

# The Councilor: A Journal of the Social Studies

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Volume 77  
Number 1 *Volume 77 No. 1 (2016)*

Article 4

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January 2016


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### Recommended Citation

Hopper, Peggy; Ratliff, Lindon; and Brown, Willie (2016) "Cross Curriculum Lesson with the Aid of Google's Ngram," *The Councilor: A Journal of the Social Studies*: Vol. 77 : No. 1 , Article 4.  
Available at: [http://thekeep.eiu.edu/the\\_councilor/vol77/iss1/4](http://thekeep.eiu.edu/the_councilor/vol77/iss1/4)

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## Cross Curriculum Lesson with the Aid of Google's Ngram

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With the combination of the Common Core State Standards and the renewed focus for using technology with all of its benefits in the classroom, middle school teachers have the opportunity to embrace the strengths of technology through a relatively new computer database, Google Ngram (Bates, 2011). Google Ngram is an easy to use data-mining tool that has applications in the classroom to learn about history and culture through the study of language and literature. With the use of Ngram, educators can help build strong connections between learning and the immense online free databases made available by Google. These connections may help create a stronger learner who is better prepared for using digital tools to enhance lifelong learning.

### What is Ngram?

For the past decade Google has been the “search engine of choice for most Web surfers” (Siegle, 2007 p. 24). With Google Earth, Sketchup, spreadsheet, translator and other programs, teachers have had access to various tools that have often been used for classroom applications. With its expanding services, Google has remained constant with one central theme: simplicity. The ease of use and speed in which results are delivered act to encourage the user to return and becomes a main reason for classroom application (Peijun, 2011). Google Ngram is no exception to this. Although some teachers and their students may at first shy away from being introduced to a data-mining tool, Ngram can be an easy and fun way to stimulate learning history and examining cultural change through language in the classroom.

It is easier to understand the development and composition of the Google Ngram Database by first discussing the Google Books Project, which originated years prior to the conception of Google Ngram. Google co-founders Sergey Brin and Larry Page wanted to digitize all of the world's books, and in 2002, Google began the secret “books” project. Soon after, they developed rapid optical character recognition technology that allowed them to scan books that have irregular type sizes and unusual fonts in 430 different languages. In 2007, Google developed numerous ways for



users to easily search through and find information in the newly digitalized books, but the release of this tool was delayed until they satisfied copyright issues (see *Google Books History* at <http://books.google.com/googlebooks/about/history.html>). Subsequently, in conjunction with Erez Lieberman Aiden and Jean-Baptiste Michel of the Harvard Cultural Observatory, Google developed Google Ngram (Bohannon, 2010; Michel, J-B., Shen, Y. K., Aiden, A. P., Veres, A., Gray, M. K., The Google Books Team, et al., 2011). This new database of digitalized books was an outlet that allowed Google to release a vast amount of cultural information to the general public without copyright infringement.

The entire database is composed of 5,195,769 books (approximately 4% of all published books) and approximately 500 billion records (Bates, 2011; Michel, et al. 2011). Each record contains 1) the n-gram or sequence of words which translates into 1-gram for one word, 2-grams for a two word phrase, 3-grams for a three word phrase, etc., 2) the year of publication of the book, 3) the number of occurrences of a certain word in the year of publication, 4) the number of pages on which that word appeared in that year, and 5) the number of books in which that word appeared in that year.

The user is then able to examine how the number of occurrences per year has increased and/or decreased since the term's inception. The database ranges from the original printing press in 1450 (the Gutenberg Bible) through 2008 and contains eleven separate corpora such as American and British English.

