

Connecting the Dots: Web 3.0 and Interdisciplinary Freshman Research

Widely acknowledged as a high-impact practice, undergraduate research is common for juniors and seniors in undergraduate science programs. Less common are opportunities for undergraduate research in the humanities and social sciences. Rarer still are research experiences for first-year college students. During the fall semester in 2012, we—Matthew Cook (a librarian) and Sean Kelly (a political scientist)—engaged first-year college students in an interdisciplinary undergraduate research course using “Web 3.0 technology.” (Web 3.0 technology is not a technical update to the Web, but rather refers to web pages that allow users to share work created with “Web 2.0 tools” such as i-Pads). Capitalizing on a previously unprocessed collection of political papers, students were introduced to the conduct of qualitative and quantitative research using primary documents in political science (Frisch et al. 2012). Simultaneously, students learned about key issues and challenges in librarianship and archival studies. Using technology such as i-Pads and a data-display app, students created visual representations of the data that they uncovered and used the technology to represent and distribute their work.

In this case study we recount our philosophical approach to the course and evaluate the value of an undergraduate research experience for first-year college students. We conclude that first-year students can benefit substantially from a research experience and that employing Web 3.0 tools can help students develop their basic research skills.

Web 3.0

This course employed one key characteristic of Web 3.0 usage that distinguishes it from earlier Web iterations, collaboration or “crowdsourcing,” which takes advantage of the collective efforts of a group to leverage limited individual resources. That is, although Web 2.0 might incorporate advanced electronic tools such as an I-Pad, Web 3.0 supports the sharing of work created on Web 2.0 tools. As Y. H. Ching and Y.C. Hsu have noted, “Although higher education has been taking advantage of Web 2.0 applications to create technologically enriched learning experiences for students, most of the existing Web 2.0 literature shows that educators did not use those applications to their full potential. That is, the participatory, interactive, collaborative, and social aspects were often missing from the learning” (Ching and Hsu 2010, 782).

The Web and various technologies allow students to incorporate visual literacy, use multi-media resources, and combine these with traditional text and classroom work to arrive at a new product. Web 3.0 allows them to share these products, and such sharing results in the creation of new work drawn from, in this case, primary documents and the contextualization of those documents.

Collections of political papers generally consist of hundreds of boxes, thousands of folders, and hundreds of thousands (even millions) of pages of documents. Gaining intellectual control over these collections is difficult under ordinary conditions. In an era of shrinking budgets and competing needs for resources, many of these collections languish for years (Greene and Meisner 2005). The recently developed tools and approaches that we discuss present an opportunity to marry technology with the desire of archivists to make collections available to researchers

In our research course, we employed Apple i-Pads™ and a data-visualization application, Popplet™, as tools for capturing students’ investigations into the papers of a former California Congressman, Democrat Harold T. “Bizz” Johnson. We had two reasons for adopting the iPad and data-visualization app. First, processing an archival collection in the traditional manner is labor-intensive and requires specialized knowledge. By creating “pictures” of the collection, instead of traditional finding aids, the learning curve was reduced, allowing the freshmen to access and describe the collection without graduate degrees in library science (Bradsher 1991). Second, graphic representations of data (files, folders, documents) allowed students to make connections that, in turn, could be shared among students and i-Pads. This created a sense of ownership as students manipulated the pictures in ways that sparked their research interests and helped them interpret items in the collection, within the context of a large volume of documents.

Course Philosophy and Structure

Bloom’s Taxonomy is a useful heuristic for categorizing the cognitive domains involved in learning (Krathwol 2002). For the purposes of this article the six-category taxonomy can be compressed into three categories: 1) *content mastery*, involving comprehension of the basic facts and concepts in a knowledge area; 2) *active mastery*, the ability to recognize and apply appropriate knowledge when confronted with new and unfamiliar material, and; 3) *knowledge creation*, the

