# Middle School Drought Analysis

| **Lesson Overview** | |
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| **Description** | The purpose of this lesson is to develop students' data literacy skills through analyzing real drought data from their state or region. Students will explore climate patterns, create visualizations, draw evidence-based conclusions, and communicate findings effectively while learning to evaluate data sources, identify patterns, and understand the ethical implications of data analysis. |
| **Subject Area(s)** | Science |
| **Grade Band(s)** | 6-8 |

| **Learning Progression Alignment** | |
| --- | --- |
| **Strand** | A - Data Literacy and Responsibility |
| **Substrand** | A1 - Nature of Data |
| **Concept** | A.1.1 Data types and forms |
| **Competency** | 6-8.A.1.1a - Utilize both categorical and numeric data. Distinguish when data is categorical versus numeric and define the difference.  6-8.A.1.2b - Ask questions about how data are collected or considered.  6-8.A.1.3a - Multiple conclusions can be drawn from the same set of data.  6-8.A.1.4a - Select attributes of interest for data investigations while recognizing those selections will retain inherent limits. |
| **Strand** | A - Data Literacy and Responsibility |
| **Substrand** | A2 - Data Ethics and Responsibilities |
| **Concept** | A.2.2 Biases in data  A.2.3 Power of data |
| **Competency** | 6-8.A.2.2a - Identify how biases in data affect inferences and questions.  6-8.A.2.3a - Analyze how data is used to solve problems, persuade, and discover new ideas. |
| **Strand** | A - Data Literacy and Responsibility |
| **Substrand** | A3 - Investigative Dispositions |
| **Concept** | A.3.1 The investigative process  A.3.2 Iteration  A.3.4 Apply context  A.3.5 Student data agency |
| **Competency** | 6-8.A.3.1a - Investigate real-world questions by cleaning, analyzing, and interpreting data to draw conclusions.  6-8.A.3.2a - Recognize that the investigative process is non-linear, often cycling between phases in various orders multiple times.  6-8.A.3.4a - Recognize that data interpretation varies across social and cultural contexts.  6-8.A.3.5b - Assess the accuracy, perspective, credibility, and relevance of various resources. |
| **Strand** | B - Creation and Curation |
| **Substrand** | B1 - Organization and Processing |
| **Concept** | B.1.1 Data cleaning  B.1.2 Organizing and structure |
| **Competency** | 6-8.B.1.1a - Informally identify anomalies and outliers in a distribution of data and make an informed decision as to whether those cases should be removed or filtered out for analysis.  6-8.B.1.2a - Use categorical attributes or bins/groups of numerical attributes in a dataset to restructure data into groups. |
| **Strand** | B - Creation and Curation |
| **Substrand** | B3 - Measurement and Datafication |
| **Concept** | B.3.2 Working with data created by others |
| **Competency** | 6-8.B.3.2a - Consider how the data were measured, with what tool and precision. |
| **Strand** | B - Creation and Curation |
| **Substrand** | B4 - Complexity of Data |
| **Concept** | B.4.2 Complexity of variables |
| **Competency** | 6-8.B.4.2b - Work with datasets that have multiple variables that can suggest or answer different questions.  6-8.B.4.2c - Work with datasets that show natural variation and understand why values differ. |
| **Strand** | C - Analysis and Modeling Techniques |
| **Substrand** | C1 - Summarizing Data |
| **Concept** | C.1.2 Measures of spread |
| **Competency** | 6-8.C.1.2a - Calculate the range for numerical data. |
| **Strand** | C - Analysis and Modeling Techniques |
| **Substrand** | C2 - Identifying Patterns and Relationships in Data |
| **Concept** | C.2.1 Comparing variables  C.2.3 Defining relationships |
| **Competency** | 6-8.C.2.1a - Use reasoning about distributions to compare two groups based on quantitative variables.  6-8.C.2.3a - Employ complex graphs and basic statistical concepts to describe patterns and identify trends, similarities, and differences within data.  6-8.C.2.3b - Create scatterplots and add line of best fit. |
| **Strand** | C - Analysis and Modeling Techniques |
| **Substrand** | C4 - Digital Tools of Data Analysis |
| **Concept** | C.4.1 Tool application |
| **Competency** | 6-8.C.4.1a - Identify relationships and patterns using a digital tool.  6-8.C.4.1b - Clean and wrangle data using a digital tool.  6-8.C.4.1c - Perform data analysis using a digital tool. |
| **Strand** | D - Interpreting Problems and Results |
| **Substrand** | D1 - Making and Justifying Claims |
| **Concept** | D.1.1 Probabilistic language |
| **Competency** | 6-8.D.1.1a - Express a finding and quantify your confidence in it by stating the degree of certainty regarding the result. |
| **Strand** | D - Interpreting Problems and Results |
| **Substrand** | D2 - Problem Identification and Question Formation |
| **Concept** | D.2.1 Verifiable questions and statements |
| **Competency** | 6-8.D.2.1a - Ask or identify a question that can be verified with data collected through observations. |
| **Strand** | E - Visualizations and Communication |
| **Substrand** | E1 - Representations and Dynamic Visualizations |
| **Concept** | E.1.1 Sense-making with visualizations  E.1.5 Representational fluency |
| **Competency** | 6-8.E.1.1a - Create data visualizations that use multiple variables.  6-8.E.1.1c - Create map visualizations to display location data.  6-8.E.1.5b - Describe how different ways of representing data can improve clarity or mislead. |
| **Strand** | E - Visualizations and Communication |
| **Substrand** | E2 - Data Storytelling |
| **Concept** | E.2.2 Write data stories  E.2.3 Adapt storytelling |
| **Competency** | 6-8.E.2.2a - Explain what the data reveals and whether it supports or contradicts any claims initially made.  6-8.E.2.2c - Create a provocative question, support that question with relevant data, and reveal the story the data is telling, including connections with real-life scenarios and potential solutions.  6-8.E.2.3a - Present data in a way that is accessible and engaging, while considering the specific needs, interests, and knowledge level of the audience. |
| **Strand** | E - Visualizations and Communication |
| **Substrand** | E3 - Acting on Data to Benefit Society |
| **Concept** | E.3.1 Intent and authorship of analyses |
| **Competency** | 6-8.E.3.1b - Identify potential biases of the source of data used to create a visualization.  6-8.E.3.1c - Communicate the limitations of data visualizations based on the source of data used to create it. |

