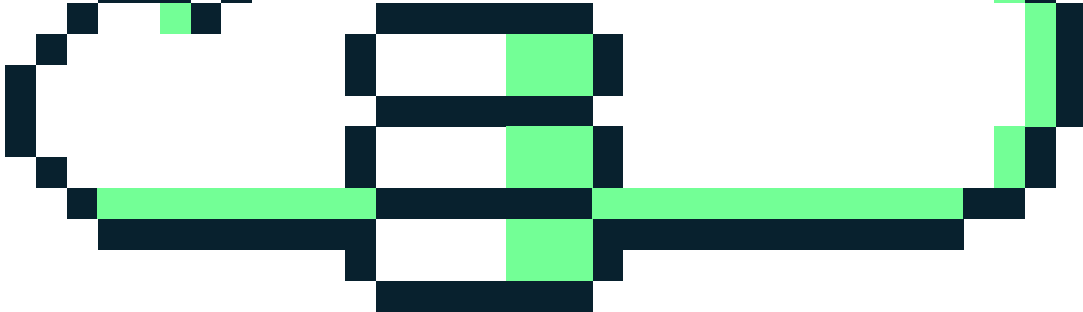


Lesson Plan >

BIG DATA



SNAPSHOT :

This lesson introduces students to the term “Big Data”, its many uses and impacts on our everyday lives. Students will explore big data as they examine its history and the technologies behind its analytics. Additional concepts such as privacy, security, liability and careers related to big data are also addressed. The lesson concludes as the students reflect on emerging trends and the promise of big data.

STUDENT LEARNING OBJECTIVES: Students will be able to:

- Define Big Data.
- Explain the 5 Vs as they relate to Big Data analytics.
- Examine the impacts of Big Data on our everyday lives.
- Describe career opportunities related to Big Data.
- Predict the future of big data in their lives and the world around them.

SYNOPSIS:

Watch the video “What is Big Data?” on the Future of Tech website.	(5 minutes)
Teacher Led Discussion	(15 minutes)
Interactive	(20 minutes)
Wrap Up	(5 minutes)
Extended Learning Opportunities	
Assessment	

TEACHER'S GUIDE:

MATERIALS:

- KWL Worksheet
- Analyze This Worksheet and Data Set
- Analyze This Teacher Resource
- Big Data: Interesting Insights
- Big Data Assessment
- Big Data Assessment Answer Key
- Computers
- Internet Access
- Small Buckets or Solo Cups

You'll want to refer often to the Future of Tech Website: futureoftech.org

To receive the answer key to the assessment, please email Eric Larson at elarson@comptia.org

Ask the students, what comes to their mind when they think of the word “data.” Record their responses on the board. Distribute the KWL Worksheet. Have the students to complete the first column and write down what they know about big data. Discuss their responses. Briefly explain that today’s lesson will introduce them to big data and its impacts.


Show the video “What is Big Data?” on the Future of Tech website. After watching the video, ask the students what types of data may be collected through various platforms (ie. Computer, Search Engines, Websites, Smart Devices, etc.) and how can the private and public sector utilize the data? Record their responses on the board. Have the students complete the second column of the KWL Worksheet -What do they want to learn about big data? Allow the students to share what they want to learn about big data.

INTERACTIVE: Divide the students into groups of 4. Distribute “Interactive: Analyze This.”

From the growing need to store large amounts of information to the need to validate and make sense of what information is worth gathering, analyzing, and storing, big data presents many opportunities and demands for the user. Explain to the students that the strips of paper in their cups represent the vast amount of data that exists. Ask the groups to quickly review the strips of paper in their cups. Ask the students what type of data they believe the cup contains. Students should respond, “States and their capital cities.” Explain how they could easily match up each state with its capital city. With the assistance of additional resources, they could learn other things from this data set as well.

Using the United States Census Bureau, Data.gov and other websites as resources, encourage the students to be creative as they brainstorm ways to analyze their data set. Have the students brainstorm three to five ways in which they could analyze their data. Consider the possibilities of having the students analyze their data set the following ways:

- Agriculture
- Energy Use
- Population Size
- State Capital Elevation
- Geographic Location
- Median Age in the State/Capital
- Total Retail Sales
- Individuals with Bachelor’s Degrees or Higher



After the students have analyzed their data, ask them to consider the following:

- Why did they choose to analyze the data the way that they did?
- How hard it was to obtain the information needed? Were multiple sources used? If so, which ones?
- How can the data can be used to form and support conclusions?
- If they were presenting the data to a client, what presentation tools would they use?

TEACHER INPUT:

Remind the students that the “What is Big Data?” video introduced them to concept of Big Data. Explain how companies and businesses have the opportunity to analyze data to obtain information about the consumer and determine trends just like they did in “Interactive: Analyze This.”

Introduce The Future of Tech website and explain that big data refers to large data sets that are computationally analyzed to reveal patterns and trends relating to a certain aspect of the data. Utilizing this website will help us as we examine big data, its impacts and future trends.