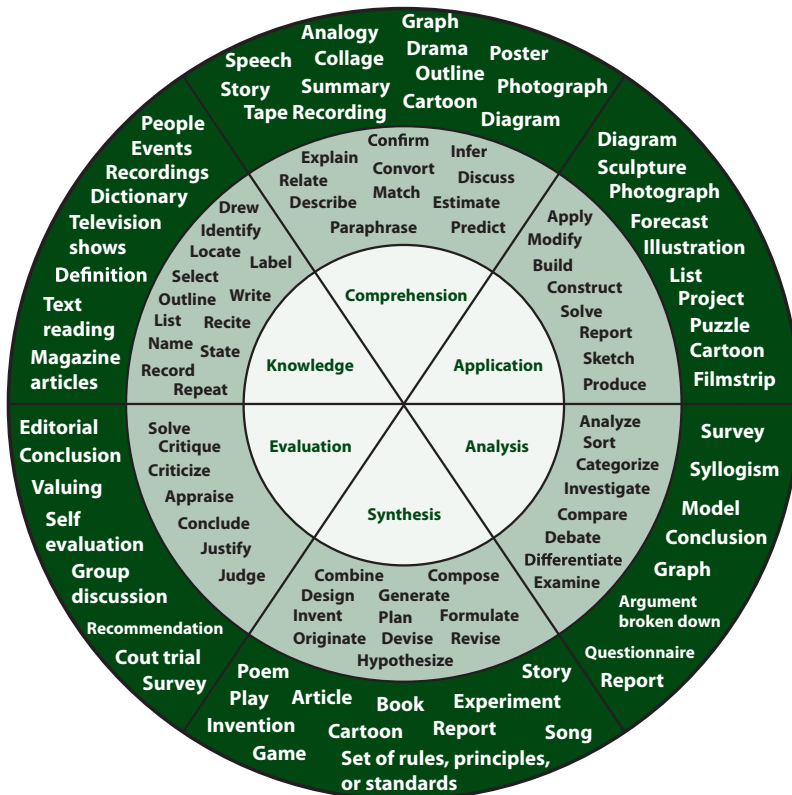
ability to critically confront new material, recognize how that material is relevant to existing knowledge, and how that material might be used to create a new understanding of existing facts. (See Figure 1.)

First-year college students mostly understand “research” based on their high-school experience. A student typically is given a topic and sent to the library; research is the process of locating information and reporting back what the student found in the existing literature. While this exercise has value—knowing what is known is important—the library research approach largely constrains the research process to the *content mastery* domain. If one accepts the premise that research involves *knowledge creation*, then the library research project falls far short of our goal for students in an undergraduate research course. Without question our purpose is to help students master content; but the value of an undergraduate research experience comes when students confront new “data” and are required to: 1) apply their existing knowledge to those data, to “make sense” of them, and 2) recognize how the new data can be employed to create new knowledge, or repurpose existing knowledge in a manner that creates a new understanding of existing insights.

Our class received support from the Stepladder Program for Interdisciplinary Research and Learning (SPIRAL, <http://www.csuci.edu/spiral>), part of a campus-wide effort to institutionalize undergraduate research at CSU Channel Islands. The SPIRAL program was in part funded by a grant from the W. M. Keck Foundation.

Our approach to the course was to help students develop “concept maps,” which are “diagrams that represent ideas as node-link assemblies” (Nesbit Adesope 2006, 413). Such maps are a means to graphically organize information in a manner that highlights the connections between and across concepts, and to present related information. Concept maps have been shown to help instructors illustrate information about complex structures to students (Weinstein and Mayer 1986).

In the context of this course, the chief contribution of the concept map was to engage students in actively incorporating new information into broader and evolving knowledge networks; that is, encouraging students to make connections between related concepts and sources of information. The mapping approach is intended to simplify a complex problem and to engage students so that they acquire the higher-level cognitive skills involved in research.



Concept-mapping software, the Popplet app, introduced a dynamic element into the students’ research experience. The technology allowed students to expand their universe of intellectual resources to include content from video, music, photos, and graphics as they were expanding their knowledge base. They developed their information-literacy skills and were also required to make intellectual connections between formerly discrete sources and concepts, wrapping them into a “web of knowledge.” The example in Figure 2 illustrates how the Popplet app can be used to present a concept map.

Designed by the authors, the concept map in Figure 2 illustrates how a document from the Johnson Collection served as a jumping-off point for a number of educational explorations. In the primary document, a constituent complains about the nomination of Judge G. Harrold Carswell to the United States Supreme Court and links it to his condemnation of the U.S. military’s incursion into Cambodia during the Vietnam War. A student, perhaps unaware of both Carswell and the Cambodian bombings, might use Popplet to document his or her explorations into these topics by employing multimedia clips, interpreting historical documents, and drawing connections between these resources and the primary document.