| **Tool(s)** | |
| --- | --- |
| **Type** | No-Code |
| **Tool** | CODAP |

| **Lesson Materials** | |
| --- | --- |
| **Dataset** | [drought.gov/states/your state](http://drought.gov/states/arizona) |
| **Datasheet** | [CODAP.concord.org](http://codap.concord.org) |

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| **Lesson Plan** | |
| --- | --- |
| **Lesson Focus** | *This lesson introduces students to real-world data analysis using drought and climate data from their own state or region. Students will learn to work with complex, multi-variable datasets while developing critical thinking skills about data sources, limitations, and ethical implications of data use in decision-making.* |
| **Content Objective(s)** | By the end of this lesson sequence, students will be able to:   * Import, organize, and analyze real drought and climate data using CODAP * Create appropriate visualizations (time series, scatterplots, geographic comparisons) to communicate findings * Identify patterns and relationships in multi-variable climate datasets * Use probabilistic language to express certainty levels about data-based claims * Evaluate data sources for potential biases and limitations * Create a data story that connects findings to real-world implications and decision-making * Apply statistical concepts (trend lines, outliers, correlation) to interpret regional climate data |
| **Prerequisite Knowledge & Skills** | * Basic computer navigation and internet browsing skills * Familiarity with reading simple graphs and charts * Understanding of basic weather and climate concepts * Knowledge of measures of center (mean, median) and basic statistical vocabulary * Ability to work collaboratively and present findings to peers |
| **Lesson Details** | |
| **Day 1: Nature of Drought Data & CODAP Introduction**  **(50 mins)** | **Student Facing**  Students explore drought monitoring websites, learn about data classification systems, and begin working with CODAP to import and visualize regional drought data. |
| **Teacher Facing**  **Opening Discussion and Data Exploration (20 mins)**   * Ask students: "How do scientists know when we're in a drought?" and "What data would you need to study drought?" * Introduce drought.gov website and demonstrate:   + Navigate to your state using the map or dropdown menu   + Explain drought classification system (D0-D4) and how percentages represent land area coverage   + Show automatically generated time series graph from 2000-present   + Use "Combine States" tool to focus on your state only * Discuss limitations: "What are the limitations of drought data?" and "Who produces this data and why?" * Show examples of different data types: numerical (percentages), categorical (severity), temporal (over time), geographical (by region) * **Learning Progression Addressed:** 6-8.A.1.1a, 6-8.A.1.2b, 6-8.A.1.4a   **CODAP Introduction (20 mins)**   * Direct students to CODAP.concord.org and demonstrate:   + Creating new documents and importing data   + Download state drought data as CSV from prepared source   + Import data using drag-and-drop method   + Create basic time series graphs using MapDate and drought categories   + Show how CODAP automatically adjusts graph types based on data types   + Demonstrate interactive features (zooming, toggling variables) * **Learning Progression Addressed:** 6-8.C.4.1a/b   **Exit Ticket (10 mins)** Students complete: "Name one thing that surprised you about the drought data and one question you now have." |
| **Day 2: Data Variability & Patterns Over Time**  **(50 mins)** | **Student Facing**  Students import NOAA weather data for their region, explore datasets for outliers and patterns, and create visualizations showing climate trends over time. |
| **Teacher Facing**  **Opening Review (5 mins)**   * Review previous day's drought data observations * Introduce guiding question: "How have drought conditions in our region changed over the past 25 years, and what patterns can we identify?" * **Learning Progression Addressed:** 6-8.D.2.1a   **Data Import and Exploration (15 mins)**   * Have students open blank CODAP and access NOAA Weather plugin * Guide them through selecting local weather stations and setting monthly intervals * Allow exploration time to identify outliers, missing values, or unusual patterns * **Learning Progression Addressed:** 6-8.B.1.1a, 6-8.C.1.2a   **Investigation: Visualizing Distribution & Variability (25 mins)**   * Students create time series visualizations:   + Drag "when" to x-axis and temperature variables to y-axis   + Add connecting lines and least square lines to identify trends   + Explore multiple variables (temperature, precipitation) * Discuss seasonal patterns and data variability * Compare findings with local university or state climate office data * Address questions about data limitations and variability sources * **Learning Progression Addressed:** 6-8.C.2.3a, 6-8.A.3.1a, 6-8.A.1.3a, 6-8.B.4.2c   **Exit Ticket (5 mins)** Students complete: "Based on the data, what is one claim you can make about drought patterns in our region? How certain are you about this claim?" |