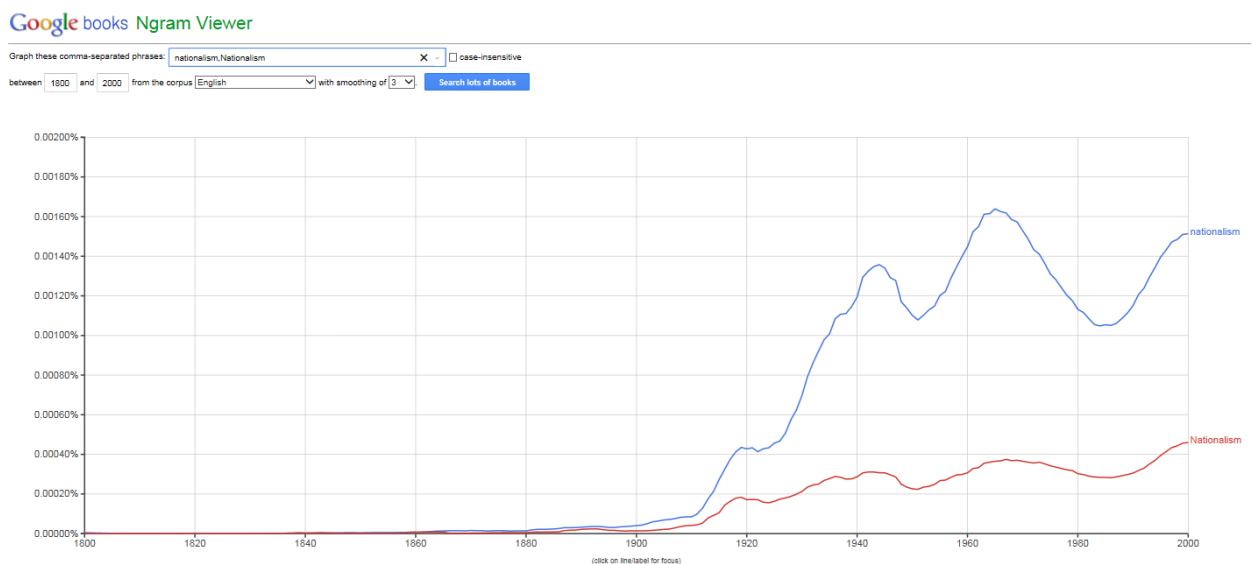
There are many highly technical aspects of the program; however, for classroom purposes Ngram is very easy to use. In fact, the most basic use of Ngram may be the best classroom application. A simple Google search using Ngram as the keyword will yield Google Ngram Viewer - Google Books with the following address: [books.google.com/ngrams](http://books.google.com/ngrams). What is opened when clicking the web address is the program itself or the Google Ngram Viewer. The program allows anyone with a computer to search the popularity of individual words as they relate to published works by using the Google Ngram Viewer. In 2012, Google showed their commitment to the development of the program by updating to include an even larger database of books (Zimmer, 2013).

So for example, in an American History class studying the advent of World War II (WWII) slang, the teacher could introduce students to Ngram by first asking students to brainstorm slang words they think were coined during World War II. By typing *war slang* or a specific slang word in the box that is labeled "comma-separated phrases" on the Viewer and then clicking on "Search lots of books" in the blue box, students will get an instant idea of when the slang word began showing up in the selected corpus of books between 1800 and 2000. The results of the search will give students an idea of whether or not the slang word was actually created during the WWII time frame. An example of war slang that could be used to demonstrate Ngram in this sample lesson is the word *conchie*, a slang term for conscientious objector. When typed into Ngram, it is clear the use of this word peaked in 1945. To get a more detailed view, the "between" dates could be narrowed to begin from 1930 when the word starts to appear. For interesting discussion in the classroom, it could also be noted that other wars engendered use of this slang term like during the



Vietnam era when the use of *conchie* peaks again around 1968.

The search words or phrases are color coded and displayed above the graphic chart—the first word in blue, the second in red, etc. These colors also correspond to how the word or phrase is represented by lines in the chart as exemplified below. Other words that may be searched to supplement a Social Studies classroom lesson are included as follows. In the example of a search for *nationalism*, it is important to realize that Ngram is case sensitive. A search of *nationalism* and *Nationalism* indicates a difference that may provide an interesting study given that capitalization is often used to indicate importance in the English language.