Figure 1. Bloom’s Taxonomy (revised by authors)

Nixon Era

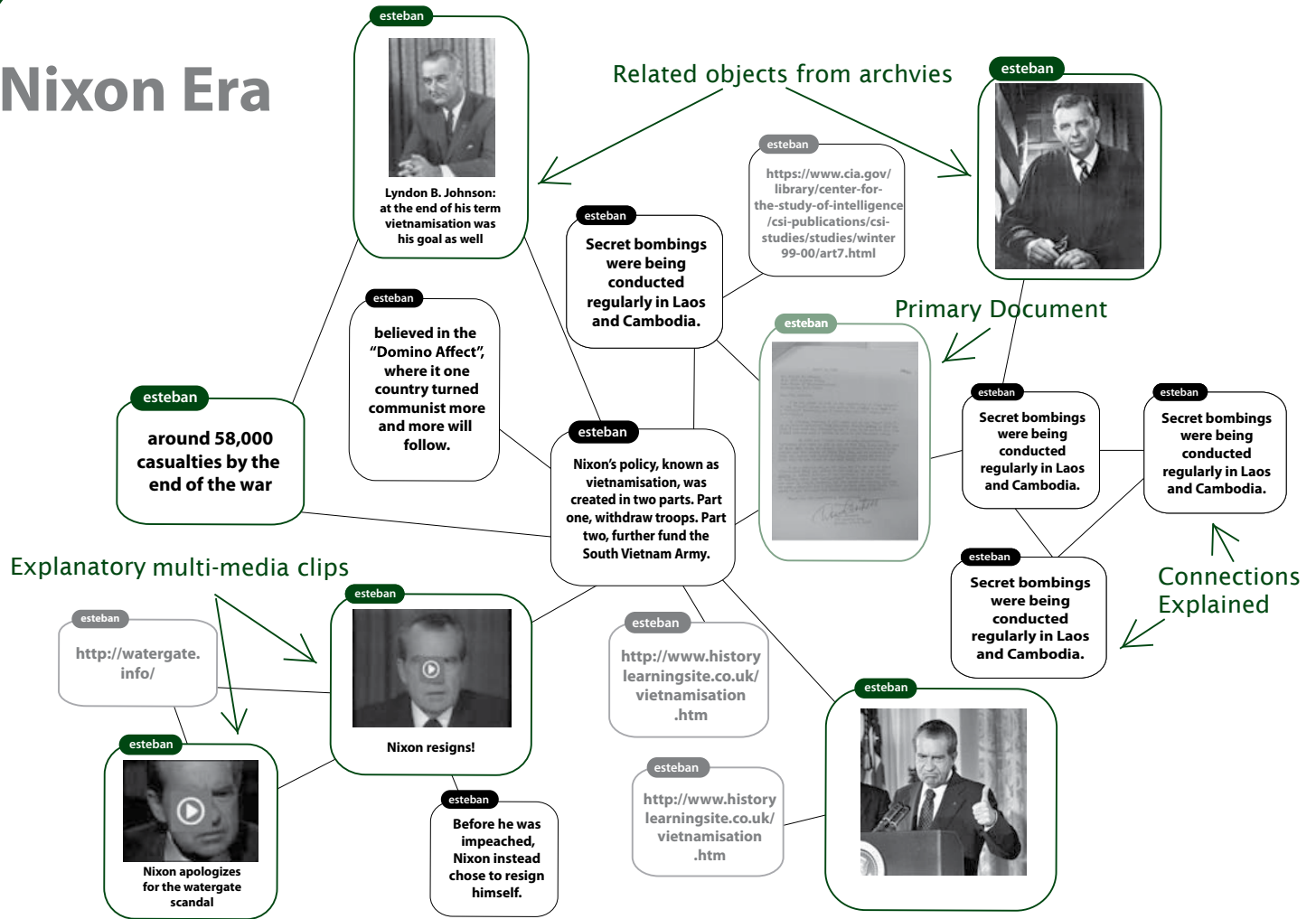


Figure 2. Using the Popplet App to Construct a Concept Map (image verbatim from student assignment)