| **Day 3: Geographic Variations & Data Ethics**  **(50 mins)** | **Student Facing**  Students work in groups to analyze different regions within their state, compare findings across geographic areas, and discuss ethical considerations in drought data collection and use. |
| **Teacher Facing**  **Opening Review (5 mins)**   * Review time-pattern findings from previous class * Introduce guiding question: "How do drought conditions vary across different parts of our state, and what factors might influence these differences?" * **Learning Progression Addressed:** 6-8.D.2.1a   **Data Import and Group Setup (5 mins)**   * Organize students into groups representing different regions/counties in your state * Help groups access NOAA data for their assigned geographic areas   **Investigation: Geographic Comparisons (30 mins)**   * Groups conduct regional analysis and gather:   + Slope of linear fit line for average temperature   + Highest average temperature and when it occurred   + Precipitation patterns and averages * Create class-wide data collection using color-coded sticky poster displays * Students complete geographic patterns analysis comparing regions * Discuss regional differences and potential explanatory factors * **Learning Progression Addressed:** 6-8.C.2.1a, 6-8.E.1.1c, 6-8.B.3.2a   **Data Ethics Discussion (15 mins)**   * Explore potential biases in drought data collection:   + Measurement methods and precision differences   + Economic or political factors in reporting   + Equal representation across geographic areas * Discuss real-world applications:   + Water restriction policies   + Agricultural planning decisions   + Emergency management protocols * **Learning Progression Addressed:** 6-8.A.2.2a, 6-8.A.2.3a, 6-8.E.3.1b |
| **Day 4: Data Transformation & Storytelling**  **(50 mins)** | **Student Facing:**  Students learn about visualization ethics, work in pairs to create data stories with multiple visualizations, and present findings that connect to real-world implications. |
| **Teacher Facing:**  **Visualization Ethics (10 mins)**   * Show examples of misleading drought visualizations * Discuss how scale, color, and design choices influence perception * Identify best practices for honest data communication * Learning Progression Addressed: 6-8.E.1.5b, 6-8.E.3.1c   **Data Storytelling Project (35 mins)**  Students work in pairs to create data stories that:   * Pose provocative questions about regional drought patterns * Use at least two different visualizations * Draw evidence-based conclusions with appropriate uncertainty language * Acknowledge data limitations * Connect findings to real-world implications for their community * Learning Progression Addressed: 6-8.E.2.2a, 6-8.E.2.2c, 6-8.E.2.3a   **Pro**ject Planning and Peer Feedback (5 mins)   * Groups share research questions and planned visualizations * Class provides constructive feedback and suggestions * Begin drafting data stories for completion as homework/extension |
| **Lesson Synthesis** | **Formative Assessment:**   * Daily exit tickets tracking understanding progression * Worksheet completion and accuracy * Participation in class discussions and group work * CODAP skills demonstration checklist   **Summative Assessment - Data Storytelling Project (100 points):**   * **Data handling and analysis (25%):** Correctly imports, organizes, and transforms data; identifies appropriate patterns; uses statistical concepts accurately * **Visualization quality (25%):** Creates clear, appropriate visualizations; proper labeling; effective visual choices * **Evidence-based reasoning (25%):** Valid conclusions from data; appropriate probabilistic language; acknowledges limitations * **Communication effectiveness (25%):** Coherent, compelling story; real-world connections; clear audience-appropriate presentation |
| **References** | **National Standards:**   * Next Generation Science Standards (NGSS): MS-ESS3-2, MS-ESS3-3, MS-ESS3-5, MS-ESS2-5 * Common Core Mathematics: 6.SP.A.2, 6.SP.B.4-5, 7.SP.A.1, 7.SP.B.3-4, 8.SP.A.1-3 * Computer Science Teachers Association (CSTA) Standards * Data Science Learning Progressions Framework   **Data Sources:**   * National Drought Mitigation Center (drought.gov) * National Oceanic and Atmospheric Administration (NOAA) * Local/state climate monitoring offices * University climate research centers   **Technology Resources:**   * CODAP (Common Online Data Analysis Platform) - free at CODAP.concord.org * State-specific drought monitoring websites * Regional climate data repositories |

