

Why dread a bump on the head?

The neuroscience of traumatic brain injury

Lesson 6: Exploring the data behind brain injury

I. Overview

This lesson exposes students to the role data access and analysis can play in answering questions about TBI. Students examine data gathered from medical and injury databases, as well as explore public perceptions of TBI through the use of Google Trends. Students first utilize Google Trends to gain insight into the way the public searches for TBI information on Google. They then use the Project Neuron dataset collection to explore publicly available data on the occurrence of TBI injuries in various populations. Students then search for a news article that relates to the subject of one of the available datasets. After, students select a portion of the data to represent visually through a graphing exercise in order to supplement or expand on the information presented in their article. This lesson enhances students' perceptions of how TBI is reported in the media, and it illustrates the importance of data collection in the monitoring of TBI.

Connections to the driving question

In this lesson students take a somewhat different approach to answer the unit's driving question. Now that they have learned about the neuroscience behind TBI, in this lesson, students explore information about public perceptions of TBI and the occurrence of TBI injuries in different populations.

Connections to previous lessons

Thus far in the unit, students have learned about the neuroscience behind traumatic brain injury. In this lesson, they pull back to a broader scope and begin to look at how they can access and analyze population level data on TBI.

II. Standards

National Science Education Standards

Content Standard A: Abilities necessary to do scientific inquiry

- Use technology and mathematics to improve investigations and communications. A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results. (Grades 9-12 A: 1/3)

Benchmarks for Science Literacy

The Nature of Science: The Scientific Enterprise

- Computers have become invaluable in science, mathematics, and technology because they speed up and extend people's ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world. (1C/M6*)

The Nature of Science: Scientific Inquiry

- Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data. (1B/M1b*)

III. Learning objectives

Learning Objective	Assessment Criteria	Location in Lesson
Locate and analyze data across multiple sources to answer a question.	By completing the worksheet in Activity 1 and the data filtering progression in Activity 2, students demonstrate an ability to locate and analyze data across multiple sources.	Activity 1 & Activity 2
Visualize the prevalence of TBI in various populations.	Students correctly complete the sketches of interest graphs in Activity 1 and generate a graph representing this information in Activity 2.	Activity 1 & Activity 2
Utilize web-based data sources to explore an issue.	In the student packet, students: <ul style="list-style-type: none"> Use Google Trends to explore data about TBI provide four well justified search terms to gather more information Use the Project NEURON TBI data explorer effectively to gather and analyze information 	Activity 1 & Activity 2
Develop skills to present raw data visually and communicate the data to others.	Students should: <ul style="list-style-type: none"> Create accurate graphs to present data visually in Parts 1 and 2 of the worksheet. Construct a strong explanation that contains a claim, evidence, and reasoning that is supported by the data they have collected and analyzed. 	Activity 2

IV. Adaptations/Accommodations

If access to a computer lab is limited, resources (Google Trends results, articles) can be printed ahead of time by the instructor and given to the students as resource packets in order for them to complete the worksheet. For both parts of the activity, students can be paired to reduce the number of computers needed. For Activity 2, students can hand draw a representation their selected datasets if Microsoft Excel is unavailable. Also, datasets can be selected and exported before the activity for the students' use. Students will encounter articles that you have possibly not read, and some of the articles may be written at a high reading level. If difficulty with reading comprehension is anticipated, students can be paired and directed to pair-read and discuss the article they select.

Safety

There are no additional safety concerns associated with this lesson.

V. Timeframe for lessons

Opening of Lesson

- Discussion on Internet's role in collecting and distributing information about TBI – 10 minutes

Main Part of Lesson

- Activity 1: TBI on the Web, What Are People Looking For?
 - Google Trends TBI analysis worksheet – 30 minutes
 - Wrap-up – 10 minutes
- Activity 2: Data, What is it Good For?
 - Claim, evidence, and reasoning intro – 15 minutes
 - Dataset explorer, filter – 10 minutes
 - Incorporating data with article – 25 minutes

Conclusion of Lesson

- Whole class discussion and homework assignment – 10 minutes

VI. Advance prep and materials

Activities 1 & 2

Materials & Preparation:

- Computers with Internet access to Google services and Project NEURON website.
 - <http://www.google.com/trends/>
 - <http://news.google.com/>
 - <http://neuron.illinois.edu/>