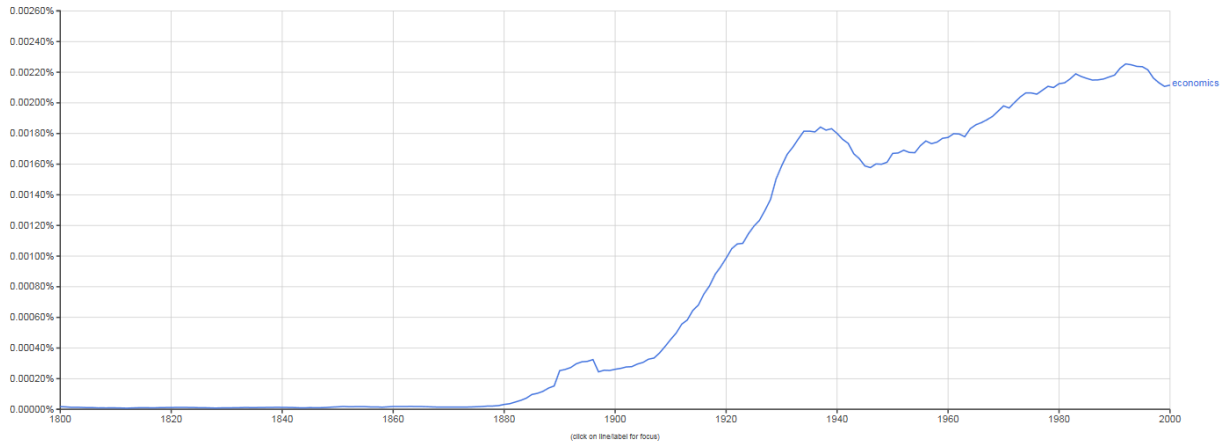


As illustrated, the range of years can be changed to narrow the search by simply re-typing the range of years in the “between” boxes. A feature that teachers may use to add interest in a classroom is accessed by scrolling the arrow along the chart lines for the exact percentage per year of each word’s occurrence giving a clear picture of one specific year. The word *economics* for example yields the following results, indicating that the word was first used in the corpus sampled by Ngram around the 1880’s.



### Google books Ngram Viewer

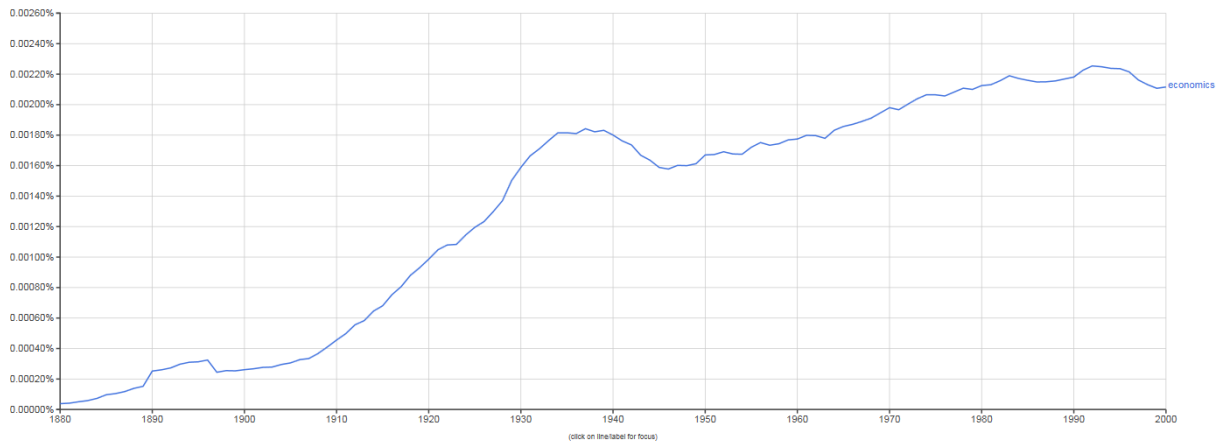
Graph these comma-separated phrases:   case-insensitive  
between  and  from the corpus  with smoothing of



Since the chart indicates *economics* first appeared in the corpus around the 1880's, the search can be refined to look at the range from 1880 to 2000 to provide the viewer with more accurate information by changing the first box "between" to 1880.

