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The Utility of Social Media for Teaching Information Has Value

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> **ACRL Information Literacy Frame:** Information Has Value
>
> **Discipline:** Sciences & Engineering
>
> **Subject:** Biology; Interdisciplinary; Biotechnology; General Education Science
>
> **Pedagogy:** Inquiry-Based Learning
>
> **Special Population**: Undergraduate Students

Feinstein[1] states that science education is "intrinsically useful" for all students, even if they are not planning on entering a science or technical field. He argues that for science education to be truly useful, it needs to extend beyond scientific facts and connect to the real uses of science in daily life. This was the impetus that inspired the curricular redesign for BIO 125: Biotechnology, a course taken to fulfill a general education science requirement. The lesson this chapter focuses on is the fourth in a five-part series of in-class activities designed to promote scientific infor-

mation literacy for BIO 125. It uses U.S. Senator Jeff Flake's (R-Arizona) website, "Wastebook," a webpage that criticizes government spending on scientific research,[2] but could be tailored to other websites. The assignment has students examine one of the claims made on "Wastebook" by researching the scientists and their studies (Appendix 15A). They describe what research is actually being done and compare it to Senator Flake's summary.

The assignment was conceptualized based on students' access to scientific "information" on social media sites and the enrolled students' lack of scientific literacy. Science literacy is imperative because science and technology permeate all aspects of daily life. Citizens need to be informed consumers and decision-makers.[3] Data analysis shows that scientific literacy increases due to the completion of college-level science courses and a baccalaureate degree.[4,5] These data show the importance of science courses for all students and that it is essential they gain scientific literacy in general education courses.

Pedagogy: Inquiry-Based Learning

This lesson incorporates inquiry-based learning (IBL). There is a natural integration between IBL and information literacy, especially scientific literacy. IBL is based on the idea that the most learning occurs through an active process of inquiry. When students are the seekers of information, they create new knowledge and understanding.[6] Dresang[7] found that one of the key factors for student engagement in IBL is that they be personally interested in the topic. Gormally et al.[8] found that students in an IBL lab significantly improved their scientific literacy and scientific process skills over the course of the semester when compared to students in a traditional classroom. However, the students in the IBL provided lower teaching evaluations and were frustrated with the workload in the course. A course that utilizes IBL needs to seek the balance between student learning and perceived student workload. Our BIO 125 is a hybrid lecture/IBL course, which seems to provide a good balance of traditional lecturers and active learning. Overall grades in the course were higher than in previous years and course evaluations were more positive.

ACRL Information Literacy Frame: Information Has Value

The "Wastebook" assignment focuses on the Information Has Value component of the framework.[9] According to the ACRL, "Information possesses several dimensions of value, including as a commodity, as a means of education, as a means to influence, and as a means of negotiating and understanding the world. Legal and socioeconomic interests influence information production and dissemination."[10] In the "Wastebook" assignment, students explore this monetary value of information by investigating how politics can influence scientific funding. Information also has an abstract value. Citizens need information in order to ethically participate in scholarly and social activities. Scientific issues, such as stem cell research, climate change, and genetically modified products, are increasingly influencing voters. The fact that information can be used to influence people, which politicians often employ, also gives information value.

The "Wastebook" assignment exposes students to the Information Has Value component of the framework in multiple ways. It shows them that Senator Flake often did not cite the studies he was criticizing. Because Flake takes the studies' findings out of context, the students must employ searching strategies to locate the original source. They also examine where and how information was published. One of the goals of the Information Has Value frame is for students to "value the skills, time, and effort needed to produce knowledge."[11] This assignment leads them to discover the knowledge production process in science. They find that knowledge production cannot be easily summarized in a few paragraphs and branded with a degrading title, as illustrated by Senator Flake's attempt.

The best-case scenario for this assignment is for the students to be engaged in the information, have lively, informed discussions about the material, and an overall excited energy in the room. Framing the lesson around the idea that scientific reports, with varying degrees of accuracy, are often encountered on social media, provide a real-life application for the students. At various times throughout the semester, we share a scientific article found on social media and discuss the merits of the article. The worst-case scenario for this assignment would be for the students to simply answer the questions on the worksheet without seeing the value of the task. It could also be problematic if a student strongly agrees with Senator Flake

and is not willing to critically analyze the information. We are careful not to present the lesson as an attack on Senator Flake, but to highlight how data can be misinterpreted. Since the class is comprised of non-science majors, it is easy to frame the lesson around their authority to summarize scientific research. We compare their recognized minimal scientific knowledge to his, which provides a direct connection with the material. We also reinforce the principle that non-scientists should refrain from actively speaking out against topics on which they do not have authoritative expertise.

