes) Data and Research (20 minutes) Gallery Walk (10 minutes) Possible Research Projects (5 minutes) Journal entry (5 minutes)	Revisit Unit 2 Problem Solving lessons introduce the concepts of research. Identify and discuss from start to finish the key stages of a research project. Remind students about the algorithmic process of unit 2. Students discuss their observations and findings, fostering collaboration and exchange of ideas. Students can think about possible final projects. Review possible Projects and links listed below. Review and make connections
Day 2 Journal entry (5 minutes) Merging Diverse Data Sets (25 minutes) Merging Diverse Data Sets Review (20 minutes) Journal Entry (5 minutes)	Encourage students to think critically about managing data. Analyze and make decisions about data Discuss and review different perspectives of merging data. Review and draw conclusions

Student Activities:

Day 1

- Complete journal entry.
- Participate in a research preview.
- Participate in Data and Research activity.
- Participate in gallery walk
- Complete journal entry.

Day 2

- Complete journal entry.
- Groups merge data sets.
- Participate in merging data set review.
- Complete journal entry.

Teacher/Learning Strategies

- **Journal Entry: *What type of data would you use in your research? Why?***
 - Students should reflect on lessons learned from Unit 2. Connect the previous unit's problem solving and algorithmic processes. Answers may vary but surveys, images, pictures, texts etc. may come up.
- **How to Research Preview**
 - Review and discuss from start to finish the key stages of a research project. Remind students about the algorithmic process of Unit 2 Problem Solving lessons. Students will work periodically on their Research project throughout this unit. Research work should be located and organized within one document.
- **Data and Research**
 - Divide the class into small groups, students may use Google, Gen-AI platforms, or any reliable website to investigate their topic. Provide students with one of the following Research topics: The Problem of Houselessness or The Problem of Drug Abuse. Each group must design a poster outlining their research.
 - Locate credible sources- such as academic journals, .gov., or .org etc.
 - **Outline your project- introduce the topic, question, *supporting information, and tools such as surveys, images, AI, etc.**

The outline should only consist of brief statements or labels, a more detailed outline will come later in the Unit.
 - Posters may include labels, images etc. Not all posters will look the same; however, encourage students to note what is needed in a Research project.
 - Note that AI is not the data itself but a tool and a great way to access data. Discuss the uses of AI in finding credible sources, topics, and data analysis.
AI should not be used to plagiarize. Briefly discuss the ramification and ethical violations of wrongly using AI.
- **Gallery Walk**
 - Have students do a gallery walk of the posters.
 - As a wrap up discuss key research stages to preview the final project
 - Choose a topic -topic should be something that interest you
 - Develop a research question- research should answer or solve a problem
 - Locate credible sources- use credible sites such as academic journals, .gov., or .org etc.
 - Outline your project- introduce the topic, question, *supporting information, and tools such as surveys, images, AI, etc.
 - Write the project
 - *supporting information, and tools such as surveys, images, AI, etc. Discuss research may include different types of data, tools such as AI, survey, images, and maps.
 - **Types of Data**
 - Text - often unstructured datasets that exist through surveys, images, social media
 - Spatial - Data related to a geographical area or region

- Qualitative -open-ended questions that often reflect one’s opinion or belief.
Example: How did you feel about your shopping experience or How did you find us?
 - Quantitative- data in the form of numbers and statistical value
Students should complete a Google search of data terms.
- Possible Research
 - Introduce students to possible research topics for the final project by using the suggested videos or other high-interest and engaging resources. (See resources.) The goal is to spark their interest and desire to learn more about the topic and to brainstorm how they can be citizen scientists on the topics.
 - Resources for the topics are included in Sample Final Project Topics. Additional resources related to these topics are included in later lessons. The primary data file for each topic is located in the ECS Unit 5 Potential Final Projects.
- Journal Entry: *Thinking about the possible topics covered, which would you choose for a project and why?*
 - Students should formulate some interest in a Research topic. Discuss and review available topics again if needed. Inform students that choosing a topic is the first initial stage of research. Students should also set aside a document, notebook or folder for their project as they will work throughout the unit on their research.