### Google books Ngram Viewer

Graph these comma-separated phrases:   case-insensitive  
between  and  from the corpus  with smoothing of



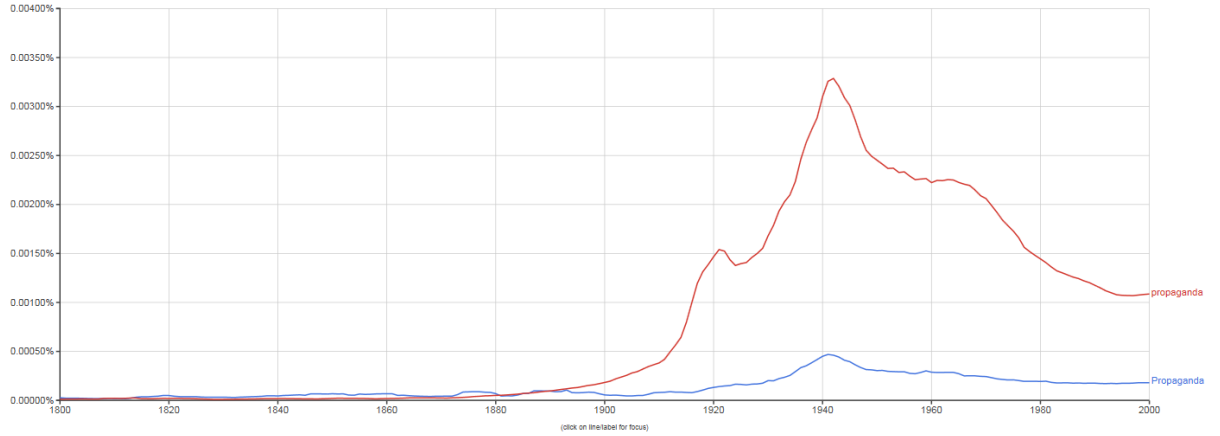
Although several words can be input, using only two or three words at once will yield more easily interpreted results. Depending on the search, teachers may also direct students to look at the differences between American English and British English which can be searched for easily by changing the language through the "corpus" pull down menu.

Examples of words that may be appropriate for use in a Social Studies lesson may also include *Propaganda/propaganda*, *Communism*, *Militarism/militarism* as follows.



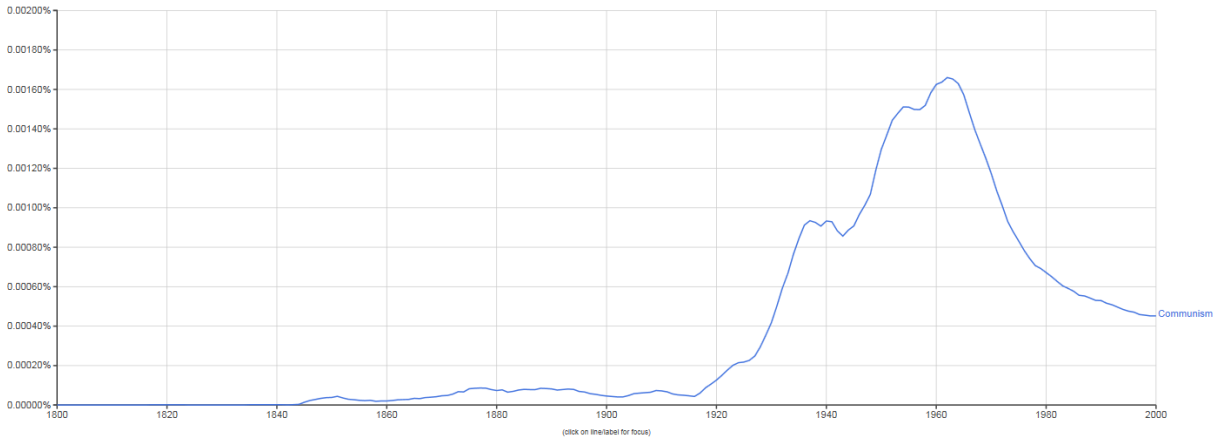
Google books Ngram Viewer

Graph these comma-separated phrases: Propaganda,propaganda X case-insensitive  
between 1800 and 2000 from the corpus English with smoothing of 3 Search lots of books



