***Teacher's Name: Ticey Little***

**Domain: Exploring Computer Science**

**Date Range: November 18, 2024 – November 22, 2024**

**ACOS Standard:**

31- Reinforce the four steps of the problem-solving process.

39- Apply the problem-solving process. Use different strategies to plan and carry out the plan to solve several problems.

**Student Friendly Outcome:** **I CAN** name and explain the steps in the problem-solving process.
I **CAN** solve a problem by applying the problem-solving process.
**I CAN** reinforce the four steps of the problem-solving process.

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| **Objectives continued from last week**<br><br>EverFi<br><br>DataScience Foundations | **Objectives continued from last week**<br><br>EverFi<br><br>DataScience Foundations | **Objectives continued from last week**<br><br>Identity Iceberg experience (15 minutes)<br><br>Journal entry (10 minutes)<br><br>Research on cornrow braiding (20 minutes)<br><br>Begin group Presentations on historical cultural background of cornrow braiding (10 minutes) | **Objectives continued from last week**<br><br>Complete group presentations (10 minutes)<br><br>Cornrow curves design tool tutorial (20 minutes)<br><br>Cornrow curves design tool Create a Project Plan (10 minutes)<br><br>Cornrow curves project (15 minutes) | **Objectives continued from last week**<br><br>Journal entry (10 minutes)<br><br>Finalize cornrow curves project (30 minutes)<br><br>Gallery Walk and Reflection (15 minutes) with reflection journal. |

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Lesson Plan

# Data Science Foundations™

# What Is Data Science?

45 minutes

**Prerequisite:** What Is Data Science?

## OBJECTIVES

*Students will be able to…*

- Recognize the applicability of data science to many real-world problems.
- Explain the ways in which the practice of data science is both growing and increasingly relevant.
- Explain the kinds of problems a data scientist might need to solve, and the methods they use to address those problems.
- Explain the kinds of problems a data scientist might need to solve, and the methods they use to address those problems.
- Recognize how to read and make inferences from basic data visualization.

## MATERIALS

In-Person Lesson

- Writing Utensils
- Printed or Electronic worksheets
- Computers, Laptops, or Tablets (optional)

Virtual Lesson

- Writing Utensils
- Electronic worksheets
- Computers, Laptops, or Tablets

## LESSON OVERVIEW

The purpose of these lessons is to give students an opportunity to go through many of the steps that Data Scientists would go through in the real world. While actual Data Scientists would be dealing with an enormous amount of data gathered from many sources, students will be dealing with data on a much smaller scale. Based on the needs of your students and time constraints in your classroom, there are three ways to use the Data Science lessons:

- **Short:** Use only the online lessons.
- **Medium:** Use the online lessons and offline lesson plans, with provided data.
- **Long:** Use the online lessons and offline lesson plans, with students collecting their own data.

The data is designed to contain a few omissions and errors so that students get some practice dealing with "dirty data." By using the provided data, students save time on designing and carrying out surveys. (This is also an option that may be used for students who might struggle with the design and implementation of surveys.)

## NOTES

| SECTION | DESCRIPTION | FORMAT | DURATION |
|---|---|---|---|
| **Opening** | **Discuss the learning from Lesson:**<br>• What is data? Why do companies collect data about their customers or users?<br>• Why is it critical to use data when making important decisions?<br><br>Possible answers:<br>• Data can be any descriptive or measurable details about a thing. Companies collect data about their customers or users in order to better understand their habits and interests so that they can increase sales and more precisely use targeted marketing. They also collect data about other topics, such as costs, income, production time, etc. Nearly every aspect of businesses can be studied and improved upon by using data.<br>• Using data is critical when making important decisions in order to have the most successful outcomes. Data allows you to analyze patterns and choose the option that best fits your needs. | Virtual:<br>**Answer** individually on paper, participate using the chat function or using virtual breakout groups.<br><br>In-Person:<br>**Think-Pair-Share**<br>Students answer the questions on their own, then compare answers with a partner. Afterward, the class participates in a whole- group discussion. | 5 mins |
| **New Learning** | The students will be completing a data science project over the coming weeks. The project includes data collection, data cleaning and validation, data analysis, and producing two reports—one each for two very different audiences.<br><br>Explain to students that they will be reading about how to choose the best sample for their project. There are many things to take into consideration when studying a population, including sample size and ensuring a representative sample. | Virtual:<br>**Read** individually, then work in breakout groups to discuss how to select a sample to study.<br><br>In-Person:<br>**Read** individually, then work in breakout groups to discuss how to select a sample to study. Finally, discuss as a class. | 20 mins |