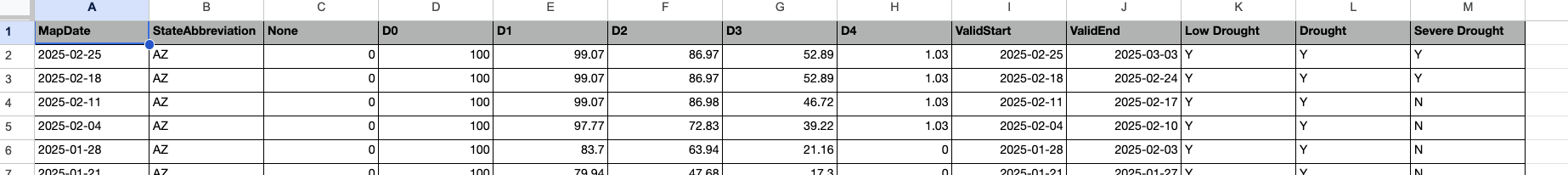
## **Lesson Sequence**

### **DAY 1: Nature of Drought Data & CODAP Introduction**

#### **Opening Discussion and Data Exploration (20 minutes)**

1. Ask students: "How do scientists know when we're in a drought?" and "What data would you need to study drought?"
2. Introduce the [drought.gov website](https://www.drought.gov/historical-information?dataset=0&selectedDatePaleo=20170101&selectedDateSpi=20250201&selectedDateUSDM=20250225) and walk through what you see:
   * Explain drought classification system ([D0-D4](https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx#:~:text=The%20map%20uses%20six%20classifications,)%20and%20exceptional%20(D4).)). What is most important to note here is that they each give you a % of land area that is in that level of a drought, but can add up to more than 100% because if 50% of the land area is in a D4 exceptional drought condition, then it would make sense that maybe 80% or even more is in a D0 of just being more dry than normal).
   * Walk through the automatically generated time series graph from 2000 - present and let students make observations
   * Use the “Combine States” tool to zoom in on just [your state](https://www.drought.gov/historical-information?dataset=0&selectedDatePaleo=20170101&selectedDateSpi=20250201&selectedDateUSDM=20250225&state=Arizona) (or whichever state you’re located in) and let students make observations
     1. Specifically move your cursor around on the time series graph below the map visualization to look at percentages of the different drought categories over time
3. Discuss: "What are the limitations of drought data?" and "Who produces this data and why?"
   * Addresses: 6-8.A.1.2b, 6-8.A.1.4a
4. Show examples of drought data in different forms:
   * Numerical (percentages of areas in drought categories)
   * Categorical (drought severity classifications)
   * Temporal (drought over time)
   * Geographical (drought by region)
5. Discuss how each data type influences analysis methods
   * Addresses: 6-8.A.1.1a

