

University of North Alabama

## UNA Scholarly Repository

---

Faculty Publications

Collier Library and Information Services

---

5-1-2015

### Teaching Information Literacy Skills to Sophomore-Level Biology Majors

Leigh Thompson Stanfield

*University of North Alabama*, [dlthompson@una.edu](mailto:dlthompson@una.edu)

Lisa Ann Blankinship

*University of North Alabama*, [lblankinship@una.edu](mailto:lblankinship@una.edu)

Follow this and additional works at: <https://ir.una.edu/libfacpub>



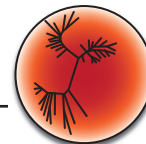
Part of the [Biology Commons](#), and the [Information Literacy Commons](#)

---

#### Recommended Citation

Thompson, L., & Blankinship, L. A. (2015). Teaching Information Literacy Skills to Sophomore-Level Biology Majors. *Journal of Microbiology & Biology Education*, 16(1), 29–33. <http://doi.org/10.1128/jmbe.v16i1.818>

This Article is brought to you for free and open access by the Collier Library and Information Services at UNA Scholarly Repository. It has been accepted for inclusion in Faculty Publications by an authorized administrator of UNA Scholarly Repository. For more information, please contact [jpate1@una.edu](mailto:jpate1@una.edu).



## Teaching Information Literacy Skills to Sophomore-Level Biology Majors

Leigh Thompson<sup>1\*</sup> and Lisa Ann Blankinship<sup>2</sup>

<sup>1</sup>Collier Library, University of North Alabama, Florence, AL 35632,

<sup>2</sup>Department of Biology, University of North Alabama, Florence, AL 35632

**Many undergraduate students lack a sound understanding of information literacy. The skills that comprise information literacy are particularly important when combined with scientific writing for biology majors as they are the foundation skills necessary to complete upper-division biology course assignments, better train students for research projects, and prepare students for graduate and professional education. To help undergraduate biology students develop and practice information literacy and scientific writing skills, a series of three one-hour hands-on library sessions, discussions, and homework assignments were developed for Biological Literature, a one-credit, one-hour-per-week, required sophomore-level course. The embedded course librarian developed a learning exercise that reviewed how to conduct database and web searches, the difference between primary and secondary sources, source credibility, and how to access articles through the university's databases. Students used the skills gained in the library training sessions for later writing assignments including a formal lab report and annotated bibliography. By focusing on improving information literacy skills as well as providing practice in scientific writing, Biological Literature students are better able to meet the rigors of upper-division biology courses and communicate research findings in a more professional manner.**

### INTRODUCTION

Information literacy is the ability to recognize the need for information, locate relevant information, evaluate information, and use information in an ethical way (1, 2, 25). It is crucial that undergraduate biology students develop information literacy and scientific writing skills early in their undergraduate experience to be successful in the sciences (4, 15, 16, 26). Information literacy skills include the ability to distinguish between popular magazines, journals, and information found on websites; to differentiate between primary and secondary sources; and to determine whether the information presented is relevant and evidence-based. Other higher-order information literacy skills include a familiarity with reputable scientific publishers and professional societies and an understanding of how literature in the field is produced and disseminated. Weak information literacy skills produce weak research, which limits student success. One goal of undergraduate science education is to teach the proper use of scientific literature in supporting student research and in drawing new conclusions based on experimental data and studies found in the primary

literature. Before graduation, the undergraduate science major should have mastered basic science writing and information literacy skills (2, 7, 10, 16, 21).

Studies show an underdevelopment of information literacy and scientific writing (14, 21, 26, 28). Familiarity with computer technology is a common trait of the millennial generation, yet this does not necessarily imply proper training in or use of information literacy. Studies by Ferguson et al. (11), Gross and Latham (18), Bandyopadhyay (4), and Ganley et al. (17) suggest that students overestimate their skills in locating and evaluating information. McEuen (23) and Gross and Latham (19) conducted studies that showed that student perception of information literacy is more about the process of finding information than an actual understanding of skills or their relevance. McEuen (23) likens the process to writing in that all college students know how to physically write; however, knowledge of the process does not make them good writers. Within the hard sciences, good writers will clearly and concisely convey information, support their statements with data, incorporate credible outside sources as needed, and properly cite information from outside sources.

