Climate Data Jam

Communicating Data to Nonscientists

Description

Students identify trends in predicted temperature and precipitation changes in several New Mexico counties and communicate the data trends to nonscientists.

Grade Level

5 – 12

Objectives

Students will:

- Analyze New Mexico temperature and precipitation data
- Identify and explain a data trend
- Develop a creative project to portray a data trend and communicate scientific data to nonscientist audiences

Time

1 Hour

Common Core State Standards

English Language Arts Standards >> Reading: Informational Texts >> Grade 5
CCSS.ELA-LITERACY.RI.5.4: Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

English Language Arts Standards >> Speaking & Listening >> Grade 5
CCSS.ELA-LITERACY.SL.5.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

English Language Arts Standards >> Science & Technical Subjects >> Grade 6-8
CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
CCSS.ELA-LITERACY.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

English Language Arts Standards >> Science & Technical Subjects >> Grade 9-10
CCSS.ELA-LITERACY.RST.9-10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
CCSS.ELA-LITERACY.RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

English Language Arts Standards >> Science & Technical Subjects >> Grade 11-12
CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Mathematics Standards >> Statistics & Probability >> Grade 6
CCSS.MATH.CONTENT.6.SP.B.5: Summarize numerical data sets in relation to their context, such as by: C. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

New Mexico State Science Standards

(Strand – Standard – Benchmark – Performance Standard)
5th Grade
1-1-1-3: Use graphic representations (e.g., charts, graphs, tables, labeled diagrams) to present data and produce explanations for investigations.
1-1-3-2: Use mathematical skills to analyze data.
2-2-1-4: Describe how human activity impacts the environment.
3-1-1-1: Describe the contributions of science to understanding local or current issues (e.g., watershed and community decisions regarding water use).

6th Grade
1-1-1-1: Construct appropriate graphs from data and develop qualitative and quantitative statements about the relationships between variables being investigated.
1-1-3-2: Use probabilities, patterns, and relationships to explain data and observations.
3-1-1-1: Examine the role of scientific knowledge in decisions (e.g., space exploration, what to eat, preventive medicine and medical treatment).

7th Grade
1-1-1-2: Use models to explain the relationships between variables being investigated.

1-1-3-2: Use mathematical expressions to represent data and observations collected in scientific investigations.
1-1-3-3: Select and use an appropriate model to examine a phenomenon.

8th Grade
1-1-3-2: Create models to describe phenomena.
3-1-1-2: Describe how scientific information can help to explain environmental phenomena (e.g., floods, earthquakes, volcanoes, fire, extreme weather).

9th – 12th Grade
1-1-3-1: Create multiple displays of data to analyze and explain the relationships in scientific investigations.
3-1-1-9: Describe how scientific knowledge helps decision makers with local, national, and global challenges (e.g., Waste Isolation Pilot Project [WIPP], mining, drought, population growth, alternative energy, climate change).

Next Generation Science Standards

5th Grade
5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Middle School
MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

High School
HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Materials

- *Climate Data Jam* handout [1 per student]
- PowerPoint presentation
- Computer and projector for the educator*
- A large assortment of craft and recycled household supplies* to be used for projects such as:
  - Large-format paper, butcher paper, and/or poster boards
  - Markers and/or crayons
  - Glue
  - Pipe cleaners
  - Plastic/paper cups
  - Plastic/paper plates
  - Paper bags
  - Fabric
  - Pom poms
  - Googly eyes
  - Streamers
  - Beads
  - Stickers
  - Cardboard
  - Empty, clean egg cartons

*Not included in kit

Background

Climate change has different effects on temperature and precipitation in different parts of the world. Even here in New Mexico, the changes in temperature and precipitation vary by region. Students will examine historic and predicted temperature and precipitation from four counties in northern, central, and southern New Mexico. A careful examination of these data will allow students to better understand predicted climate change in New Mexico and develop appropriate action projects.

As the climate changes, changes in temperature and precipitation will impact humans and ecosystems. Temperatures are predicted to increase throughout the United States. Some areas will receive less precipitation than historic levels, and some will receive more. However, *how* and *when* these changes in precipitation affect people and ecosystems may be complex. For example, in some counties, total annual

precipitation is predicted to increase, but seasonal predictions show that much of the precipitation may occur at different times of the year than it historically fell. Seasonal changes in precipitation may have important effects on local ecosystems and human residential, commercial, and agricultural water supplies.

Most areas in the United States are predicted to experience warmer temperatures in the future. As temperatures continue to increase, more water from lakes, streams, oceans, soil, and plants will likely evaporate or transpire, especially in arid areas. Evaporation and transpiration are often combined and termed evapotranspiration, which is the total of evaporation and transpiration from Earth's surfaces, bodies of water, and plants. Higher temperatures cause water to evaporate more quickly because water molecules move faster when they are warm. Since the molecules are moving faster, more of them can leave the surface at one time. For evapotranspiration to occur, however, the humidity of the atmosphere must be less than the surface, and therefore evapotranspiration rate increases will be most pronounced in dry regions. In dry regions, evapotranspiration rates may offset any gains experienced through increased precipitation rates.