#### **CODAP Introduction (20 minutes)**

1. Direct students to [CODAP.concord.org](http://codap.concord.org) and click “Launch CODAP”
2. Demonstrate basic functions using the projector:
   * Creating a new document
   * Importing data
     1. Download the data from the [drought.gov](http://drought.gov) website that represents your region and save as a .csv (format it to look like the below)
     2. In CODAP click the down arrow on the top left hand menu bar and click Import -> Local File -> drag and drop the .csv file there
   * Creating a simple graph (get a baseline for non-drought times)
     1. Click the Graph button and then drag MapDate to the x-axis and None to the y-axis. Click the Measure (ruler icon) on the right side of the graph and click Connecting Lines. Have students think-pair-share about the years that seem like your state did not have a lot of drought conditions.
     2. Have them click the None on the y-axis of the graph and show them that they can easily toggle between other options that CODAP will graph on the y-axis. Have them switch to D4 and compare the years that the data said there were not drought conditions versus the graph of D4 conditions that talk about exceptional drought conditions (please remind them that this is in percent of land area…which means that 50% of your state could have no drought conditions while maybe 10% of your state is experiencing severe drought).
     3. Also show them how they can drag their clicker along the x-axis to zoom in or out in the timeline
   * Show that CODAP creates different graphs depending on the type of data
     1. Either close out the graphs that you have already created or just click the graph button to create a new one
     2. Drag the MapDate to the bottom and drag the Severe Drought to the y-axis, this creates a bar chart showing time periods where D3 or D4 drought conditions existed in at least 50% of your state
     3. If you click the ruler and choose Count or Percent, it will then show the data on the top right of the graph so students can compare
     4. Have them remove the Severe Drought from the y-axis and instead look at Drought, which shows times when D1 and D2 drought conditions covered more than 50% of your state
   * Manipulating data displays - give them some time to just play around in the CODAP interface and change around the graphs
   * Addresses: 6-8.C.4.1a/b

#### **Exit Ticket**

Students complete: "Name one thing that surprised you about the drought data and one question you now have."

* Addresses: 6-8.A.1.3a, 6-8.A.3.5b

### **DAY 2: Data Variability & Patterns Over Time**

#### **Opening (5 minutes)**

1. Review from the previous class (the data they looked at, the conclusions they’ve started to form), how this was an analysis over your state as an entire state
2. Introduce guiding question: "How have drought conditions in my area changed over the past 25 years, and what patterns can we identify?"
   * Addresses: 6-8.D.2.1a

#### **Data Import and Exploration (15 minutes)**

1. Have students open back a blank CODAP page, then click Plugins - Getting Data - NOAA Weather
   * You will have to do some troubleshooting with them as class to determine where they want to get data from, picking a station, and changing the interval date to monthly so you can generate the data
2. Give them a few minutes to mess around with the dataset on their own, if you want, have them try to see if they can find any potential outliers, missing values, or unusual patterns in the dataset
   * Addresses: 6-8.B.1.1a, 6-8.C.1.2a

#### **Investigation 1: Visualizing Distribution & Variability (25 minutes)**

1. Students create visualizations to show drought data distribution:
   * Drag “when” to the x-axis and average temperature to the y-axis. Click the ruler and click Connecting Lines as well as Least Square Line to see if there’s a trend. Repeat for minimum temperature or any other columns you’d like to investigate
   * Discuss seasonal patterns in the data (Addresses: 6-8.C.2.3a, 6-8.A.3.1a)
   * Have students compare the conclusions they are drawing with local scientists / news sources are saying
2. Discuss variability in the data:
   * "Does drought severity vary over time?"
   * "What might explain the patterns we're seeing?"
   * "What are the limitations of this data set?"
   * Addresses: 6-8.A.1.3a, 6-8.B.4.2c

#### **Exit Ticket**

Students complete: "Based on the data, what is one claim you can make about drought patterns in your state? How certain are you about this claim?"