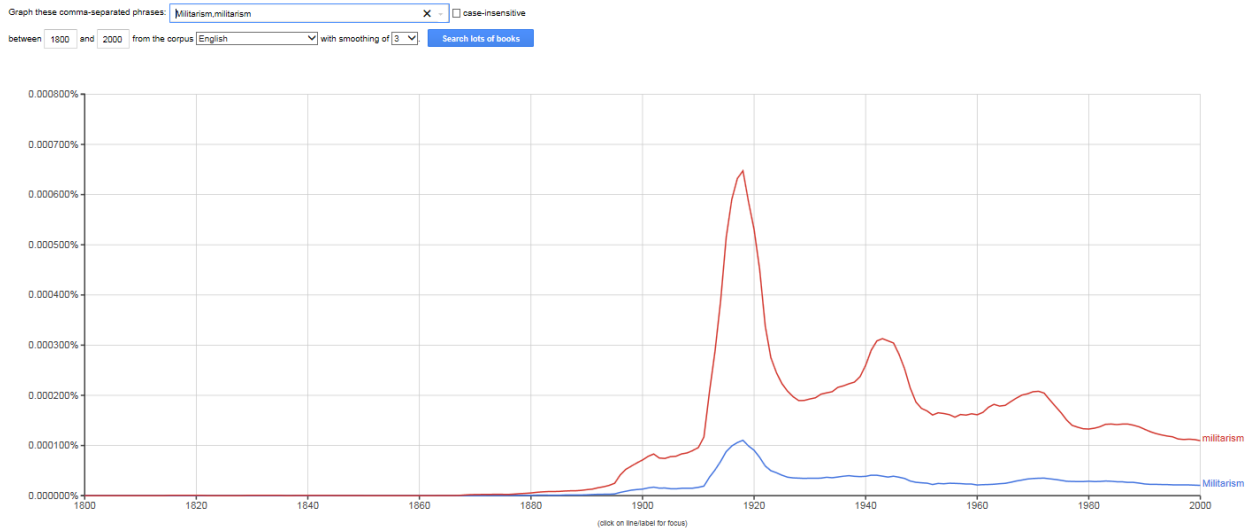
Google books Ngram Viewer

Graph these comma-separated phrases: Communism X case-insensitive  
between 1800 and 2000 from the corpus English with smoothing of 3 Search lots of books





Google books Ngram Viewer



**Connection to National Council for the Social Studies Standards (NCSS):**

One reason to incorporate Ngram in the classroom is that teachers can address several of the NCSS thematic standards. The chart below demonstrates how each NCSS standard connects a theme to an idea that can be explored using Ngram.

NCSS Theme	Connection
Culture and Cultural Diversity	The understanding of common word usage within a society allows for a stronger understanding of a culture within a certain time frame.
Time, Continuity and Change	Ngram demonstrates word usage through time, thus allowing the students to see the important events in the past
Individuals, Groups and Institutions	The study of word usage among groups can be explored as compared to common individualized words
Science, Technology and Society	Use of computers within a classroom setting reinforces the need and power of science within the curriculum
Global Connections	Students can examine word usage throughout regions and explore the various usages of words in different cultures. This allows for global realizations of terms.



## Sample Social Studies Lesson Plan for Ngram

For the teacher who wants to utilize Google Ngram but is not sure exactly how to begin, the following sample lesson plan is one that can be used in a middle school Social Studies class. In this lesson plan, the Times Beach Disaster was selected because of it being the largest Dioxin exposure in United States history. Because of the major coverage associated with the spill, new terminology (i.e., Dioxin contamination) began to emerge in national news sites and research papers. Analyzing events such as the Times Beach Disaster allows for students to see a strong spike in Ngram word usage which illustrates how events in history affect language use.

### Sample Lesson Plan

<b>Title</b>	The Times Beach Disaster
<b>Missouri Standards</b>	<p><b>Standard 1:</b> identify problems and define their scope and elements</p> <p><b>Standard 4:</b> evaluate the processes used in recognizing and solving problems</p> <p><b>Standard 5:</b> reason inductively from a set of specific facts and deductively from general premises</p>
<b>National Standards</b>	<p><b>Strand II: Time, Continuity, and Change:</b> Social Studies programs should include experiences that provide for the study of the ways human beings view themselves in and over time.</p> <p><b>Strand VIII: Science, Technology, &amp; Society:</b> Social Studies programs should include experiences that provide for the study of relationships among science, technology, and society.</p> <p><b>Strand VIII: Global Connections:</b> Social Studies programs should include experiences that provide for the study of global connections and interdependence.</p> <p><b>Strand III: People, Places, and Environments:</b> Social Studies programs should include experiences that provide for the study of people, places, and environments.</p>
<b>Materials</b>	<ul style="list-style-type: none"> <li>• Materials and resources: The teacher will need: Copies of <i>Silent Spring</i> by Rachel Carson Paper Pens/Pencils Computers with Internet Access</li> </ul> <p>The students will need:</p>