Day 2

- Journal Entry: *Why would you need to merge or combine data? What might that look like?*
- Merging Datasets
 - Merge DAY 1 HOMEWORK
 - Students were asked to collect when they are feeling happy throughout the day.
 - The data should document how each student is feeling at various times. Merging the datasets should present challenges for students. The group should collectively problem-solve and collaborate to create a merged data set. Allow the students to combine the new data set as they see fit.
 - Do not provide any instructions about how or what to document. Students should simply document what they feel and how. **You should expect to see differences.**
 - Break class into groups of 4 to merge their personal data sets into one.
 - Individuals in each group should share their school/room data spreadsheets with each other and discuss the choices they made.
 - How was Happiness recorded?
 - How were dates/times written?
 - How were locations recorded?
 - Did everyone record the same number of entries for each day?
 - If the goal is to merge the group’s data into one consistent set, how might the number of entries per student be affected?
 - It is likely that each person recorded their data differently.
 - The group’s task is to merge their four data sets into one consistent data set.
 - The group should agree on how to denote days, times, locations and happiness.
 - It may be that some data needs to be compromised in order to conform to the group standard.
 - UNDER NO CIRCUMSTANCES
 - should new data be “invented” after the fact to fit the mold.

- The group should also agree on how many records (rows) of data should be allocated for each person.
- It need not be exactly the same number per person, but it should be representative of the group.
- For example, if one student has a minute-by-minute account of their day, while another just made one entry for each class they were in, how can they make that consistent?
- Once the group agrees on a standard, they must produce one file that represents everyone's data from the group.
- Students should use whatever collaboration technology is available to divide up the work of doing this—you shouldn't have one student re-typing all the data. A "low-tech" suggestion is for each student to re-type/convert their personal data, save the file, and send it to one person who can copy/paste the sheets together.

Note: This activity can also be done on poster paper without actual data entry, if desired.

- Merging Data Sets Review
 - Each group should present their findings. Allow 2-3 minutes per group to discuss their challenges or revelations. This section should prompt students to share openly about mistakes, challenges, and lessons learned. The mistakes encountered will be great learning tools.
- Journal Entry: Does filtering or cleaning data makes it less reliable? Why or why not?
 - Discussion should connect previous lessons from Unit 2. Students should reflect and share experiences about how data is made, any tools they use to merge data.

Resources

- Bullying
 - www.stopbullying.gov
 - <https://www.cdc.gov/healthyyouth/about/index.htm> (DASH)
- Healthcare
 - <https://www.cdc.gov/healthyyouth/index.htm>
 - <https://www.cdc.gov/mmwr/volumes/72/su/su7201a6.htm>
- Pollution/Climate
 - <https://www.worldbank.org/en/topic/pollution>
 - <https://www.epa.gov/p2>
 - <https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-pollution>
 - <https://education.nationalgeographic.org/resource/pollution/>

Teacher Reflection Notes

Instructional Lesson # 3. Days 4-5

Topic Description: Understanding the complexities of collecting, processing, and analyzing large data sets can be cumbersome and challenging. In this lesson students will learn how to analyze and effectively use data tools. Students learn how to navigate and filter big data.

Objectives:

The student will be able to:

- Understand big data and its characteristics
- Utilize tools to analyze large data sets
- Draw conclusions about the data set selected
- Identify issues related to the topic or aspects of the topic of particular interest to the groups.
- Discuss methods of collecting and validating data
- Collaborate with others to create artifacts
- Understand and discuss data bias

Outline of the Lesson: (Include approximate time required for each segment.)

Segment	Reason/Purpose
Day 1 Journal entry (5 minutes) Census Data Scavenger Hunt (20 minutes) Census Data History Article (15 minutes) Developing Research Questions (10 minutes) Journal entry (5 mins)	Reflect on previous lessons and units and make connections. Students will analyze and conclude data that informs. Discuss methods of collecting and validating data. Review and discuss the story of data
Day 2 Journal entry (5 minutes) Creating Research Tools (15 minutes) Building Surveys (20 minutes) Gallery Walk (15 minutes)	Review and discussion allow students to share their thoughts about the previous day. Decide on topic research question Collaborate with others to create and analyze artifacts and discover new facts about data

Student Activities

Day 1

- Complete journal entry.
- Complete Census Data Scavenger Hunt.
- Read the census data history article.
- Develop research questions.
- Complete journal entry.