* Addresses: 6-8.D.1.1a

### **DAY 3: Geographic Variations & Data Ethics**

#### **Opening (5 minutes)**

1. Review time-pattern findings from previous class
2. Introduce new guiding question: "How do drought conditions vary across different parts of your state, and what factors might influence these differences?"
   * Addresses: 6-8.D.2.1a

#### **Data Import and Setup (5 minutes)**

1. Have students open a blank CODAP version and get into groups to be able to see if we can distinguish any patterns or differences across latitudes and longitudes in your state (ex: if you live in the northern part of the state, compare to regions in the middle and the north)
2. Once the students are grouped and given the areas they are studying, help them get the NOAA data for that region

#### **Investigation 3: Geographic Comparisons (30 minutes)**

1. Allow the students the freedom to do a similar analysis as the previous class for their assigned region
2. Explain the region-level data structure and potential methodological limitations (Addresses: 6-8.B.3.2a)
3. Have students get the following data from their region
   * Slope of linear fit line for average temperature
   * Highest average temperature seen and when it occurred
   * Year when precipitation seemed highest / average amount of precipitation in a year
4. Have sticky posters up around the room with this various data you want gathered and as they find their specific location, have them go up and color in a data point on the charts so as a class, you start to get a picture of any patterns in the state (make sure that each area has a specific color!)
5. Students complete the "Geographic Patterns" worksheet:
   * Identify counties with most/least severe drought
   * Compare northern vs. southern regions
   * Look for patterns between neighboring counties
   * Addresses: 6-8.C.2.1a, 6-8.E.1.1c

#### **Data Ethics Discussion (15 minutes)**

1. Discuss potential biases in drought data collection:
   * How are drought measurements taken?
   * Are all areas measured with equal precision?
   * How might economic or political factors influence drought reporting?
2. Consider how drought data is used for decision-making:
   * Water restrictions
   * Agricultural planning
   * Emergency management
   * Addresses: 6-8.A.2.2a, 6-8.A.2.3a, 6-8.E.3.1b

#### **Exit Ticket**

Students identify one way drought data might be used to make decisions, and discuss how data quality or bias might affect those decisions.

* Addresses: 6-8.A.2.3a

### **DAY 4: Data Transformation & Storytelling**

#### **Visualization Ethics (10 minutes)**

1. Show examples of misleading drought visualizations
2. Discuss how scale, color, and other choices can influence perception
3. Identify best practices for clear, honest data communication as they make their projects
   * Addresses: 6-8.E.1.5b, 6-8.E.3.1c

#### **Data Storytelling Project**

1. Students work in pairs to create a data story that:
   * Poses a provocative question about your state drought
   * Uses at least two different visualizations
   * Draws evidence-based conclusions
   * Acknowledges limitations and uncertainty
   * Connects to real-world implications
   * Addresses: 6-8.E.2.2a, 6-8.E.2.2c, 6-8.E.2.3a

#### **Project Planning**

1. Each group shares their research question and planned visualizations
2. Class provides feedback and suggestions
3. Students begin drafting their data story

#### **Homework/Next Steps**

Students continue working on their projects (can be extended to additional days as needed)

## **Assessment**

### **Formative Assessment**

* Daily exit tickets
* Worksheet completion
* Class discussions
* CODAP skills checklist

### **Summative Assessment**

Data Storytelling Project:

* Data handling and analysis (25%)  
  + Correctly imports, organizes, and transforms data
  + Identifies appropriate patterns and relationships
  + Uses statistical concepts accurately
* Visualization quality (25%)  
  + Creates clear, appropriate visualizations
  + Labels axes and elements correctly
  + Chooses effective visual representations
* Evidence-based reasoning (25%)  
  + Draws valid conclusions from the data
  + Uses probabilistic language appropriately
  + Acknowledges limitations and uncertainty
* Communication effectiveness (25%)  
  + Tells a coherent, compelling data story
  + Connects findings to real-world context
  + Presents information clearly for the audience