| SECTION | DESCRIPTION | FORMAT | DURATION |
|---|---|---|---|
| **New Learning (cont'd)** | Students will read the passage individually. Then in small groups, students will highlight important parts of the passage. Finally, the class will come together as a whole group to discuss sampling strategies. | | |
| **Activity: Project Introduction** | Introduce the activity by passing out the project sheet and sharing with students that they will be completing a project over the next few weeks. They may choose to work alone or with a partner. The students will select a topic that can easily be observed directly or through means such as interviews or surveys.<br><br>*Notes: You may want to give students at least one day to design their surveys and around a week to carry out the surveys.*<br><br>Students will go through all the processes that a data scientist would in the real world in order to study and analyze an issue. At the end of their project, they will make recommendations based on the data they collected and analyzed.<br><br>During class they should work individually or with a partner to design their survey or observation questions. Students may choose to create online surveys using free websites (such as SurveyMonkey, Airtable, or Typeform) that they can direct students to.<br><br>**Differentiation Help:**<br>For students who may struggle with the data collection portion of the project, encourage them to use the sample data included for the medium-length version of the project. | Virtual:<br>Students will **read** the assignment sheet individually, then either work alone or with a partner in a breakout room to **determine the topic** they would like to collect data on.<br><br>In-Person:<br>Students will **read** the assignment sheet individually, then either work alone or with a partner to **determine the topic** they would like to collect data on. | 15 mins |

| SECTION | DESCRIPTION | FORMAT | DURATION |
|---|---|---|---|
| **Closing** | "Excellent work today! In the online module, you learned about the work that data scientists do and then in class we began thinking about how we can complete a data science project of our own. We learned about the importance of carefully planning sample collection. And we began planning the project you will be working on over the next few lessons." | **Formalize** learning with the whole group. | 1 min |
| **Evaluation** | As an exit ticket, have students answer the following questions.<br>• What topic will you collect data on?<br>• How will you collect it? (Observation, interviews, surveys, etc.)<br>• What recommendations or decisions might you be able to make based on your data analysis? | **Assess** individually. | 3 mins |
| **Homework** | Students will finalize and carry out their surveys or observations. | **Extend** individually or with a partner. | 1 week |

## LEARNERS NEEDING SUPPORT

## LEARNERS READY FOR EXTENSIONS

## NOTES FOR NEXT TIME

## RUBRIC

### DATA SCIENCE PROJECT: STEP 1

| | EXEMPLARY *(4 points)* | ACCOMPLISHED *(3 points)* | DEVELOPING *(2 points)* | BEGINNING *(1 point)* | SCORE |
|---|---|---|---|---|---|
| **Recommendations** | The data that will be collected will allow for a clear and concrete recommendation to be made. | The data that will be collected will allow for a concrete recommendation to be made. | The data that will be collected will loosely allow for a recommendation to be made. | The data that will be collected may not allow for a recommendation to be made. | |
| **Sample Plans** | The sample is representative and of sufficient size to accurately reflect the whole population. | The sample is largely representative and of sufficient size to reflect the population. | The sample size is somewhat representative and of sufficient size to reflect the population. | The sample is not representative nor of an appropriate size. | |
| **Data Collection Plans** | Plans for collecting data are well thought out and clearly explained. | Plans for collecting data are thoughtful and clearly explained. | Plans for collecting data are loosely thought out and the explanation is present. | Plans for collecting data are poorly thought out and explained. | |
| **Questions** | Questions or observation topics are thorough and do not contain any obvious bias. | Questions or observation topics are complete and contain little bias. | Questions or observation topics are partially incomplete and may contain bias. | Questions or observation topics are incomplete or clearly biased. | |
| | | | | **Total Points** out of 16: _____ | |

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Lesson Plan

Data Science Foundations™

# Collecting, Cleaning, and Validating Data

45 minutes

**Prerequisite:** Collecting, Cleaning, and Validating Data; What Is Data Science?

## OBJECTIVES

*Students will be able to…*

- Describe the methods used to collect data, including quantitative and qualitative methods, and web scraping.
- Describe the methods used to clean data and populate missing values.
- Describe the methods used to validate data.
- Describe the methods used to clean data and populate missing values.
- Describe the methods used to validate data.