An Interdisciplinary Introduction

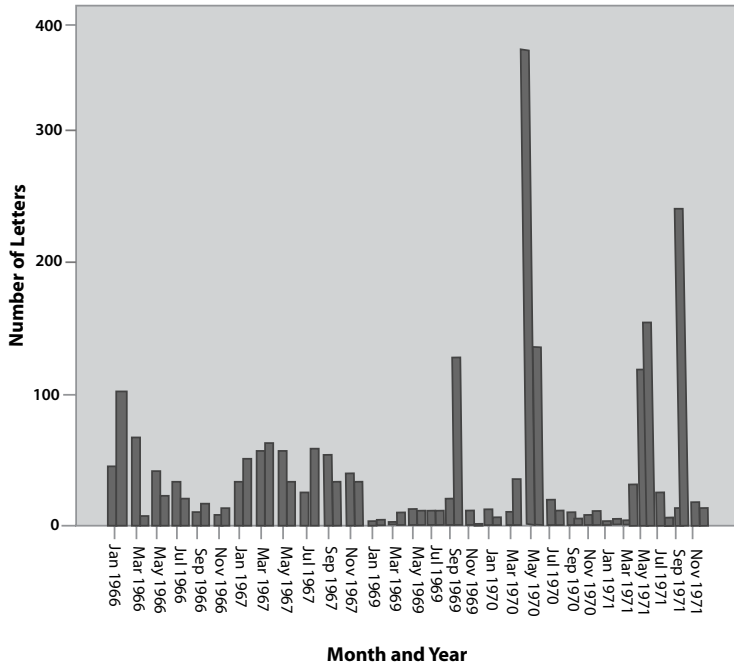
The unprocessed collection of Representative Johnson’s papers that we worked with contained the records produced in his congressional office during his service in the House of Representatives from 1959 to 1980. Acquired by the John Spoor Broome Library at CSU Channel Islands in 2011, the papers were contained in about 700 boxes, uncatalogued, unprocessed and, thus, unavailable to researchers.

Prior to the first class session we created a subset of this collection, consisting of constituent letters to Congressman Johnson on the topic of the Vietnam War. These letters represented “activated” public opinion—the opinions of his constituents who felt strongly enough about an issue to register their opinions in letter form. We chose the Vietnam War letters because they represented opinions on an issue of historical significance large enough to be recognizable to students, but an issue on which they would not have significant knowledge.

During the first class session students were required to count the number of letters for an assigned year, noting the total for each month, and to report their findings. Using the quantitative data that they generated, we created a graphic representation of the data for the second class session (see Figure 3). This exercise highlighted the potential of the collection as a source of quantitative data; the relationship between primary sources and political science—transforming seemingly qualitative data into quantitative data (Frisch and Kelly 2009, 2012)—began to take shape.

The graph—and the month-to-month and year-to-year variations—provided an opportunity to engage students in discussing possible explanations for what caused the variations in the volume of public opinion. This allowed us to focus their attention on searching for potential explanations for observed changes, and how these changes might reflect constellations of events during the Vietnam conflict. It also suggested that the “stories” or “meaning making” associated

Figure 3. Student Letter Count by Month



with these spikes were one example among many, and that each data point could be linked to one or more additional data points and to other stories.

While counting the letters, students were asked to sample and read some of them and to identify one piece of correspondence that they found intriguing, based on their own criteria. The second part of the introductory assignment required students to explore further the notion of discovery by “contextualizing” that single constituent letter (see Figure 4a). Any given letter is a product of the social, historical, and political context in which it was written. Students were required to locate and connect appropriate primary and secondary sources to the letter so that a reader today would have the context necessary to understand the letter.

Figure 4a is a letter from a constituent to Congressman Johnson in which the constituent writes, in part, “Instead of the tax increase which the Administration is proposing to pay for the War in Vietnam, why not just win that war by using our air and sea power and simultaneously cutting out the Great Society boondoggle?” To understand the content of this letter, the student researched the Great Society and the Vietnam War and linked both to the Civil Rights Act

Figure 4a. Constituent Letter

JUNE 1971 - During a college commencement speech, Senator Mike Mansfield labels the Vietnam war “a tragic mistake.”

JUNE 13, 1971 - The New York Times begins publication of the ‘Pentagon Papers’ a secret Defense Department archive of the paperwork involved in decisions made by previous White House administrations concerning Vietnam. Publication of the classified documents infuriates president Nixon.