	<ul style="list-style-type: none"> <li>- Access to Google</li> <li>- To gather or make artifacts</li> <li>• Technology resources:                         <ul style="list-style-type: none"> <li>IE Explorer or other suitable browser</li> </ul> </li> <li>• The number of computers required is 1 per student.</li> </ul>
<b>Objectives</b>	<p>Objectives:</p> <p>The student will:</p> <ol style="list-style-type: none"> <li>1. identify the location of the Times Beach area and the surrounding ecosystems.</li> <li>2. identify the causes of the Times Beach pollution.</li> <li>3. analyze the effect the pollution had on the various ecosystems.</li> <li>4. compare the Times Beach events with selected passages from <i>Silent Spring</i>.</li> <li>5. examine trending environmental terms in research by using Ngram.</li> </ol>
<b>Procedures</b>	<p>This lesson is two-part. The first part focuses on the historical background of the Times Beach pollution as it relates to passages from <i>Silent Spring</i>. The second part involves historical analysis of Ngram key words association with pollution.</p> <p>Introduction/Historical</p> <ol style="list-style-type: none"> <li>1. Before students read passages from <i>Silent Spring</i> the teacher should lecture on the events surrounding the pollution of Times Beach.             <ol style="list-style-type: none"> <li>a. Construction of paved roads in the surrounding area</li> <li>b. The contamination of the area with dioxin</li> <li>c. EPA intervention</li> </ol> </li> </ol>



d. Buying of the land and modern state park

Teacher Note:

- Go over the geography of the Times Beach area
- Discuss the EPA revisit of the site

### **Introduction/Silent Spring**

- Read selected passages (teacher's discretion)
- Discuss the impact Rachel Carson's book had on society
- Explain America's viewpoint about the environment prior to *Silent Spring*

### **Introduction of Ngram**

- Discuss how to use Ngram by searching the words “Rachel Carson” or “*Silent Spring*” to get an indication of the current popularity of her work
- Have the students search the word “environment” with the parameters 1950-2000. Notice the use of the word expanded after the publication of *Silent Spring*

-Introduce other terms from *Silent Spring* that yield interesting results and have students relate these to Rachel Carson’s information (examples: “pesticides” and “insecticides”)

Example passage for terminology:

“These sprays, dusts, and aerosols are now applied almost universally to farms, gardens, forests, and homes—nonselective chemicals that have the power to kill every insect, the “good” and the “bad,” to still the song of birds and the leaping of fish in the streams, to coat the leaves with deadly film and to linger on in soil—all this though the intended target may be only a few weeds or insects. Can anyone believe it is possible to lay down such a barrage of poisons on the surface of the earth without making it unfit for all life? They should not be called “insecticides,” but “biocides.” (Carson, 1962,



	pp 7-8) - Have the students create a list of words associated with the environment (examples: “DDT” and “dioxin”) - Allow the students to independently search for trends in the words they chose and postulate why they occurred
<b>Assessment</b>	Students will present the trends they found in their selected keywords. Students will receive a group grade for their poster through an assigned rubric (see Appendix A).

### Extending the Sample Lesson with Connections to the Common Core State Standards

A possible modification of this lesson plan may be to include a middle school English/Language Arts class for a collaborative lesson. Ngram is a natural tool for an English class because of the language study it inherently involves. The method of pairing texts by using books that share a common theme or information can be used to increase background knowledge needed for comprehension of the informational text and create motivation for reading a more difficult informational book, such as *Silent Spring* (Soalt, 2005). One method for implementing pairing in a classroom is by choosing trade books with easy reading levels that can be read before or in conjunction with the informational text is sometimes called twin texts to indicate their common purposes (Camp, 2000).