Interactions between precipitation and temperature in our global climate are complex. Predicting how climate change will affect water supplies for humans and ecosystems is an important first step to developing adaptation and mitigation strategies. The effects may vary greatly in localized areas because of seasonal variability in climatic conditions, especially precipitation and temperature.

Tips for Entire Class Participation

- Group sizes can vary to encourage each student to play a role. We recommend groups of 1 – 3 students.
- Encourage students to use their own interests (e.g., art, music, games) to drive their creative project. If they are working in groups, suggest they work with someone who shares a common interest.

Preparation

1. Prepare the craft and recycled household supplies for student use. If you have space, it is helpful to lay the supplies out on a surface so that students can more quickly assess available supplies and develop project ideas.
2. Set up a computer and projector and display the PowerPoint presentation.

Teaching Guide

Introduction to the Project and the Data (~10 minutes)

1. Pass out a Climate Data Jam handout to each student.
2. Give an introduction to the Climate Data Jam using the PowerPoint presentation.
    a. Slide 2: Students will be creating a Climate Data Jam project in the next hour. The goal is to design a creative project and presentation that explains New Mexico climate data to an audience not familiar with this information.
    b. Slide 3: Here is an example of a student using painting to communicate data. The amount of different paint colors were scaled to reflect the amounts of solar radiation, soil temperature, air temperature, and precipitation over several two-year periods in Las Cruces, New Mexico.
    c. Slide 4: This is an example of a student using dance to communicate data. The height of the student's foot was scaled to represent the amount of precipitation received every two years in Las Cruces, New Mexico. The ribbon tied to her foot helps visualize the differences each year.
    d. Slide 5: Students may work individually or in teams of up to three students. Students should develop a very creative project to represent the data and appeal to nonscientists.

The project should not be a graph or table. Instruct students to use their imaginations to design a project that will be attention grabbing and appealing. Example products could include songs, poems, children's stories, newscasts, physical models, infographics, and skits. Representations of the data trend or trends must be scaled accurately.

i. Emphasize that students should represent a trend or trends in the data in a creative way rather than using the data directly in their projects. For example, one water droplet picture represents 1 mm of precipitation change.

e. Slide 6: Ensure that students understand the word trend by asking for a volunteer to define it [answer: the general direction, or pattern, of the data, something that is happening in the data.]
f. Slide 7: Students will see data from four New Mexico counties, including one in the north, one in central NM, and two in the south.
g. Slide 8: Students will have two datasets. The first is New Mexico predicted temperature changes by county. The data compares historic data (1971-2000) with future predictions (2040-2069) based on the mean of 20 general circulation models. Have students examine data and ask students to identify some trends in the dataset. [For example: All counties are predicted to have warmer annual temperatures with the greatest increases in spring in three of the four counties.]
h. Slide 9: The second data set shows New Mexico predicted precipitation changes by county. The data also compares historic data (1971-2000) with future predictions (2040-2069). Have students examine data and ask students to identify some trends in the dataset. [For example: Some counties are predicted to get more precipitation and some are predicted to get less. However, all counties should expect a drier spring, an important season for crops and native plants.]
i. Slide 10: Direct students to look at the top of page 1 of their handout. A good Data Jam project is clear in that it accurately represents the data in a way that is understandable to nonscientists. The data must be scaled correctly, and a legend explaining how the data are represented must be included. The project should also be creative. Think of an imaginative way to get the attention of nonscientists. Finally, the project should be concise. Focus on one important trend, and explain it well.

Procedures: Project Development (~30 minutes)

1. Slide 11: Direct students to look at the project directions on page 1 of their handout.
    a. Students should decide if they would like to work alone or with one or two other students to complete their Climate Data Jam project
    b. Complete the Planning and Brainstorming Notes. Tell students this is on page 1 of their handout. In this section, they will list the trend or trends that they might like to represent with their project and provide some possible ideas for a creative project.
    c. Create the Climate Data Jam project (infographic, skit, etc.).
    d. Fill out the Presentation Summary.
    e. Practice the presentation.
2. As soon as they have a plan, help students get started and circulate through the room to help them as needed. Thirty minutes goes very quickly, so encourage students to stay on task so they can complete their project!

Conclusion: Project Presentations (~20 minutes)

1. Remind students that they have just three minutes to present their projects.
2. Encourage them to use the Presentation Summary on page 3 of the handout to prompt them to include all of the necessary components.

3. Determine the order of group presentations by asking for volunteers, drawing numbers from a hat, or assigning an order that is preferable to you.
4. Begin the first presentation. Set a timer or plan to watch the clock for three minutes.
5. Repeat with the remaining groups until all have presented.
6. Lead a discussion about the Climate Data Jam projects and what students learned. Solicit feedback for ideas about how this project could be extended.

Extensions

1. Challenge students to showcase their Climate Data Jam project in a public setting.
2. Use the temperature and precipitation maps to compare other counties in New Mexico or counties in other states. <http://spatial-web.nmsu.edu/flexviewers/PrecipitationByCounty/> <http://spatial-web.nmsu.edu/flexviewers/maxtempbycounty/>

This lesson has been adapted for New Mexico Climate Champions from "Climate Data Jam" by the Asombro Institute for Science Education and the Southwest Climate Hub. <https://swclimatehub.info/education/climate-change-and-water-cycle/day7-10>