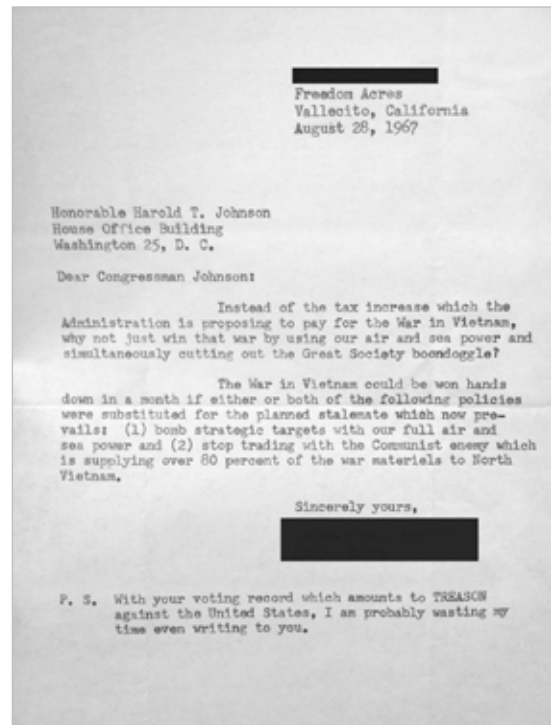
JUNE 15, 1971 - Nixon attempts to stop further publication of the Pentagon Papers through legal action against the Times in the U.S. District Court.

JUNE 18, 1971 - The Washington Post begins its publications of the Pentagon Papers. The Times and Post now become involved in legal wrangling with the Nixon administration which soon winds up before the U.S. Supreme Court.

JUNE 22, 1971 - A non-binding resolution passed in the U.S. Senate urges the removal of all American troops from Vietnam by year’s end.

JUNE 28, 1971 - The source of the Pentagon Papers leak, Daniel Eisenberg, surrenders to police.

JUNE 30, 1971 - The U.S. Supreme Court rules 6.3 in favor of the New York Times and Washington Post publication of the Pentagon Papers.



Great Society

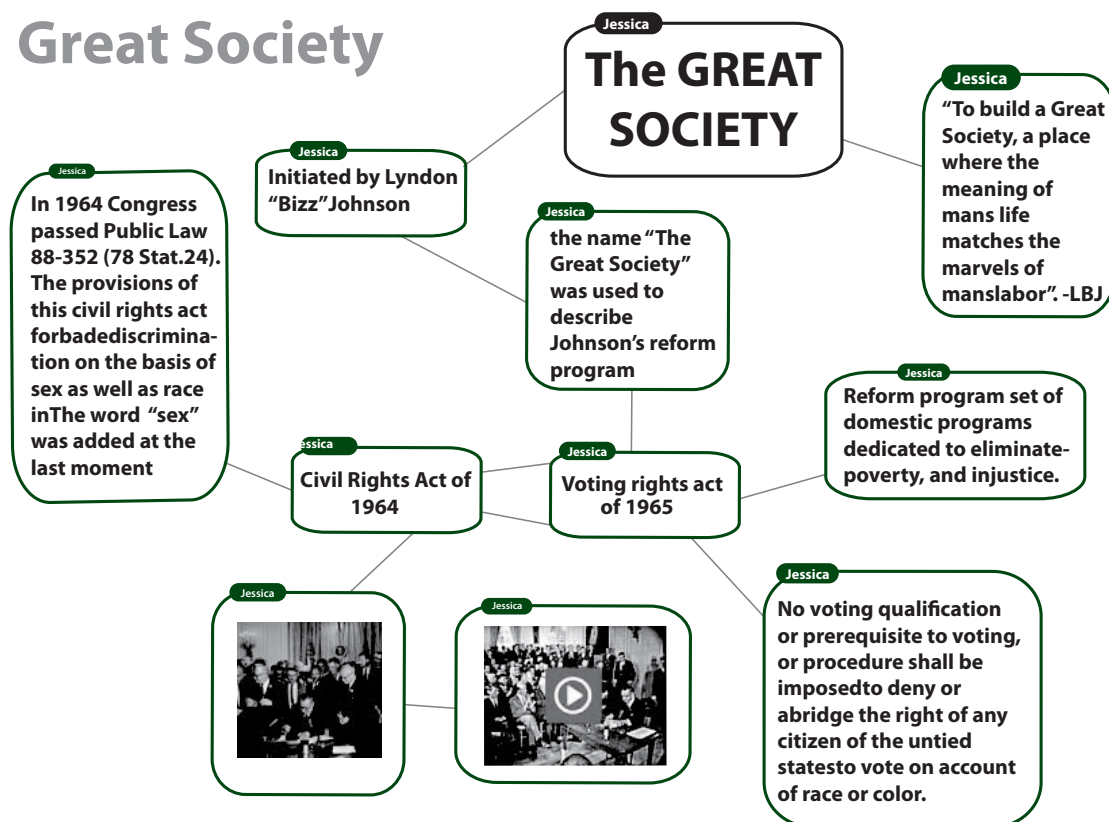


Figure 4b. Concept Map Based on the Constituent Letter
(image verbatim from student assignment)

of 1964 and Voting Rights Act of 1965, which might have made for a fine research paper describing that complex relationship. However, in this instance, the student used Popplet to graphically organize his findings (see Figure 4b) in a manner focusing the connections between and across concepts, using primary, secondary, and multi-media resources (Weinstein and Mayer 1986).