## MATERIALS

In-Person Lesson

- Writing Utensils
- Completed Homework (Data collection design)
- Computers, Laptops, or Tablets

Virtual Lesson

- Writing Utensils
- Completed Homework (Data collection design)
- Computers, Laptops, or Tablets

## NOTES

*(differentiation, student groupings, additional questions, etc.):*

| SECTION | DESCRIPTION | FORMAT | DURATION |
|---|---|---|---|
| **Opening** | In this lesson, you learned about types of surveys and how collecting, cleaning, and validating data works.<br>• What does it mean to clean data?<br>• How can data be validated?<br>• What is the difference between qualitative and quantitative data?<br><br>Possible answers:<br>• Cleaning data means to fix missing or incorrect data.<br>• Validating data means to double check that everything is accurate, in the correct category, formatted properly, and consistent.<br>• Quantitative data includes numbers or measurements. Qualitative data includes descriptions, but not numbers. | Virtual:<br>**Answer** individually on paper, participate using the chat function or using virtual breakout groups.<br><br>In-Person:<br>**Think-Pair-Share**<br>Students answer the questions on their own, then compare answers with a partner. Afterward, the class participates in a whole-group discussion. | 5 mins |
| **New Learning** | Explain to students that they will be continuing to learn more about the processes data scientists go through by reading the article (provided here) about data cleansing. Students will then follow those steps to clean their own data.<br><br>Tell the students to keep in mind that most of the articles will be aimed at data scientists who work in the field and so that there may be steps that are not relevant to a small-scale project like the one they are working on. They will need to determine what they can apply to the project and what steps they may omit. | Virtual:<br>Students will **read** an article independently, then work in breakout rooms with two partners to identify how to apply the steps of data cleaning to their data.<br><br>In-Person:<br>Students will **read** an article independently, then work in breakout rooms with two partners to identify how to apply the steps of data cleaning to their data. | 15 mins |

| SECTION | DESCRIPTION | FORMAT | DURATION |
|---|---|---|---|
| **Activity** | Students will use this time to put the data they have collected into a table or spreadsheet. (See attached table as an example that students may use.) After all the data is recorded, they will begin the process of cleaning it, using the steps they recorded previously. Explain to the students that because they are collecting data themselves, it is unlikely to be very dirty and that dirty data is usually the result of repeat submissions, failure to answer all questions, user error, or poor collection techniques.<br><br>Once all the data has been recorded, they should validate the data by going back through the surveys and double-checking that they have recorded all of the data accurately. Remind students that they will need to bring their cleaned and validated data with them to the next class period in order to continue working on the project.<br><br>**Differentiation Help:**<br>Students needing extra support may use the data provided with the lesson. It was designed to have a few minor errors so that students will be able to go through the process of cleaning the data with their peers. | Virtual:<br>Students will **record** their data in a table or spreadsheet, then **clean** the data.<br><br>In-Person:<br>Students will **record** their data in a table or spreadsheet, then **clean** the data. | 20 mins |
| **Closing** | "Great work today! You have made wonderful progress in collecting, cleaning, and validating your data. For your homework, you will complete the next step of the project. During our next session, we will begin the process of visualizing our data. After that, we will begin to create reports that explain our recommendations for decisions based on our data." | **Formalize** learning with the whole group. | 1 min |
| **Evaluation** | Have students turn in their Data Cleaning Research sheets. | **Assess** individually. | 3 mins |

| SECTION | DESCRIPTION | FORMAT | DURATION |
| --- | --- | --- | --- |
| **Homework** | Complete any data cleaning work that was not finished in class. | **Extend** individually or in small groups. | 1 hour |