Students who fall prey to the "I already know that" (IAKT) syndrome are less likely to pay attention during library instruction sessions (5). Students who receive discipline-specific library instruction make better database choices for literature searches and produce more scholarly work (13). A study by Cronje et al. (8) also supports the

\*Corresponding author. Mailing address: Collier Library, Instructional Services Librarian, University of North Alabama, UNA Box 5028, Florence, AL 35632-0001. Phone: 256-765-4466. Fax: 256-765-4438. E-mail: [dthompson@una.edu](mailto:dthompson@una.edu).

use of discipline-specific library instruction, and the authors found that their freshmen-level students were better able to logically support conclusions drawn from laboratory experiments with data from the primary literature.

While information literacy skills are essential for the research aspect of scientific writing, the process of becoming a good communicator within the science disciplines is developed over time through practice. The number of composition classes a student has taken and the use of university writing centers are not strong indicators of student scientific writing ability. This is most likely due to the difference in writing styles between the humanities and hard sciences and the lack of staff trained in “writing across the disciplines” at writing centers. Practice in science writing is the only way students will improve their science writing skills (21). This suggests that science writing and information literacy training should occur early in undergraduate education to provide ample time for the development of good writing skills.

Several studies have investigated the use of writing assignments in freshman and sophomore level classes. Fuselier and Nelson (16) found that one session of library instruction with several writing assignments throughout the semester is enough to help students differentiate between primary and secondary sources and improve citation usage and format. Other studies indicate students improved their communication, writing, and analytical skills (24), formed important relationships with course or university librarians that would be beneficial in upper-division science courses (13), and were better able to identify and avoid plagiarism (15). Libarkin and Ording (22) demonstrated that writing assignments improved communication skills and the ability to support experimental findings and predict future outcomes in experimental situations in a non-majors entry-level biology course. However, the non-major students still had difficulty identifying hypothesis statements and applying experimental outcomes to daily life (22).

Within undergraduate biology courses, instructors typically use lecture time to teach course-specific information (23). Instructors assume students have basic knowledge of information literacy gained through library instruction and therefore do not cover, or minimally cover, how to search the primary scientific literature (9). These assumptions and common practices have led to a disconnection between faculty perception and the actual skills and knowledge possessed by undergraduate students (10).

Faculty often assume that students know how to interact with the scientific literature. Instructors may assume that students know how to read scientific literature and locate credible sources using library or credible online databases (e.g., PubMed). However, science writing represents an entirely different style of communication than what most students have been exposed to through traditional university writing or English composition courses. Porter (25) acknowledged that some science writing and reading assignments can be intimidating to upper-division science students to

the point where assignments may be deleterious to student learning. Porter (25) emphasized the importance of science information literacy skills beyond undergraduate education and into the student’s professional life. Bandyopadhyay (4) indicated that science information literacy skills are of even greater importance due to the large amount of information readily available through the Internet. Science students now have the greater burden of determining whether or not information found on the Internet is credible and appropriate for class assignments (4).

There are a number of examples of faculty-librarian collaboration related to the introduction of information literacy and its importance in undergraduate biology courses (6, 12, 14, 16, 20, 24, 25, 28). Faculty-librarian collaborations have included a single information literacy lesson, multiple sessions within the same course, course-specific workshops, and embedded librarian participation throughout the semester (16, 27, 29). A number of articles discussed the incorporation of writing and library research assignments in undergraduate science courses to improve students’ abilities to understand and communicate within the science disciplines (4, 7, 21, 22, 25). Jerde and Taper (21) commented that students do not have sufficient opportunities to practice scientific writing or read scientific literature.

Collaborations between teaching faculty and librarians allow for improvement of student information literacy and scholarly communication skills. At the University of North Alabama, a required sophomore level Biological Literature course (BI 200W) uses an embedded librarian to teach information literacy skills to biology majors and minors. Students practice their science research and writing skills through a number of assignments that range from database usage to writing formal lab reports and grant proposal evaluation.

