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Important Information Literacy Standards for Life and Health Sciences

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Life and Health Sciences

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Information literacy in the life and health sciences is a dynamic field, with challenges, opportunities, and rewards for the successful practitioner. This chapter will describe the big picture of information literacy in these disciplines, list relevant performance indicators from the ALA/ACRL/STS Task Force on Information Literacy for Science and Technology [STS-TFILST] (2006) Information Literacy Standards for Science and Technology (hereafter Standards), and give some practical advice for life and health sciences librarians and librarians with instructional responsibilities in those disciplines. The focus is on undergraduates at research universities, although many principles and strategies will apply to other circumstances.

The Landscape: Characteristics, Challenges, and Opportunities

Encompassing a broad range of study, the life sciences examine life in all its forms and at all levels, from microscopic protein pathways functioning in a cell to whole organisms and their interactions with other organisms and their environment. It includes a number of specific sub-disciplines, from molecular biology and physiology to zoology and botany. Researchers work in the lab or in the field, and often both.

As in any field, student characteristics vary somewhat. There is a large group of life sciences majors who are pre-professional; these students will go on to further education in biomedical professional programs (e.g., medical, dental, pharmacy, optometry). Another group of life sciences majors will complete research-based programs in graduate school, obtaining MS and PhD degrees. Pre-professional students, particularly those headed for medical school, tend to be competitive and high-achieving. Many students, regardless of track, will want to gain laboratory experience by working in labs run by faculty researchers.

Professors in the life sciences tend to be independent, believing that they don’t need assistance from the library. In fact, many faculty in these disciplines view the library as a content provider only, and it can be difficult to convince them of the value of information literacy for themselves and their students.

In the life sciences, peer-reviewed journals are the most important form of information dissemination. Monographs are used rarely, if at all. Research assignments typically require the use of peer-reviewed literature. Lower-division courses that meet the institution’s science general education requirements have tended towards relaxing the standards for using high-level information sources. Some require students to use the Internet and focus assignments on evaluating sources in an attempt to parallel real-life learning. Major-based, upper-division courses require peer-reviewed, mostly primary sources. Primary sources report on experiments conducted by the authors, as opposed to summaries or other secondhand reports.

The most important databases in the life sciences are PubMed (Medline), Biosis Previews, Zoological Record and Web of Science (Scopus is used by some institutions in place of or along with Web of Science). Smaller, discipline-specific databases, such as Agricola, Environmental Science, GREENR, and SPORTDiscus, are useful for specialty areas like agriculture, environmental science and exercise science.. Pubmed (www.pubmed.gov) has an excellent search algorithm and is provided free to all by the National Library of Medicine. Pubmed’s highly effective keyword search (that automatically maps to Medical Subject Headings, or MeSH terms) allows for quick retrieval of relevant results. Subject headings in most life sciences databases are not as important as in some other disciplines, because, quite often, they are too broad to be useful for typical searches. Taxonomic categories in BIOSIS Previews and Zoological Record are the only exception, as they can help narrow search results to a specific species.

The health sciences are related to the life sciences and often overlap with them. The health sciences focus on the applied life sciences and how to ensure human health. They may include nursing, nutrition, dietetics, public health, health promotion and wellness, athletic or fitness training, and pre-physical and pre-occupational therapy. Health sciences students tend to be less competitive or high-achieving than some in the life sciences, and professors in these fields tend to be more open to assistance from the library. Nursing in particular has a high level of engagement with the library, as demonstrated by a wide body of literature (see Flood et al., 2010; Guillot et al., 2010; Phillips & Bonsteel, 2010). A wider variety of sources and databases are available in the health sciences, including such smaller, specialized resources as AltHealthWatch and PEDro. Clinical sources such as UpToDate are more important, as are evidence-based sources, including the Cochrane Library and National Guidelines Clearinghouse (http://www.guideline.gov/).

Both challenges and opportunities in information literacy abound in the life sciences. Faculty and student resistance is often a problem. Because professors believe their students already have information literacy skills and feel that their classes are already full to the brim with content, they don't want to make room for information literacy instruction. In addition, students often believe they already know how to do literature research. Another challenge is structural. The presence of information literacy instruction in a given course is often based on the individual relationships librarians build with professors, instead of structural integration into the life sciences curriculum. Personnel turnover of faculty and librarians, as well as arbitrary changes in research assignments, can make information literacy integration transient. McGuinness (2007) reviews the literature related to integrating information literacy into the curriculum and concludes that partnering with an academic champion (one academic who is supportive of information literacy) does not lead to long-term integration. She advocates for top-down planning and targeting institution-wide initiatives, which are more likely to result in long-term information literacy programs. Yet another challenge is the high volume of students in the life sciences. Scores of students are attracted to biology, and high enrollment can make instruction difficult for library personnel, who are often limited in number.