- Student Packet: “Exploring the Data Behind Brain Injury”
(*U4_L6_StudentPacket_ExploringDataBehindBrainInjury*) (can be split into Part 1 and Part 2 if needed)
 - Enough copies should be made so each student has a packet
- Access to a printer if students will be graphing data electronically or handing in sample searches and their filtered datasets
- “Exploring the Data Behind Brain Injury: Teacher Copy”
(*U4_L6_TeacherGuide_ExploringDataBehindBrainInjury*)
 - This document has additional notes in it to support the teacher in guiding students through the lesson. One copy can be printed for teacher use.

VII. Resources and references

Google Services and Project NEURON website:

- <http://www.google.com/trends/>
- <http://news.google.com/>
- <http://neuron.illinois.edu/>

VIII. Lesson Implementation

Opening of the Lesson:

Tell students that for this lesson, they will be exploring the role the Internet plays in collecting and distributing information about traumatic brain injury. Introduce the lesson by asking the class as a whole:

- How do you use the Internet to gather information?

List these responses on the board, or if in the computer lab, they can be typed as a list in a word processor and projected. Try to get a good mix of responses from the students before moving on to introduce the tools they will be using today. If time allows, discussion about some of the various tools used may be helpful. Tell the students that for the next few class periods they will be exploring two internet-based tools that will help them observe and interpret data about TBI.

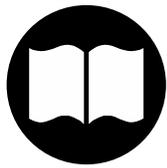
Main Part of Lesson:

	<p>Teacher Content Knowledge</p> <p><i>Educational Internet filters</i> Many schools and districts filter the web traffic that is allowed through their network. Before starting this lesson, check with your school’s technology specialist to make sure the students will be able to access the websites listed above.</p> <p><i>Google Trends</i> Google Trends is a publicly available tool from Google that allows a user to enter search terms and see a visual representation of that searches’ change in volume (how often people are searching for that term). Google Trends data goes back to 2004. For more detailed information on the kinds of data returned for a search, see the teacher “Google Trends Guide” supplement (<i>U4_L6_Supplement_GoogleTrendsGuide</i>).</p> <p><i>Project Neuron Dataset Collection</i> The Project Neuron dataset collection is a database hosted at the University of Illinois that combines several publicly available datasets geared toward traumatic brain injury. Students can use the Project Neuron interface to select a dataset they are interested in and filter that data accordingly. They can then use the site to visually represent the data, add their own supporting text, and export a single finished document.</p> <p>Datasets in the database include:</p> <ul style="list-style-type: none"> • NCAA sports injury survey statistics • National Center for Catastrophic Sports Injury • CDC Injury Surveillance System
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Activity 1: TBI on the Web, What Are People Looking For?

Activity 1 consists of a guided worksheet (Part 1 of the student packet “Exploring the data behind brain injury”) designed to introduce the students to Google Trends and the role web search information can play in examining the public’s interest in different aspects of traumatic brain injury. The worksheet is designed to guide the students through the many ways Google Trends can present search statistics and how each can be used to better understand the public perception of TBI.

For the exercise, the sample term “concussion” is used to introduce different features of Google Trends. At the end of the worksheet, students are asked to use what they have just learned to come up with 4 additional search terms that they think would be effective in helping them find additional information they are interested in.



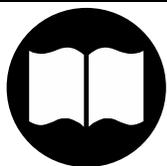
Teacher Pedagogical Knowledge

While the worksheet acts as an introduction to Google Trends as a data exploration and visualization tool, it is not necessary to conclude the lesson with the worksheet. Students can be asked to create a short presentation about a particular search term, or additional attention can be given to the analysis of patterns within the interest data. If desired, there are a lot of opportunities for additional class time based on this activity.

After handing out the worksheet, give the class a brief introduction to the context behind Google Trends. Tell the class that the reason Google is able to provide Trends as a tool is that they track what people search for and how often. Students may have questions about this, so asking the class the following can start a short discussion:

- Why does Google (or any other search engine) track this information?