## DISCUSSION

Biological Literature is a one-credit one-hour-per-week sophomore-level course taken by all biology majors and minors. The existing information literacy and scientific writing skills of students in this course vary. In Biological Literature, students are trained in locating and utilizing information in the technical literature and in scientific writing. To address varying skill levels and to hone students’ development of the necessary skills, the authors collaborated to design a series of in-class lessons and homework assignments that develop information literacy and scientific writing skills. These lessons include three one-hour librarian-led workshops covering source credibility and database and web searching. Homework assignments were given after each session. This collaboration has been ongoing and has evolved over the past two years.

Students were asked to complete an assignment where they critically read and analyzed a preselected journal article. It was noted that some students had trouble understanding the differences between popular magazines, journals, and web pages. In addition, some had difficulty grasping the

differences between a journal as a whole and an article as a piece within the journal during later assignments such as database searches and literature reviews. This may be attributed to the way information is located and retrieved. Most articles were found using databases and appeared as citations, for example, 18(4):28–42, in a results list. While citations contained clues to indicate the article was part of a larger collection, students did not always recognize that journals contain more than one article per edition (3).

To address the issue of journal layout and facilitate a discussion of the differences between popular reading and scientific literature, the course librarian developed an activity. During this in-class workshop students were taught the differences between journals and articles, varying types of scientific literature (e.g., trade magazines, peer reviewed primary research articles, abstracts, etc.), and source credibility using a method of short lecture followed by an exercise to practice the skill. Paper copies of both general science magazines (e.g., *Scientific American*) and scientific journals (e.g., *Cell*) were given to each member of the class. Students were asked to examine each type of source and note differences. The course librarian and faculty member asked students questions about the journals and magazines. Discussion questions focused on the differences in print material appearance, intended audience, content and scope. When doing the exercise, most students were able to distinguish between magazines and journals; however, they were unable to differentiate between the types of scientific articles.

After students analyzed these basic points, the course librarian and faculty member then introduced peer review, the peer review process, and how peer review helps to establish source credibility. Peer review of a source can be determined from the journal's front matter, the journal's website, or using ULRICH'S web database ([ulrichsweb.com](http://ulrichsweb.com)). Each method was reviewed by the course librarian. Next, the course librarian and faculty member led a brief discussion on reputable scientific publishers, professional organizations and their publications (e.g., American Society for Microbiology, the American Chemical Society), and how journals are ranked.

Each student completed an individual assignment using the journal they were provided. Students were asked to examine the table of contents of the print journals and to note the different sections (i.e., editorials, original research, review articles, etc.) and identify two or three different types of articles. Students selected one article and answered a series of questions about their chosen article, the type of article it represented, and the collection of print articles as a whole. While students were completing the in-class assignment, the faculty member and course librarian were available to answer questions.

After students completed this exercise, a discussion and review of the parts of a scientific article were led by the course librarian. Also covered in this discussion were the differences between primary and secondary sources and when each should be used in supporting original scientific

writing. This discussion allowed students to see how the primary literature can be used to support original research and also as a source for research ideas. To reinforce the skills covered in the session, students were given a homework assignment that reviewed the in-class discussions and asked them to compare and contrast an original research article to another type of article.

The course librarian then discussed the library's subscription databases, comparing and contrasting them with web search engines such as Google and Google Scholar. While many students have been to general library orientation instruction, few remembered how to search effectively or use advanced search functions or subject-specific databases. The librarian demonstrated navigating the library's homepage, identifying subject specific databases, and accessing databases from off-campus locations. Students were given a general biology topic, and with their input, a relevant database was selected, search phrases or keywords including synonyms were identified, and a search strategy was developed. Because students often neglect to consider synonyms and the use of Boolean Operators (and, or, not) when searching library databases, searches may yield too few or an overwhelmingly large number of results. Having students generate a list of keywords encouraged them to consider alternative search terms and illustrated one of the differences between using a search engine, where results are obtained no matter what terms are used, and a library database that uses subject headings and author-supplied keywords. Once a database search was conducted, the results list was examined. Students were asked if the search needed to be expanded or narrowed and guided in each process.

The search was revised if necessary and the results list was examined in more detail. Using examples from the results list, articles were selected and students were asked to look first at the article record in the database and then at the article to determine whether or not it was a primary or secondary source. This afforded an opportunity to explain what comprises a database record, including how to identify the journal (or source), the date, volume and issue number, pages, author, and subject headings or keywords. Students were reminded to use [ulrichsweb.com](http://ulrichsweb.com) to determine the peer-reviewed status of a source. Accessing full-text articles, using interlibrary loan, and citing sources in the proper format were also discussed.