There were a number of benefits to this interdisciplinary introduction to the course. First, it signaled to the students that this was not a lecture course; rather, they would be in an experiential-learning environment, and they would be interacting regularly with archival materials (a first for all of our enrollees). Second, students were introduced to the technological tool used in the course, in this case Popplet. Third, it demonstrated that the work might be done by an individual, but that it would be linked to something greater; each discrete effort would inform the whole (the Web 3.0 ethic). Fourth, we demonstrated that the focal point of the course would change. Whether it was a single letter, a policy issue, or a complete policy or political domain, everyone in the class would be responsible for establishing linkages to broader issues.

By the fourth class meeting, the students understood the course's aims, were familiar with their cataloguing tool, and

knew the breadth and depth of the collection. It was then time to begin work in earnest. Despite intellectually understanding the course's goals, the question of how to achieve them needed to be answered. As one student asked, "Where do we begin?" Unfortunately for that student and the rest of the class, we could only answer, "We don't know."

In teaching information literacy, the first step, however awkward, is a key teaching moment (Maybee 2007). The "not knowing" is a valuable tool in building vocabulary and contextualizing research

hits. Further, information literacy is a process and this fact is noted in the university's general education goals (<http://www.csuci.edu/provost/ge-taskforce/goalsandoutcomes.htm>). With the first search in a database, the aim is to begin and then evaluate information, making searching an iterative process (Andretta 2013). The students began taking down boxes and describing their contents employing Popplet. In-class presentations by students noted some reoccurring problems concerning description, display, and effective story telling. The students, with little faculty input, negotiated these issues and arrived at best practices. But the sheer volume of the collection became a concern; it appeared as though the students would have a difficult time accessing and describing every box. So we identified themes in the collection (e.g., civil rights, Vietnam, state parks, and California water projects) and had students create concept maps for those issues.

Interestingly, different issues engendered different approaches. Congressman Johnson's work on the Interior Committee meant that he had accumulated a great deal of material on, for instance, dams in the Western half of the United States. The student working in that research area noted quickly that there were very few constituent letters on this topic, but a large number of Congressional reports, Department of the Interior findings, geographical data from the Department of

Agriculture, and site-visit notes. In contrast, the collection's materials on the Vietnam War were rich in constituent data, newspaper clippings, and some Presidential reports, but lacked significant materials on Congressional discussions regarding the war. Congressman Johnson was not a member of the Foreign Affairs Committee and, thus, his collection would reflect that. The in-class Popplet presentations illustrated this clearly and allowed for excellent teaching moments concerning both the political process (that is, the effects of specialization and committee assignments) and the arrangement of data for different types of materials.