## LEARNERS NEEDING SUPPORT

## LEARNERS READY FOR EXTENSIONS

## NOTES FOR NEXT TIME

## ANSWER KEY

| DATA CLEANING RESEARCH | |
|---|---|
| **List the articles you read:**<br><br>*Students should receive one point for each title and author they list.* | **6 points** |
| 1. What steps did the articles have in common?<br><br>*Answers will vary, but may include steps such as: checking spelling, remove duplicates, remove extra spaces, etc.* | **3 points** |
| 2. What steps are relevant to your project?<br><br>*Answers will vary, but should include steps such as removing duplicates, checking spelling, and ensuring consistent formatting.* | **3 points** |
| 3. List five or more steps you will take to clean your data.<br><br>1. *Correcting typos*<br>2. *Check spelling*<br>3. *Make sure numbers are not spelled out (1, 2, 3, not one, two, three)*<br>4. *Filling in missing information, when possible*<br>5. *Omit outliers* | **3 points** |

**Instructional Lesson # 4. Days 6-8**

**Topic Description:** This lesson reinforces the four main phases in the problem-solving process.

**Objectives**

The students will be able to:

- Solve a problem by applying the problem-solving process.
- Express a solution using standard design tools.
- Determine if a given solution successfully solves a stated problem.
- Explain benefits of diversity in software development.

**Outline of the Lesson**

| **Segment** | **Reason/Purpose** |
|---|---|
| Day 1<br>Identity Iceberg experience (15 minutes)<br>Journal entry (10 minutes)<br>Research on cornrow braiding (20)<br>Begin group Presentations on historical cultural background of cornrow braiding (10 minutes) | ECS Problem solving *Step 1- Understanding the problem.* Connections to Unit 1 lesson 1 and Unit 1 Room Activity about benefits of Diversity and understanding their own importance as an individual in a diverse group where their voice is heard and valued.<br><br>Students will be able to explain the benefits of diversity in software development teams. |
| Day 2<br>Complete group presentations (10 minutes)<br>Cornrow curves design tool tutorial (20 minutes)<br>Cornrow curves design tool Create a Project Plan (10 minutes)<br>Cornrow curves project project (15 minutes) | *Problem Solving Step 2*- Making a Plan<br>Learn to Express a solution using CSDT design tools.<br><br>Work with an elbow partner to complete the tutorial.<br><br>Work individually (or as a pair) to plan a project where you will create a unique pattern using cornrow curves software. |
| Day 3<br>Journal entry (10 minutes)<br>Finalize cornrow curves project (30 minutes)<br>Gallery Walk and Reflection (15 minutes) with reflection journal. | *Problem Solving Step 3*- Work individually to execute the plan for the cornrow curves project.<br><br>Determine if a given solution successfully solves a stated problem. Connect the outcomes and effects of specific solutions of a given problem.<br>*Problem Solving Step 4*- Participate in a gallery |

| | |
|---|---|
| | walk and reflection. |

**Student Activities**

Day 1

- Complete Identity Iceberg Experience.
- Complete journal entry.
- Groups review the history of cornrow braiding and present to the class.

Day 2

- Complete the CSDT Cornrow Curves tutorial.
- Explain benefits of diversity in software development
- Design a unique pattern for their own cornrow curves project.

Day3

- Evaluate positive and negative consequences when algorithms and software is developed with or without hearing diverse voices and ideas.
- Complete the pattern designed and planned for the cornrow curves project;
- Determine if a given solution successfully solves a stated problem
- Participate in a gallery walk and reflection journal.

**Teaching and Learning Strategies**

Day 1

- Identity Iceberg Experience
    - Using the Iceberg Activity (See resources.) students work individually on the handout.
    - Share with an elbow partner to continue the activity. Student volunteers can share one feature from above the line and one from below.
    - Remind students about their learning from Unit 1 Human Computer Interaction- specifically lesson 1 and Room Activity lesson. This image can be added to their digital portfolio if one was created in Unit 1
- Introduction to CSDTs Culturally Situated Design Tools with Cornrow Curves software
    - Journal Entry: *Take a look at the software options in CSDT. How did you represent your own culture on your Identity Iceberg? What observations can you make about culture represented in the software you have reviewed in the CSDT collection? How can diverse groups show that individuals are important and valued?*
        - There are a variety of ways to set the stage for this activity. Displaying images of people with cornrow braids is one example. The first set of activities is intended for students to learn more about the historical and cultural context of cornrow braiding as part of the first step of the problem-solving process- understanding the problem itself. One example might be to have students read The CROWN act. (See resources.)https://www.thecrownact.com/