Once students indicated that they were comfortable with searching library databases, a demonstration of the same search strategy developed for the database search was performed in Google Scholar, allowing students to see the similarities and differences in each resource. During the Google Scholar web search demonstration the domain extension (.com, .edu, and .gov) for types of credible site were discussed. While .com sites are less credible, .edu and .gov sites are generally assumed to be more credible because they often contain research findings. However, caution must be used as the .edu and .gov sites may not be peer reviewed. Differences between locating a journal article using a search

engine and general websites, blogs, or other types of online information were also presented.

Student questions and discussion were encouraged throughout the library instruction sessions. A course Lib-Guide (online library guide specific to Biological Literature) was developed for students to refer to throughout the course, and the librarian was added to the course management system (CMS). The course librarian contacted students at monthly (during full semesters) or weekly (during the June term) intervals over the course of the semester through the CMS. Information literacy and scientific writing skills were reinforced by subsequent assignments that required students to use the resources and skills discussed in the library sessions. These assignments included 1) reading a scientific article, 2) abstracting an article, 3) conducting a database search, 4) conducting a web search, 5) determining keywords for the database or web searches, 6) writing a full length lab report supported by the primary literature, and 7) writing an annotated bibliography.

## CONCLUSION

Courses that train and provide students with practice in using information literacy and science writing skills offer the most impact to students early in their academic careers (13, 14, 15, 16). At the University of North Alabama, Biological Literature is a pre-requisite for advanced biology courses. This course provided training in information literacy and source evaluation in collaboration with an embedded course research librarian. Students developed their research and analytical skills through a series of assignments in conducting literature searches, source evaluation, abstracting, and writing annotated bibliographies and lab reports.

Undergraduate students who received the training that Biological Literature or similar courses provide were more confident writers and retained better research skills in upper-division science courses (7, 13, 22). Science writing is an essential skill for biology students who go on to graduate or professional programs (21, 25). Students were better prepared for the rigors of upper division science courses. Faculty within the Department of Biology have commented on the higher quality of student in their upper-division biology courses since the implementation of information literacy training by the course librarian and increased writing assignments.

Courses with high writing requirements do represent a significant time investment for faculty and the course librarian (4, 24). To help with instructor grading, students were assigned a combination of individual and group assignments. For group assignments, students worked in groups of three in which one student completed the writing portion of the assignment and two students served as peer reviewers. Each assignment had detailed instructions for author and reviewers and roles rotated throughout the semester so that each student practiced scientific writing and peer review. Peer review had the added advantage of minimizing instructor over-editing which has been shown to produce

the desired level of quality but not lasting improvement in student writing skills (17). Timely instructor feedback on assignments is an important form of mentoring undergraduate writers (15, 21). Investment in undergraduate writing and science research skills in the Biological Literature course has proven to be worthwhile to improve student communication and research skills and prepare students for advanced biology courses.

## ACKNOWLEDGMENTS

The authors declare that there are no conflicts of interest.