Divide the students into pairs. Utilizing the Future of Tech website, ask each group to identify five interesting insights related to one of the following categories under the Big Data Learning Unit:

- Our Digital World and Big Data
- History of Big Data
- The Technologies Behind Big Data Analytics
- The Impact of Data on Our World
- Privacy, Security and Liability
- Careers in Big Data
- Companies Leading Big Data
- The Promise of Big Data

Have the students record their insights on the Big Data: Interesting Insights worksheet and report their insights to the class.

WRAP-UP:

Explain to the students how this lesson introduced them to big data and the things to consider when analyzing data. From defining big data to considering how the data can be analyzed and its impacts, students are able to process just how much data exists and determine its value. Ask the students to forecast how big data and the technologies associated with it may impact their lives and the workplace in the next five to ten years.

ASSESSMENT:

Have the students complete column 3 on their KWL Worksheet –
What did they learn about big data?

EXTENDED LEARNING OPPORTUNITIES:

- Have students complete a Career Interest Survey to see where their interest lies and discuss how their interest may align with career opportunities related technology.
- Invite guest speakers from the field to your class to discuss big data.
- Invite your school or local education agency IT specialist to your class to discuss big data, privacy, security and liability at the school and/or local education agency.

WEBSITE RESOURCES:

[United States Census Bureau](#)

[Data.gov](#)

[Reddit](#)

[RefDesk](#)

[iTools](#)

[Encyclopedia.com](#)

[Reference.com](#)

[Lifewire](#)

[Datahub.io](#)

STANDARDS ALIGNMENT:

CSTA K-12 Computer Science Standards (2017)

- 1B-IC-18 Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.
- 2-IC-20 Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. Advancements in computer technology are neither wholly positive nor negative. However, the ways that people use computing technologies have tradeoffs. Students should consider current events related to broad ideas, including privacy, communication, and automation. For example, driverless cars can increase convenience and reduce accidents, but they are also susceptible to hacking. The emerging industry will reduce the number of taxi and shared-ride drivers, but will create more software engineering and cybersecurity jobs.
- 3A-IC-24 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. Computing may improve, harm, or maintain practices. Equity deficits, such as minimal exposure to computing, access to education, and training opportunities, are related to larger, systemic problems in society. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people who lack access to broadband or who have various disabilities. Students should also begin to identify potential bias during the design process to maximize accessibility in product design.
- 3B-IC-25 Evaluate computational artifacts to maximize their beneficial effects and minimize harmful effects on society.
- 3B-IC-27 Predict how computational innovations that have revolutionized aspects of our culture might evolve.

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K-W-L CHART

WHAT I KNOW OR THINK I KNOW ABOUT BIG DATA

WHAT I WANT TO LEARN ABOUT BIG DATA

WHAT I LEARNED ABOUT BIG DATA

ANALYZE THIS

Group Members:

Using the data set provided, list a minimum of three ways to analyze the data.

- 1.
- 2.
- 3.
- 4.
- 5.

How did your team decide to analyze the data set?

Why did your team choose to analyze the data this way?

How hard was it to obtain the information needed? Were multiple sources used? If so, which ones?

How can the data be used to form and support conclusions?

If you were presenting the data to a client, what presentation tools would you use?

Data Set

Print one copy for each group. Cut into strips and place the strips in a small bucket or cup.

Alabama	Illinois
Alaska	Indiana
Arizona	Iowa
Arkansas	Kansas
California	Kentucky
Colorado	Louisiana
Connecticut	Maine
Delaware	Maryland
Florida	Massachusetts
Georgia	Michigan
Hawaii	Minnesota
Idaho	Mississippi

Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island

South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
Montgomery
Juneau
Phoenix

Little Rock
Sacramento
Denver
Hartford
Dover
Tallahassee
Atlanta
Honolulu
Boise
Springfield
Indianapolis
Des Moines
Topeka
Frankfort
Baton Rouge

Augusta
Annapolis
Boston
Lansing
St. Paul
Jackson
Jefferson City
Helena
Lincoln
Carson City
Concord
Trenton
Santa Fe
Albany
Raleigh

Bismarck
Columbus
Oklahoma City
Salem
Harrisburg
Providence
Columbia
Pierre
Nashville

Austin
Salt Lake City
Montpelier
Richmond
Olympia
Charleston
Madison
Cheyenne

ANALYZING DATA TEACHER RESOURCE

Context and Background Information:

The Bucket of Data

The bucket of data serves as a resource for the students to visually process how data can be stored, organized and analyzed.

The bucket represents the World Wide Web.

The strips of paper represent any form of information/data.

The student groups are the processor/analyzer. The knowledge that they have will help them determine the various ways that they can analyze the data.

When the students responded that the data represented states and capitals, they retrieved that information from where? Their brain.

If you were to ask them what else they could do with their data, they might respond that they could analyze it and then sort the states and capitals alphabetically or even by region of the country. They may even say that could take a part of the data and identify the states that they have traveled to. The various ways that the students are grouping the data are simple examples of the students retrieving information (data) from a source (their brain). This same process takes place behind the scenes through our computers, software programs and the internet but at a much quicker rate due to algorithms.