Let students know that one of the major reasons search engines like Google track what people are searching for is to provide better search results in the future. Google has their own response to this question, shown below:



Teacher Content Knowledge

Why does Google store search engine logs data? We store this data for a number of reasons. Most importantly, we store data to improve our search results and to maintain the security of our systems. Analyzing logs data helps our engineers both improve your search quality and build helpful innovative services. Take the example of Google Spell Checker. Google’s spell checking software automatically looks at a user’s query and checks to see if that user is using the most common version of the word’s spelling. If we calculate a user is likely to get more relevant search results with an alternative spelling, we’ll ask “Did you mean: (more common spelling)?” In order to provide this service, we study the data in our logs. Logs data also helps us improve our search results. If we know that users are clicking on the #1 result, we know we’re

	probably doing something right, and if they're hitting next page or reformulating their query, we're probably doing something wrong. In addition, logs data helps us prevent against fraud and other abuses, like phishing, scripting attacks, and spam, including query click spam and ads click spam.
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Give students plenty of time to work through the guided worksheet and to explore Google Trends. When students are getting to the end of Activity 1 on the worksheet, ask the class:

- How could Google Trends help you more effectively research a topic of interest?

Have students provide a few examples. Try to stress that this is a flexible tool and can be used for all kinds of research applications.



Scientific Practices: Analyzing and Interpreting Data

Scientists use a multitude of ways to gather, analyze, interpret, and present data. In this lesson, students are introduced to new tools (internet resources) for investigating important questions in science. They are also guided through a process of critical analysis and data interpretation as they use graphical interpretation and data visualization to make sense of the information they find.

Activity 2: Data, What is it Good For?

For Activity 2 of the lesson, students will be applying the "Claims, Evidence, and Reasoning" framework to an exploration of real publicly available TBI data as they explore "Project NEURON's TBI Data Explorer." The site is designed to guide the students through the activity of researching available data, picking a dataset, filtering the data, visualizing the data, and linking their selections to a news article. The website allows the students to save their final sheet with their visualization, claim, evidence, and reasoning as a single document.



Scientific Practice: Constructing Explanations

Through the Claim, Evidence, and Reasoning framework, students are introduced to the critical elements of a compelling scientific explanation. They then apply this understanding to evaluate information they find and also to construct their own explanations.

Students will use Part 2 of the student packet, "Exploring the data behind brain injury", to work through this second activity. Below is a description of sequence students will follow.

Activity 2 Worksheet Sequence and Question Themes:

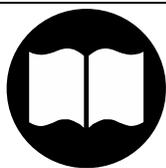
- Introduction to Claims, Evidence, and Reasoning (CER)
 - Sample CER application
 1. Locate the claim, evidence, and reason in the statement below
 2. How did the sample text use data to support its claim?
 3. Where did the data come from? Who collected it?
 4. Do you think the article did a good job of providing reasoning for its claim?
- Exploring the Data
 5. What kinds of data are available on the Project NEURON site?
 - Used to guide a search for a new article of a related topic
 6. Does the article you selected make any claims? If so, what are they? If not, could you create a supporting claim?
 - Preparation for web activity
 - Formulate a question you can answer through the data

Conclusion of Lesson:

When the students have finished Activity 2, let them know that as a portion of their journal homework they will be grading another student's finished CER document and evaluating how it fits with the article they selected. Let them know that they will be using a rubric to provide feedback. To conclude the lesson, ask the students:

- What is role public interest plays in the kind of information that is reported in the news?
- How can this information help you search more intelligently for the kind of information you want on TBI?
- Why is it valuable to collect data on the occurrence of TBI? Who uses this information?

For homework, ask the students to complete the Lesson 6 page in their Lesson Journals.

**Teacher Pedagogical Knowledge**

The Lesson Journals are completed for each lesson in the TBI unit, and they are used together as a review and assessment tool in the final lesson. Students will review material from the unit and will contribute to a class 'zine' that integrates ideas and content from the unit. A zine (pronounced ZEEN) is a form self-publication with original text and images. Similar to a magazine, the topics are usually of a particular interest and the method of reproduction is via photocopiers.

Assessments

For both Activity 1 and Activity 2, students will be completing worksheets that guide them through the different internet tools and how to collect, sort, and analyze data. These worksheets require students to create graphs, answer questions, and construct an explanation using the claim, evidence, and reasoning framework. These completed worksheets can be used an assessment of student understanding of all the concepts covered in this lesson.