

Engaging Contexts: Data Integration

Data Source

Centers for Disease Control and Prevention <https://www.cdc.gov/>

In the spring my eighth-grade science students will be doing a unit on the human body, and three-day lesson in the unit is about the causes of diseases. The most obvious and appropriate choice for a data source about diseases is the official website of the Centers for Disease Control and Prevention. The volume of information and data contained on the website is staggering; possibilities for data mining and research are endless. As part of the Department of Health and Human Services, the mission of the CDC is to protect our nation's health security. The third part of the CDC's Pledge to the American People (and to me as a science teacher, the most important part) is to "[b]ase all public health decisions on the highest quality scientific data that is derived openly and objectively." (Found at <https://www.cdc.gov/about/organization/mission.htm>) This statement assures me of the veracity and objectivity of the data presented on the CDC website. I believe that using data from the CDC website will allow me to enhance my lesson about the causes of diseases, address new objectives, and make the learning more meaningful for my students.

Lesson Enhancement

As a hook to engage my students on the first day of the lesson, I will use polio as an example of an infectious disease caused by a virus that has been eradicated in the U.S. due to vaccination. To access information about polio on the CDC website, I typed "polio" into the

search engine and was directed to <https://www.cdc.gov/polio/>. This page contains an overview of the disease, how it is transmitted, its symptoms, and the efforts the CDC has made to eliminate it, as well as links to additional information and data. The Our Progress link contains an infographic of two world maps, one for 1988 and one for 2014. Each map shows the nations where polio still existed at that time. This infographic highlights the progress made in eradicating polio and naturally leads to a discussion of the vital importance of vaccines.

Another infographic (found at https://www.cdc.gov/globalhealth/immunization/infographic/eradicate_polio.htm) contains a table showing the year-to-year change in the number of worldwide polio cases from 1988 to 2013. There was a steady decline in the number of cases, from 350,000 in 1988, to 548 in 2001. However, from 2002 to 2010, polio cases bumped up and down until finally falling steadily again from 2011 to 2014. I will have my students analyze this data and hypothesize about why this up-and-down movement in the data may have occurred. This should lead to additional discussions about the importance of consistent, universal vaccinations. To further drive the point home, I will show my students pictures of people afflicted with polio (available at <https://www.cdc.gov/polio/us/photos.html>). I will then ask students to write a letter to the editor to persuade parents to vaccinate their children against polio and other infectious diseases.

A summative assessment in the unit has students researching four diseases that affect humans, each caused by a different microorganism (bacterium, virus, fungus, protist). Students are then to create a public service announcement for each disease, describing how the disease is transmitted, how it is treated, and how it can be prevented. I will require my students to use the CDC website as their primary source for researching these diseases and emphasize that any other

information source they use should be created and operated by a government agency, hospital, or university, not by a corporation motivated by financial interests.

In preparation for the PSA assignment, I will show my students how to access information about outbreaks of food-borne illnesses by clicking on an illness in the Outbreaks section of the CDC home page. For example, an outbreak of *salmonella* linked to ground beef is found at <https://www.cdc.gov/salmonella/newport-10-18/index.html>. This page gives a full outbreak report along with data about the number of reported cases, the states in which the outbreak has occurred, the number of hospitalizations and deaths, and whether a recall of the food product has occurred. I will also show students the Foodborne Diseases Active Surveillance Network (FoodNet) (found at <https://www.cdc.gov/foodnet/reports/>). FoodNet is a collaboration with CDC and reports information about outbreaks of foodborne diseases caused by nine different pathogens. On the page found at <https://www.cdc.gov/foodnetfast/> there are graphs showing the incidences of confirmed cases for each of the nine pathogens. These graphs can be customized by selecting any year between 1986 and 2017, specific pathogen(s), age group, sex, race, and geographic area. Through this customization, I will ask students to answer questions such as “Which age groups are more likely to contract food-borne illnesses?” The graph of Percentage of Confirmed Infections by Month raises the question “In which months are food-borne illnesses more likely to occur and why?”

Another enhancement to student learning the CDC website allows is for my students to understand how an outbreak of a food-borne illness is tracked down to its source. The page <https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/index.html>

provides detailed information about the steps involved in the investigation of a food-borne illness outbreak. After reviewing these steps, I will have my students use the free Solve the Outbreak app developed by the CDC (<https://www.cdc.gov/mobile/applications/sto/>) to investigate and solve an outbreak.

I am an advocate for using data when teaching students about real-world issues and problems. Using data gives a context to concepts that can seem abstract. How diseases are spread is easier for students to understand if they have access to information about a real-life outbreak, the number of people who were infected, how they were infected, and the preventative measures put into place to slow down and stop the outbreak. Using actual data gives the learning more context and makes it more concrete. Data collected by student observation is more authentic and meaningful than that gleaned from a website, but having students collect their own data is not always possible or practical, as is the case with the spread of disease. Students could certainly be encouraged to collect data about the number of sick days taken by students in the class, the length of each absence, and the time of year when these occurred. An analysis of this data could reveal seasonal patterns of illness. However, any personally identifying information or details about the type of illness students had could not be shared.

Interdisciplinary Context

By using the information and data in the CDC website as I have described above, I will be able to enhance student learning outcomes by addressing these STEM standards, practices, and objectives:

- Next Generation Science Standards:
 - MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
 - MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
 - MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- NGSS Science and Engineering Practices
 - Engaging in Argument from Evidence
 - Obtaining, Evaluating, and Communicating Information
- NGSS Crosscutting Concepts:
 - Patterns
 - Cause and Effect
 - Stability and Change
- Common Core State Standards for Mathematics: Standards for Mathematical Practice
 - MP1: Make sense of problems and persevere in solving them.
 - MP2: Reason abstractly and quantitatively.
 - MP3: Construct viable arguments and critique the reasoning of others.
 - MP4: Model with mathematics.
- ITEEA Standards
 - 7. Students will develop an understanding of the Designed World. This includes selecting and using
 - 17. Information and communication technologies

In addition to the above STEM learning outcomes, the learning activities integrating CDC data also address objectives in English Language Arts (writing a persuasive essay) and

Social Studies (analyzing the uneven distribution of economic and natural resources, educational opportunities, and medical care across nations).

References

Centers for Disease Control and Prevention (2018). Retrieved from <https://www.cdc.gov/>

International Technology Education Association. (2007). *Standards for technological literacy:*

Content for the study of technology (3rd ed.). Reston, VA: International Technology

Education Association. Retrieved from

<https://www.iteea.org/Publications/STEMProducts/77454.aspx>

National Governors Association for Best Practices, & Council of Chief of State School Officers.

(2010). *Common Core State Standards for Mathematics: Standards for Mathematical*

Practice. Retrieved from <http://www.corestandards.org/Math/Practice/>

NGSS Lead States. January 2013. *Next Generation Science Standards: For States, By States*

(NGSS Public Release II, The Nature of Science in the Next Generation Standards).

Washington, DC: The National Academies Press. Retrieved from

<http://www.nextgenscience.org/>