For example, if a middle level English class was included in the Social Studies lesson presented above, both classes could be reading about the Times Beach disaster in magazines, newspapers, books, etc. and using *Silent Spring* as the informational, non-fiction book—CCSS. ELA-Literacy.RH.6-9 which states: “Compare and contrast texts in different forms or genres (e.g., stories and poems; historical novels and fantasy stories in terms of their approaches to similar themes and topics.” (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). This reading could be prefaced or supplemented with reading one of many books concerned with surviving disasters that are fiction (or fictionalized) and written on a lower, easier to read level.

*Phoenix Rising* by Karen Hesse (1994), for example, is about a nuclear disaster and how it affects a 13 year old girl. As she discovers, “No one on this entire planet was separate from anyone else. We are all connected, by the water we drank, the air we breathed. The release of the radiation . . . had risen into the atmosphere. Heightened levels of radiation registered everywhere. Halfway around the world it had tainted rice crops, poisoned grazing fields, turned the air toxic where babies slept in the open (p. 123).” This is a theme that Rachel Carson uses repeatedly, that all life on earth is interrelated—CCSS.ELA-Literacy.RH.6-7 which states, “Compare and contrast a



fictional portrayal of a time, place, or character and a historical account of the same period as a means of understanding how authors of fiction use or alter history.” (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).

*Phoenix Rising* is completely fictional, but other novels are available that are not. *Dark Water Rising* by Marian Hale (2006) is a fictionalized account of a real life disaster—the hurricane often called the Galveston Storm that occurred on September 8, 1900 in Galveston, Texas. The hurricane is still known as the deadliest storm with loss of life estimated at 6,000 to 8,000 people (National Geographic, 2014). Visual documentation that can augment the lesson is available online (see <http://video.nationalgeographic.com/video/news/us-galveston1900-vin?source=relatedvideo> and <http://www.history.com/topics/1900-galveston-hurricane>)—CCSS. ELA-Literacy.RH.6-7 which states, “Compare and contrast a written story, drama, or poem to its audio, filmed, staged, or multimedia version, analyze the effects of techniques unique to each medium. . .” (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). The novel outlines the events of one family and gives detailed accounts of the everyday struggles to get life back to normal after the storm.

### Final Thoughts

Teachers and their students living in the digital age can enhance learning through a wide assortment of tools. Instructional aides such as Google Ngram can be utilized in the classroom to assist with cross curricular connections as well as foster a better understanding of technology's role. The major benefit of using Ngram in a classroom is the simplicity of usage combined with its extremely large database. Whether the classroom has one central computer or a classroom set of tablets, Google Ngram can be used successfully with a minimum of preparation and therefore open the classroom to an extremely powerful global database. One strength of Ngram is the almost instantaneous results that can be obtained during a classroom lecture or as students express an interest during a regular classroom session. Ngram is also one of the few data bases that can easily confirm the connection between culture and language creation during historical periods. The authors encourage educators to utilize and expand on the sample lesson plan. Through the usage of Google Ngram, educators can energize selected lesson plans and encourage the growth of web based skills that may foster life-long learning in this new Web 2.0 age.



## Appendix A

### Presentation / Project Rubric

	1	2	3	4	Score/Level
Creativity	Material presented includes no noticeable variety	Material is presented with little originality or creative thought	Material is presented with apparent originality and creativity	Material is presented with exceptional originality and use of creative thought	
Content	Project is unorganized and meets less than half the requirements	Project is well-organized and meets at least half of the requirements	Project is well-organized and meets most requirements	Project is well-organized and meets all requirements	
Grammar	Project includes multiple grammatical and stylistic errors	Project includes some errors in grammar and/or formatting that does not interfere with clarity	Project includes few grammatical and/or stylistic errors	Project is nearly error-free which reflects clear understanding and thorough proofreading	
Presentation	Presentation is careless, hurried, and illegible	Presentation appears rushed and somewhat careless, but the content is legible	Presentation is clear, uncluttered, and attractive	Presentation is clearly defined with evidence that pride and care was taken	



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