## REFERENCES

1. **Association of College and Research Libraries (ACRL).** 2000. Information literacy competency standards for higher education. American Library Association, Chicago, IL.
2. **Association of College and Research Libraries (ACRL).** 2006. Information literacy standards for science and engineering/technology. American Library Association, Chicago, IL.
3. **Badke, W.** 2014. Research strategies: finding your way through the information fog, p 104–105. IUUniverse, Inc., New York, NY.
4. **Bandyopadhyay, A.** 2013. Measuring the disparities between biology undergraduates' perceptions and their actual knowledge of scientific literature with clickers. *J. Acad. Libr.* **39**:194–201.
5. **Bell, S. J.** 2007. Stop IAKT syndrome with student live search demos. *Ref. Serv. Rev.* **35**:98–108.
6. **Bowden, T. S., and A. DiBenedetto.** 2001. Information literacy in a biology laboratory session: an example of librarian-faculty collaboration. *Res. Strategies* **18**:143–149.
7. **Brownell, S. E., J. V. Price, and L. Steinman.** 2013. A writing-intensive course improves biology undergraduates' perception and confidence of their abilities to read scientific literature and communicate science. *Adv. Physiol. Educ.* **37**:70–79.
8. **Cronje, R., K. Murray, S. Rohlinger, and T. Wellnitz.** 2013. Using the science writing heuristic to improve undergraduate writing in biology. *Int. J. Sci. Educ.* **35**:2718–2731.
9. **Diep, K., and D. Nahl.** 2011. Information literacy instruction in four Vietnamese university libraries. *Int. Inf. Libr. Rev.* **43**:198–206.
10. **Dubicki, E.** 2013. Faculty perceptions of students' information literacy skills competencies. *J. Inf. Lit.* **7**:97–125.
11. **Ferguson, J. E., T. Y. Neely, and K. Sullivan.** 2006. A baseline information literacy assessment of biology students. *Ref. User Serv. Q.* **46**:61–71.
12. **Ferrer-Vinent, I. J., and C. A. Carello.** 2008. Embedded library instruction in a first-year biology laboratory course. *Sci. Technol. Libr.* **28**:325–351.
13. **Ferrer-Vinent, I. J., and C. A. Carello.** 2011. The lasting value of an embedded, first-year, biology library instruction program. *Sci. Technol. Libr.* **30**:254–266.

14. **Firooznia, F., and D. K. Andreadis.** 2006. Information literacy in introductory biology. *J. Coll. Sci. Teach.* **35**:23–27.
15. **Freeman, E., and E. Lynd-Balta.** 2010. Developing information literacy skills early in an undergraduate curriculum. *Coll. Teach.* **58**:109–115.
16. **Fuselier, L., and B. Nelson.** 2011. A test of the efficacy of an information literacy lesson in an introductory biology laboratory course with a strong science-writing component. *Sci. Technol. Libr.* **30**:58–75.
17. **Ganley, B. J., A. Gilbert, and D. Rosario.** 2013. Faculty and student perceptions and behaviours related to information literacy: a pilot study using triangulation. *J. Inf. Lit.* **7**:80–96.
18. **Gross, M., and D. Latham.** 2012. What's skill got to do with it?: Information literacy skills and self-views of ability among first-year college students. *J. Am. Soc. Inf. Sci. Technol.* **63**:574–583.
19. **Gross, M., and D. Latham.** 2009. Undergraduate perceptions of information literacy: defining, attaining, and self-assessing skills. *Coll. Res. Libr.* **70**:336–350.
20. **Jacob, N. P., and A. P. Heisel.** 2008. A faculty-librarian partnership for investigative learning in the introductory biology laboratory. *J. Coll. Sci. Teaching.* **37**:54–59.
21. **Jerde, C. L., and M. L. Taper.** 2004. Preparing undergraduates for professional writing: evidence supporting the benefits of scientific writing within the biology curriculum. *J. Coll. Sci. Teaching.* **33**:34–37.
22. **Libarkin, J., and G. Ording.** 2012. The utility of writing assignments in undergraduate bioscience. *CBE Life Sci. Educ.* **11**:39–46.
23. **McEuen, S. F.** 2001. How fluent with information technology (FIT) are our students? *Educause Quart.* **24**:8–17.
24. **Petzold, J., B. Winterman, and K. Montooth.** 2010. Science seeker: a new model for teaching information literacy to entry-level biology undergraduates. *Iss. Sci. Technol. Libr.* **63**. [Online.] <http://www.istl.org/10-fall/refereed2.html>.
25. **Porter, J. R.** 2005. Information literacy in biology education: an example from an advanced cell biology course. *Cell Biol. Educ.* **4**:335–343.
26. **Scaramozzino, J. M.** 2010. Integrating STEM information competencies into an undergraduate curriculum. *J. Libr. Admin.* **50**:315–333.
27. **Sinn, R. N.** 1998. Library instruction for biology courses: a literature review and survey. *Res. Strategies* **16**:103–115.
28. **Winterman, B.** 2009. Building better biology undergraduates through information literacy integration. *Iss. Sci. Technol. Libr.* **58**. [Online.] <http://www.istl.org/09-summer/refereed1.html>
29. **York, A. C., and J. M. Vance.** 2009. Taking library instruction into the online classroom: best practices for embedded librarians. *J. Libr. Admin.* **49**:197–209.