Lesson Plan

Learner Analysis

- Typical students are non-science majors fulfilling a general education science requirement. They range from freshman to senior status and represent a wide variety of majors and backgrounds in science. They also differ greatly in their information literacy skills.
- This lesson could also be used for science majors, with a different evaluation focus, such as the quality and diversity of research that was funded. One of the challenges in a general education course is that students have vastly different skill sets. Group work can help to overcome this hurdle because experienced students can help their classmates. However, creating balanced groups can be problematic. Students tend to want to work with their friends, which is not always the best learning environment. In our classroom, students sit in clusters based on social groups (athletes, musicians, etc.).
- The optimum grouping of students would push these social boundaries and diversify the makeup of the groups. Assigning groups to change the dynamic provides an opportunity for students to diversify their understanding of the material.

Orienting Context and Prerequisites

- Readers should be sure that students have some fundamental information literacy skills related to reading, evaluating, and searching for scholarly articles before initiating the "Wastebook" assignment.
- Before coming to class, students read an article that outlines the association between political affiliation and perceptions on climate change to orient them to political influence in science.[12]

Instructional Context

Classroom Set-up and Technology

- This activity can be accomplished with any desk/table configuration, but the optimal teaching environment for this activity is a classroom with tables where the students can interact with one another. Since they will be asked to search online resources, students will need a connected device per pair at best or per group at the least. They must have access to the internet.
- Research the studies discussed in "Wastebook" to determine which ones students will be able to research successfully. Copy the page(s) from "Wastebook" to prepare student handouts. An example would be to copy the "Hipster Parties" summary found on pages 11–14 for one group to analyze.[13] Copy as many different summaries as applicable or one per number of groups.[14]

Learning Outcomes and Activities

Learning Outcomes

As a result of this lesson, students will be able to:

1. recognize bias in the information reporting; and
2. establish the authority of different sources of information.

Learning Activities

1. Lecture *(5 minutes)*
   - Since this is a scaffolded activity, built off previous classes that covered the basics of information evaluation and how to construct and execute effective searches using available research tools, the librarians introduce the "Wastebook" activity by indicating that students will need to keep these skills and concepts in mind for the activity.
2. Reading "Wastebook" summary *(LO1, 5–10 minutes, essential)*
   - Students are asked to form groups and are provided a "Wastebook" summary—for example, "Hipster Parties" by Senator Flake,[15] along with the activity worksheet (Appendix 15A).
3. Search for Original Research Study *(LO2, 15–20 minutes, essential)*
   - Students use the internet to find the authors of the research study that Senator Flake summarized, research who they are, their affiliations, and describe their research.

4. Compare Original Study to "Wastebook" summary *(LO1–2, 5–10 minutes, essential)*
    - After finding an author's original research, students cite the original research and compare it to the summary by Senator Flake.[16]
5. Evaluating Authority *(LO2, 10 minutes, optional)*
    - Using online resources, such as search engines and databases, examine Senator Flake's authority to report on science compared to the scientists.
6. Group Summary *(LO2, 15–20 minutes, optional)*
    - After all the groups have finished, one person from each group gives an oral summary of their findings by reporting the following information:
        a. The title Senator Flake gave the research
        b. What Senator Flake reported that the scientists are doing
        c. What the authors are actually doing
        d. The main point of the author's research

Assessment

This assignment is assessed directly using the worksheet found in Appendix 15A. The worksheet is worth seven points, one point per question and one point for the oral presentation. Students turn in the assignment before they leave class. Most of the answers are usually descriptive/subjective. Students receive credit for their answers if they are able to:

- analyze evidence (sources) for quality and accuracy;
- identify flaws in the reasoning and/or processes presented;
- selectively and effectively use available search tools to conduct their analyses;
- justify their responses using details and sources;
- provide logical solutions that are consistent with the evidence presented; and
- clearly articulate their groups' conclusions in their oral presentations.

Question five addresses the authority of the authors versus the authority of Senator Flake. The correct response is that Senator Flake does not have the authority to report on these scientific studies and should not be perceived as a credible source.

This assignment is indirectly assessed at the end of the semester on the final exam, which is an optional component of assessment. The overall goal of this and the other assignments is for students to gain scientific literacy and the ability to critically evaluate information in some of the various ways that it is presented. The essay prompt on the final exam is:

> We spent a large amount of time this semester reading primary and popular scientific literature and discussing topics related to them. Your friend sends you an article that he/she found online describing a new biotechnology product aimed at college students that uses microbes to clean dorm rooms.
>
> Explain how you will further evaluate the scientific merit of the article, the product, and the technology itself. Your answer should include at least five evaluation criteria and an explanation of why they are important.