- Using the legacy math software and historical perspective. (https://csdt.rpi.edu/culture/legacy/index2.html. Depending on your internet blockers, you may occasionally need to temporarily disable some settings.) The legacy math software allows students to move forward together with these common core math concepts.
    - Divide students into five groups and ask each group to read and take notes on one of the following sections and find additional sources on their topic:
        - African Origins
        - Middle Passage
        - Civil War to Civil Rights
        - Hip Hop
        - AfroFuturism
    - Each group will be responsible for sharing their notes in a poster presentation from their group with the rest of the class.
    - Resources: Read: https://www.thecrownact.com/
    - Group discussion on cultural background of cornrow braiding.
        - Students collectively work on understanding the problem through this presentation activity from
        - CSDT historical perspectives.
        - Question to consider during conversations: What did you learn through the researching the history of cornrows about African American Culture that you did not know before the activity? What are the similarities and differences between the cultural identities of Native American and African American in Colonial America?

Day 2

- Cornrow curves design tool tutorial
    - View “How to Braid” with elbow partner.
    - Optional activity: Braiding with yarn to be able to experience and facilitate further discussion of the process of braiding as an algorithm.
    - Individual students complete Part I of the tutorial, following all instructions and checking their work with their elbow partner.
    - Students use their journal to take notes using the software tutorial.
    - Think about your learning about iterative algorithms from the mathematical work in CSDT. We continue our work with algorithms later in this unit.
    - Resource: Cornrow curves software tutorial
- Cornrow curves project plan and project
    - Each group of students should complete the following. Each step of the process should be documented by the students:
        - Students create their own plan of a cornrow design. Questions students should be asking themselves when planning their design: “What context of the history of cornrows does their design draw from?” “Is their design appropriate within the context they chose?” “What does their cornrow design communicate to

others?" *(These questions can be extended to other CSDT software such as Adinkra.)*
    - Students create their strategy for their design. Highlight the mathematical concepts used and where and how they are used. Reinforce the strategy of finding a similar problem that has already been solved to help solve the new problem.
    - Students create their own design using the Math software (Note: The programming software can be used in Unit 4 to allow students who are interested to create extensions of their designs.)
    - Students reflect upon their process and the outcome of their design.

Day 3

- Journal Entry: *How would you feel if you were discriminated against in any way? Describe a situation in which you feel you have experienced discrimination.*
    - Ask a few volunteers to share their thoughts with the whole class, leading to a class discussion. • Then ask students to follow up this conversation in their journals about how they would feel if the discrimination was happening due to an algorithm—meaning a non-human with which they had no recourse and were not able to even have a discussion regarding the discrimination.
        - Discussion: As AI tools continue to advance computers can solve some problems faster than humans, and human intelligence is needed to solve some kinds of problems. What kinds of problems do students face that might be able to be solved using AI tools or without AI tools? How might algorithmic bias be a factor to problem solving?
        - Discussion: As students learn to appreciate the impact of design, art and historical perspectives of diverse groups of people, could this type of learning and appreciation lead to less discrimination? How can software development team diversity be applied to algorithm and software development?
- Complete project
- Gallery Walk and final reflection journal
    - Students share their solutions on their screens with a Gallery Walk and Reflection journal.
    - Ask students questions that will get them to reflect on the importance of diverse cultural perspectives on computer science during the design and development of software.
- Journal Entry: *What went well for you in carrying out your plan? What was difficult for you? What might you do differently if you prepared another design plan?*

**Resources**

- https://www.oregon.gov/ode/students-and-family/equity/NativeAmericanEducation/Documents/SB13%20Curriculum/Materials_GR10_Identity_and_Survivance_Iceberg_Worksheet.pdf
- https://adl.org/sites/default/files/identity-iceberg/story.html

- The CROWN act: https://www.thecrownact.com/
- (https://csdt.rpi. edu/culture/legacy/index2.html. Depending on your internet blockers, you may occasionally need to temporarily disable some settings.)
- Barbershop computing https://csdt.org/culture/barbershop/index.html
- Afrofuturism https://csdt.org/culture/afrofuturism/index.html
- https://www.thecrownact.com/

**Teacher Reflection Notes**