## **Extensions**

### **For Advanced Students**

* Statistical analysis: Calculate correlation coefficients between variables
* Model building: Create a simple predictive model for drought severity
* Data collection: Design a drought measurement protocol for school grounds
* Cross-state analysis: Compare your state to neighboring states

### **Cross-Curricular Connections**

* **Social Studies:** Research historical impacts of drought on your state communities
* **Language Arts:** Write a news article about drought findings
* **Math:** Calculate statistical correlations between variables
* **Computer Science:** Create automated data analysis scripts in CODAP
* **Art:** Design infographics to communicate drought data to the public

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### **DAY 1: Drought Data Exploration Handout**

#### **Part A: Drought Classification System**

1. List the five drought classifications (D0-D4) and what each level means:
   * D0: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * D1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * D2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * D3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * D4: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Why might the percentages of land in different drought categories add up to more than 100%?
3. Who collects drought monitor data? What might be some limitations of this data?

#### **Part B: CODAP Exploration**

1. What years did your state have the least drought conditions according to the "None" data?
2. What years had the highest percentage of exceptional drought (D4) conditions?
3. How does the D4 data compare to the "None" data? Are there any interesting patterns?
4. What surprised you most about the drought data for your state?
5. What question do you now have about your state's drought conditions?

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### **DAY 2: NOAA Weather Data Analysis**

#### **Part A: Data Collection**

1. Weather station location chosen: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Time period examined: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Primary variables we're analyzing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### **Part B: Temperature Trend Analysis**

1. Create a graph with "when" on the x-axis and "average temperature" on the y-axis.
   * Describe the pattern you see: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Is there a visible trend over time? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * What is the slope of the least squares line? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Are there any outliers or unusual values in the temperature data? If so, describe them:
3. Looking at the data, do you observe any seasonal patterns? Describe them:

#### **Part C: Precipitation Analysis**

1. Create a graph showing precipitation over time.
   * What years had the highest precipitation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * What years had the lowest precipitation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Is there a visible trend in precipitation over time? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How does the precipitation pattern relate to drought conditions?

#### **Part D: Comparison with Official Data**

1. How do your findings compare with what local scientists and experts are saying?
2. Based on the data, write one claim about drought patterns in your state:
3. How certain are you about this claim? What evidence supports it?

### **DAY 3: Regional Climate Comparison**

#### **Part A: Regional Data Collection**

1. Region of your state assigned to our group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Key data points we found:
   * Slope of temperature trend line: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Highest average temperature and when it occurred: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Average annual precipitation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Years with highest precipitation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### **Part B: Regional Patterns Analysis**

After all groups have shared their data on the class charts:

1. What patterns do you notice in temperature trends across different regions of your state?
2. How does precipitation vary across different regions of your state?
3. Which regions of your state appear to be experiencing the most severe climate changes?
4. What factors might explain the regional differences we're seeing?

#### **Part C: Data Ethics Reflection**

1. What are some potential biases in how drought and climate data is collected?
2. Are all areas of your state measured with equal precision? Why or why not?
3. How might economic or political factors influence drought reporting or responses?
4. Name one way drought data might be used for decision-making:
5. How might data quality or bias affect these decisions?

### **DAY 4: Data Storytelling Project Plan**

#### **Part A: Visualization Ethics**

1. List three ways data visualizations can be misleading:
2. What design choices will you make to ensure your visualizations are clear and honest?

#### **Part B: Research Question Development**

1. What specific question about your state drought will your project address?
2. Why is this question important or relevant?

#### **Part C: Visualization Planning**

1. Visualization #1:
   * Type of graph/chart: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Data to be displayed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * What this visualization will show: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Visualization #2:
   * Type of graph/chart: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Data to be displayed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * What this visualization will show: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### **Part D: Data Story Outline**

1. Introduction (How will you introduce your topic and question?):
2. Key finding #1: Supporting data: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Key finding #2: Supporting data: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Limitations of your data analysis:
5. Real-world implications or recommendations:
6. Conclusion:

#### **Part E: Presentation Plan**

How will you present your data story? (Digital slides, poster, video, etc.):

Who is your target audience?

How will you make your presentation engaging and accessible to this audience?