This prompt allows the instructor to assess students' learning of evaluation criteria for scientific articles and technology. It was meant to help the instructor identify the extent to which students retained the learning objectives measured during the "Wastebook" exercise and their ability to transfer those concepts in another context. Evaluation criteria cited by the students included the source of the article, the author's affiliation, a link to original research, grant funding and peer review of the article. The final exam question was worth ten points. The students were expected to include five pieces of evaluation criteria and an explanation of why these criteria were important. Each of these was worth two points, one point for the evaluation criteria and one point for the explanation. An example of a correct answer would be, "Check to see if the article is peer reviewed. Peer review is important because it is a checks and balance system for publishing in science." Other acceptable answers included looking to see if the research was supported by a grant, author affiliation indicating authority or expertise, the number of replicates used, if the article contained a link to original scientific research, or the source of the article. Students received partial credit if they provided less than five criteria or they lacked explanations.

Appendix 15A
Science in Politics Class Activity

Names of all group members:

Honor Code:

1. From the assigned "Wastebook" paper, what is your topic? What does Senator Flake say the scientists are doing?

2. Go to the internet and try to find the authors of the original study. Who are they? Where are they affiliated?

3. Go to the author's webpages to try to find more information about their current research. Describe their research. What is their driving motivation?

4. Find the citation for the papers published related to the "Wastebook" description. What are the scientists actually doing?

5. What are the problems with how the "Wastebook" document is presented? On the page itself, what is the quality of their evidence? What authority does this author have?

6. Imagine someone you went to high school with posts a link to this site on Facebook. How would you address the problems associated with the presentation of the information?

7. Your group will report the following information to the class:
   a. The title Senator Flake gave the research and what he says the scientists are doing
   b. What the authors are actually doing
   c. The main point of the author's research

Notes

1. Noah Feinstein, "Salvaging Science Literacy," *Science Education* 95 (2011): 168–85.
2. Jeff Flake, "Wastebook: The Farce Awakens," last modified December 2, 2015. http://www.flake.senate.gov/public/index.cfm/press-releases?ID=350692fa-d8b4-436f-9730-d03a0d146758.
3. Karin Griffin and Hema Ramachandran, "Science Education and Information Literacy: A Grass-Roots Effort to Support Science Literacy in Schools," *Science & Technology Libraries* 29(4) (2010): 325–49.
4. Jon Miller, "The Conceptualization and Measurement of Civic Scientific Literacy for the 21st Century," in *Science and the Educated American: A Core Component of Liberal Education*, eds. John G. Hildebrand and Jerrold Meinwald (Cambridge, MA: American Academy of Arts and Sciences, 2010), 241–55.

5.   Jon Miller, "Civic Scientific Literacy: The Role of the Media in the Electronic Era," in *Science, Technology, and the Media*, eds. Donald Kennedy and Geneva Overholser (Cambridge, MA: American Academy of Arts and Sciences), 44–63.

6.   Sonja Špiranec and Mihaela Zorica, "Information Literacy 2.0: Hype or Discourse Refinement?," *Journal of Documentation* 66(1) (2010):140–53; Brandon Franklin, Lin Xiang, Jason Collett, Megan Rhoads, and Jeffrey Osborn. "Open Inquiry-Based Learning Elicits Deeper Understanding of Complex Physiological Concepts Compared to Traditional Lecture-Style or Guided-Inquiry Learning Methods," *The FASEB Journal.* 29(1) Supplement (2015): 541; Pertti Vakkari, "Searching as Learning: A Systematization Based on Literature," *Journal of Information Science* 42(1) (2016): 7–18.

7.   Eliza Dresang, "The Information-Seeking Behavior of Youth in the Digital Environment," *Library Trends* 54 (2) (2005): 178–96.

8.   Cara Gormally, Peggy Brickman, Brittan Hallar, and Norris Armstrong, "Effects of Inquiry-Based Learning on Students' Science Literacy Skills and Confidence," *International Journal for the Scholarship of Teaching and Learning* 3(2) Article 16 (2009), available at https://doi.org/10.20429/ijsotl.2009.030216.

9.   ACRL 2015. *Framework for Information Literacy for Higher Education*, http://www.ala.org/acrl/standards/ilframework.

10.   Ibid.

11.   Ibid.

12.   Sandra Marquart-Pyatt, Aaron McCright, Thomas Dietz, and Riley Dunlap, "Politics Eclipses Climate Extremes for Climate Change Perceptions," *Global Environmental Change* 29 (2014): 246–57.

13.   Jeff Flake, "Wastebook: The Farce Awakens."

14.   Ibid.

15.   Ibid.

16.   Ibid.

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