Day 2

- Complete journal entry.

- Build surveys.
- Participate in a gallery walk.

Teaching/Learning Strategies

Day 1

- Journal Entry: *Thinking about the future, how is data growing or evolving?*
 - The purpose of the question is to provoke thoughts about the data. Data is evolving and changing to meet the needs of society. Each new innovation is the result of data. Data revealed a need and that need produced an innovation, the innovation produces data
- US Census Scavenger Hunt
 - Lead students through the navigation of the Census site (See resources.). Follow the instructions below pointing out features and information as you go. Allow time to search and analyze the site and data. Explaining the concepts of data filtering -selecting specific data based on certain criteria.
 - Visit US Census Data site
 - USA Overview
 - Type USA in the search bar
 - Click the View Profile link on the left
 - Population
 - Type USA in the search bar
 - Click the View Profile link on the left
 - Education
 - Type Education in the search bar
 - Select Education Attainment
 - Point out the search bar and navigation panes. Illustrate how to navigate the site. Allow students time to review data and draw conclusions.
 - Does the data inform?
 - What does the data reflect?
 - What data tools did you see on the site?
 - What type of data was used.
- Census Data History Article
 - Allow students to read the Census Data History article (See resources.) and discuss their findings. The purpose of the article is to show students that some data may not reflect the whole society. The data may or may not include all stakeholders. Who determines what is data and how it is used? This could also connect to the homework assignment for Day 1. Both data sets were open to individual interpretations as to what data should be included.
- Journal Entry: *What research tools can you use to collect data? What data types?*

Day 2

- Journal Entry: *What is bias and how can it affect the integrity of data?*
 - This prompt is a reflection of the previous day's lesson. Methods used to collect data are just as important as the data itself. Collecting data should be
- Creating Research Tools
 - Survey Notes
 - Types of Survey Questions:
 - Multiple Choice: Provide multiple answer choices and are great for getting data

- quick
 - Yes or No: Simple and clear-cut answers
 - Open Ended: Allow users to share personal ideas and experiences
- Questions should be clear, unbiased, and to the point.
- Research Process
 - Choose a topic
 - Develop a research question
 - Locate credible sources- such as academic journals, .gov., or .org etc.
 - **Outline your project- introduce the topic, question, *supporting information, and tools such as surveys, images, AI, etc.**
 - Write
 - Review
- Visit the US Census.gov and navigate to the Measuring Maternal Mortality. (See resources. Allow students a few minutes to read the document and share information that stood out. Make note to address “Issues to Consider in Questionnaire Design” at the end of the document.
- Building Surveys
 - Reflecting on yesterday’s lesson US Census Scavenger Hunt students must create a survey based on the Scavenger’s Hunt. Questions can address any problem, issue, or attraction; however, it must contain all three types of survey questions.
- Gallery Walk
 - Place posters around the room and allow students to view and post ideas about the state.

Resources:

- US Census Data <https://data.census.gov/>
- US Census Scavenger Hunt Notes
- Census Data History The U.S. Census Has a Long History of Discrimination | Fortune (<https://fortune.com/2019/06/20/2020-us-census-question/>)
- Measuring Maternal Mortality | Census Bureau (<https://www.census.gov/content/dam/Census/programs-surveys/international-programs/stic/maternal-mortality-english.pdf>)

Teacher Reflection Notes

US Census Scavenger Hunt Notes

US Census Scavenger Hunt https://data.census.gov/		
	What does the data show?	Data Type and Tool
Type USA in the search bar Click the View Profile link on the left		
Education Type Education in the search bar Select Education Attainment		
Population Type USA in the search bar Click the View Profile link on the left		