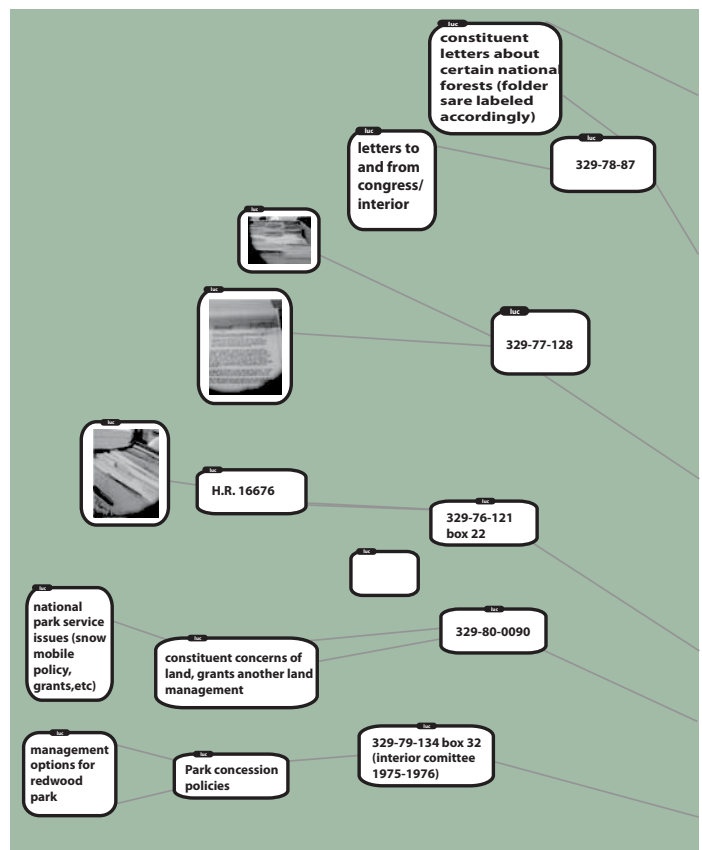
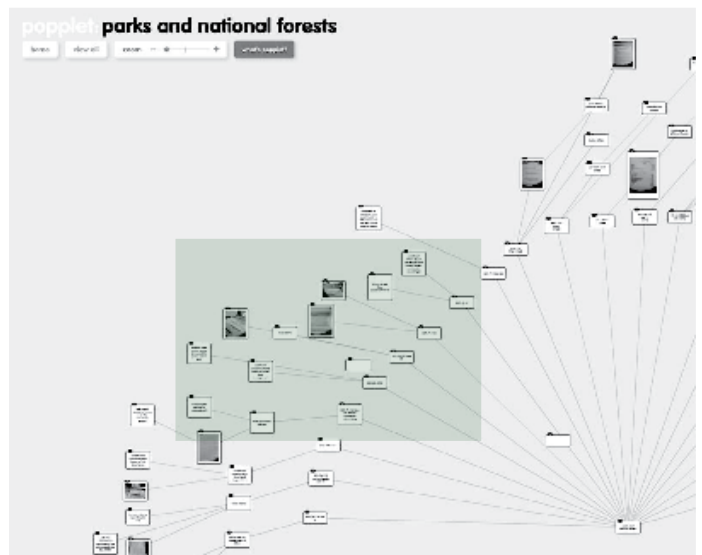
By the 9th week of the course, students had developed a level of comfort with both the tools and the collection, thus allowing for more complex or richer understanding on the part of the students. As Figure 5 indicates, the students were then able to provide a context for their issue that had only been hinted at in their first Popplet assignment. Unlike traditional finding aids, students used more images in their descriptions of the collection, in an effort to let the collection tell the story visually (see Figure 5). The benefit to researchers wanting to access the collection will be concrete; rather than having a textual description of documents in the collection, researchers will be able to view documents that are representative of the collection.

Issues of meta-data standards, controlled vocabulary, and library or archival organizational models are replaced with an individual approach to the task, reflecting both students' understanding of the subject and the material that they are describing. Some issues, like civil rights, have a brief life in the collection, whereas others, such as national parks, are evident in every year of the Congressman's tenure. How should this be reflected in a Popplet? Watching students answer that question by evaluating, analyzing, and synthesizing the documents in unique ways was the most rewarding part of the class.



Students working with the Bizz Johnson Paper Collection.

Figure 5. Finding Aid for Parts of the Collection Focusing on California Water Projects
(image verbatim from student assignment)



CUR Sidebar

Online Guide Encourages Undergraduate Research Using Social Media

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As a student explains the significance of her research to her peers, she points to the key figure on her poster. Another student asks a question. The speaker responds, although some time later. This scene is typical of many undergraduate research poster sessions—however, it takes place entirely online, using the Cloud-based application VoiceThread (<http://voicethread.com/>). With the ability to unite people separated by time and distance, VoiceThread and other social media tools can be used for everything from virtual poster sessions to collaborative discussions concerning datasets.

When thoughtfully and deliberately implemented, approaches using social media can effectively facilitate undergraduate research. CUR Geosciences Division has designed an online resource to encourage and support the use of social media in undergraduate research. For details, see http://serc.carleton.edu/NAGTWorkshops/undergraduate_research/social_media.html.

Although the examples in the resource guide are based in the geosciences, the best practices and social-media tools apply to all disciplines. The guide describes four types of such tools (social networking sites, blogs, collaborative projects, and content communities) and gives specific examples of how they can be used from the earliest stages of mentoring undergraduate researchers through final dissemination of their research projects. Using social media with undergraduate researchers presents some challenges, which are also addressed in the guide—in particular, social media etiquette and fair use and copyright policies. Additional resources and examples can be found at the CUR Geoscience Diigo social bookmarking site (<http://www.diigo.com/list/curgeoscience>).