Encourage the students to make that connection by providing the following example:

Through guided practice, give the student groups two minutes to answer the following question:


- **Using their bucket of data, identify the ten states with the largest population and predict their estimated population.**

Ask them how confident they are about their answers.

Utilizing a smart device or computer, ask the students to search “United States Population by State”.

A simple search of United States population by state provides sources such as:

- [The 50 US States Ranked By Population](#) from World Atlas
- [US States - Ranked by Population 2019](#) from World Population Review
- [2018 National and State Population Estimates](#) from the United States Census Bureau
- [U.S and World Population Clock](#) from the United States Census Bureau



Each of these sites provides the student with additional information about the states and/or capitals. Data that would take years for our students to collect physically is now at their fingertips with the click of button.

Then, give the students two minutes to answer the following question:

- Using [US States - Ranked by Population 2019](#) from World Population Review as their source of information, identify the ten states with the largest population and predict their estimated population.
- Students are also able to analyze the data from World Population Review the following ways:
 - Population
 - Population Growth
 - Percent each state represents of overall population of the United States

Ask the students how their responses changed when their source changed.

Encourage the student groups to make other predictions related to their data set, then compare their responses to those found on the Internet.

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INTERESTING INSIGHTS

Group Members:

In groups, select one of the following sections of the Future of Tech website (futureoftech.org) to review.

- **Our Digital World and Big Data**
- **History of Big Data**
- **The Technologies Behind Big Data Analytics**
- **The Impact of Data on Our World**
- **Privacy, Security and Liability**
- **Careers in Big Data**
- **Companies Leading Big Data**
- **The Promise of Big Data**

Section our group chose:

Provide a brief overview of the section in two or three sentences:

List five interesting insights that your group learned while reviewing the section.

- 1.
- 2.
- 3.
- 4.
- 5.

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Name: _____

Select the best response.

1. Large data sets that are computationally analyzed to reveal patterns and trends relating to a certain aspect of the data are referred to as
 - a. Analytics
 - b. Big Data
 - c. Data Mining
 - d. Data Processing
2. An early example of collecting and processing information to help civilizations structure, organize and make sense of disconnected complicated pieces of information or growing knowledge was known as a:
 - a. Census
 - b. Spreadsheet
 - c. Punch Card
 - d. Ballot
3. Introduced in the late 1800's, this device automatically counted and recorded data using punch cards.
 - a. Edgar F. Codd's relational database
 - b. John von Neumann's computer
 - c. Herman Hollerith's tabulating machine
 - d. Thomas Edison's computer
4. A device with an array of electronic components and transistors etched onto a wafer-thin piece of material is known as a(n):
 - a. Capacitor
 - b. Transistor
 - c. Power Generator
 - d. Integrated Circuit
5. The use of remotely connected computer servers to store and process large datasets is known as:
 - a. Artificial Intelligence
 - b. Distributed Computing
 - c. World Wide Web
 - d. Cloud Computing

Match the following with the appropriate term:

- | | |
|----------------|--|
| ___6. Volume | A. the speed at which data is available |
| ___7. Variety | B. the difficulty of verifying the accuracy of the data we collect |
| ___8. Velocity | C. the types of data that in a given platform |
| ___9. Veracity | D. the costs and benefits of collecting and analyzing the data |
| ___10. Value | E. the amount of data that exists in a given platform |

Match the following with the appropriate term:

- | | |
|------------------------------------|---|
| ___11. Distributed Computing | A. a field of computer programming that uses algorithms to interpret text and audio |
| ___12. Machine Learning | B. an extension of machine learning that uses artificial neural networks with many deep layers, modeled after the human brain, to accomplish complex tasks like facial recognition and real-time language translation |
| ___13. Cloud Computing | C. a branch of artificial intelligence that enables computers to use algorithms to acquire skills usually associated with humans. |
| ___14. Natural Language Processing | D. uses software to coordinate tasks that are performed on multiple computers simultaneously |
| ___15. Deep Learning | E. makes it possible to store information on a distant hard drive (in the cloud) and then retrieve it on demand from any computer, tablet, smartphone or other digital device |

List one example of how big data impacts each of the areas below:


16: Your Everyday Life:

17. Business and Industry:

18. Public Safety:

19. Your Health:

20: Your School:



Match the following with the appropriate term:

___21. Bioinformatics

___22. Computational Toxicology

___23. Geospatial Intelligence

___24. Innovation Management

A. combining geospatial analytics with business intelligence and military and government applications to answer complex questions about operations and potential markets

B. applying big data analytics to real-world problems in biology and genomics

C. an emerging field of study that marries advanced analytics and the life sciences

D. helps businesses and organizations turn raw data into insights that can help them make decisions

25. The U.S. Bureau of Labor Statistics sees big data jobs, which require a range of education and experience, increasing at rates higher than other sectors. Identify one of big data career, then describe why you might be interested in pursuing that career.