Course Outcomes

Measurement of course outcomes was consciously built directly into the course. Prior to the beginning of the course, we designed pre- and post-course student surveys centering on learning objectives that we considered important for this course. We were interested in knowing what the impact of the course was on students' subjective confidence in their ability to complete concrete tasks. Three interesting clusters of results emerged from the data we gathered.

In the domain of disciplinary knowledge, students' subjective understanding of the job of "congressman" increased substantially, with the pre- to post-course measure of "confidence" increasing a mean of 35 points (see Table 1). Students in the course also became somewhat less cynical about members of Congress, with students slightly more likely to believe that the lawmakers were not solely concerned about themselves. In the words of one student, "It has made me appreciate them more." Students became more convinced that members of Congress do pay attention to their constituents. Said one student, "They do try to follow the people's voice." However, their exposure to the Congressman's papers did not make them less cynical about Congress as an institution. One student said the experience "left me with the realization that we need change due to a broken system."

Overall, students gained in their ability to evaluate information. In particular, students indicated increased confidence in their ability to evaluate the validity of sources of information and to develop context for an historical document. Students indicated they perceived a small gain in their ability to distinguish between primary and secondary sources.

With regard to changes in students' confidence about their ability to engage in higher-order tasks associated with research, the findings are somewhat mixed, as shown in Table 1. Students reported improved confidence in their ability to conduct independent research and establish connections between concepts. Students' confidence in their ability to complete a project and present their research to an audience dropped. We speculate that these results reflect students' improved appreciation of the efforts required to conduct a *bona fide* research project, one that extends beyond collecting and reporting on established knowledge.

Conclusion

This course presented an opportunity to engage in a unique and innovative teaching experience. An unprocessed collection of political papers provided the means of engaging first-year students in interdisciplinary undergraduate research. Frankly, this course would not have been as successful if it resided solely in the political science or library "silos."

Despite its uniqueness—and the attendant difficulty of replicating this on another campus—there are important lessons to be learned from this case study. In the context of an already-processed archival collection, using i-Pads and apps such as Popplet could be incorporated into a course to foster collaboration and improve the quality of an existing finding aid, thus helping to make documents within the collection available to remote researchers. There is no reason why the approach we took is not portable to any field, from the humanities to the natural sciences, given the ability it demonstrated to mine archival sources for data. Using concept-mapping techniques is eminently elastic.

The largest drawback centered on the specific descriptive tool that we utilized; it was not robust enough for our purposes. Sharing Popplets from student to student, although possible, was not easy. The visuals looked impressive, but some key functions, such as searching, hierarchical orga-

nization, and manipulation, were not present or robust enough. For instance, if a student discovered later that an organizational schematic should be altered to better reflect newly discovered materials, reordering or introducing new terminology was not easily accomplished in the same way that, say, an Excel spreadsheet might allow for “search and replace,” the introduction of a new column, or moving data around. It was, however, a valuable tool for the students to address one of our central learning objectives: encouraging them to make explicit connections.

The most pleasant surprise was how readily the students engaged the material in the collection. We feared that the sheer volume of the collection and the fact that it was paper-based (old technology and, at times, grimy) might deter the young students. That was not the case. They not only didn’t shy away from the collection but they also readily understood the connection between the documents in their hands, the larger issue, and how that issue could be reframed or examined today. Likewise, they responded to the emotion of, for instance, the constituents’ letters, which did propel them to research outside of class on topics that they previously had not fully understood. To that end, we intend to further develop resources that employ primary sources in the political-science curriculum.

Table 1. Student Perceptions in Pre- and Post-Course Surveys

From 0 (not at all) to 100 (completely), indicate your confidence in personally performing the following tasks:	Post-Course Mean	Pre-Course Mean	Mean Difference
Disciplinary Knowledge			
<i>Explaining what members of Congress do</i>	52.75	17.25	+35.50
Evaluating			
<i>Providing context for an historical document</i>	70.25	27.75	+42.50
<i>Assessing the validity of an information source</i>	58.00	28.25	+29.75
<i>Distinguishing primary from secondary sources</i>	62.50	60.25	+2.25
Creating			
<i>Making connections between concepts</i>	45.25	36.75	+8.50
<i>Conducting independent research</i>	62.25	60.50	+1.75
<i>Completing an independent research project</i>	52.25	73.25	-21.00
<i>Presenting research to an audience</i>	30.00	52.25	-22.25

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