Despite these challenges, there are a number of opportunities for information literacy in the life sciences. Professors in the life sciences give research assignments; they want their students to develop communication skills. In addition, in recent years, the evaluation of information has increased in importance. Faculty are expecting their students to find quality information and understand why it is valuable. This takes the focus off the logistics and navigation of a library website. Similarly, it has become more important that students understand the information landscape of their chosen fields. This allows them to navigate to the best sources for their information need. Recently, Ferrer-Vincent and Carello (2011) explored another opportunity when they demonstrated that life sciences information literacy instruction led to skill retention three years after the instruction. This research supports the idea that life sciences librarians can make a long-term difference. Taken together, these opportunities provide an opening for life sciences librarians to integrate information literacy into the curriculum.

Important Standards

The Standards provide a framework for all science librarians, although some performance indicators are more relevant to the life and health sciences than others. This section presents the indicators most important for students in these fields. The Standards are written in a language librarians understand, so it is important to translate the standards and performance indicators into the more general language of research skills, because this is what faculty understand. The following discussion reflects some useful translations.

This selection of standards is shaped by a teaching philosophy of restricting instruction to the most important content, the “less is more” concept, as librarians often have limited face time with students. One-shot sessions are common, but one session doesn’t provide enough time to effectively teach students all the skills librarians think are valuable. Librarians feel tempted to cram sessions full of everything they know that would help students; however, they must resist the urge to lecture for 50 minutes and “fit everything in.” Students become alienated and do not learn. Instead of trying to present everything, start with the assumption that all students can retrieve results from databases, and then focus on the skills that will help them efficiently sift and sort those results to find sources they can use for their assignments. Try to build in time for hands-on searching and active learning exercises. Based on this philosophy, the following list of standards is not comprehensive, but instead reflects those that are most important to the life and health sciences.

Life Sciences

Performance indicator 1.3, and in particular 1.3.a, refers to students' knowledge of the life sciences literature. Students need to understand the flow of information in the discipline, from laboratory experiment or observation of the natural world to primary journal article, then on to review articles and other sources. Performance indicators 1.3.b and 3.2.a both relate to primary, secondary, and tertiary sources. Taken together, the translation of these indicators is that students should be able to identify sources by type and recognize the advantages of each.

Understanding the flow of information in the life sciences and characteristics of primary, secondary, and tertiary sources is an important skill for life sciences students, because each type of source matches different information needs. Often students need to start a research project by looking for relevant review articles, because it helps them understand increasingly technical and specific primary literature. Primary literature reports new information, and includes details about methodology and data, but review articles are key for summarizing trends and bringing together current knowledge in a given field. Tertiary sources are excellent for topic development and general background information. Understanding these distinctions will allow students to navigate directly to the types of sources that align with their current needs.

Relevant in all disciplines, performance indicator 2.1.b recommends that students understand the focus of each database and be able to select those appropriate for their information needs. Student researchers must select appropriate databases, and instruction about the subject coverage and selection criteria of each available source will provide the necessary information for this choice. Becoming familiar with included fields, limits, and other aspects of database organization will allow students to use advanced search interfaces effectively.

Performance indicator 2.2.f notes the significance of bibliographic searching, or cited reference searching. Students use this skill effectively when they examine reference lists of other suitable sources. Many researchers do this by looking at bibliographies in relevant articles; however, Web of Science, Scopus and Google Scholar allow users to view cited references for most articles. The dynamic linking of titles and abstracts is a boon to students as they can more easily identify relevant articles using abstracts. This standard is particularly meaningful in biology, because it provides another way to find relevant articles that keyword searching may have missed. Although not explicitly stated, this indicator also encompasses the importance of using citation numbers to identify high impact papers. For example, in Web of Science, it is possible to sort a results set by the number of times other articles have cited it. This allows students to identify those landmark articles that must not be missed by anyone investigating the subject.

Performance indicator 5.2 is key for those life sciences students in laboratory groups or on long-term projects, because it notes the value of currency in the life sciences. The search alert is an excellent tool for keeping up to date. Life sciences students have a particular need for current awareness services because lab research is by its nature outside of the typical semester framework. Students in a lab may work on a project for a year or two, and they will need to stay abreast of relevant research.

Health Sciences

In the health sciences, there are two additional outcomes of particular consequence, 2.2.b and 2.2.d. The first notes that students need to identify and use subject headings relevant to their topics. This standard is important for the health sciences, because there is a wider variety of databases available in this area, and many require using subject heading searches in order to produce effective and comprehensive results. For example, using subject headings in CINAHL generally leads to more relevant results than keyword searching. The second indicator, 2.2.d, notes the importance of applying Boolean operators and truncation correctly. Many specialized health sciences databases require careful search construction for relevant results. In addition, health sciences students are typically less familiar with these concepts.

Some disciplines have their own standards, created by professional associations or other relevant organizations. Nursing, for example, has several guidelines and recommendations for information literacy in the field. These include the American Association of Colleges of Nursing's (AACN) *Essentials of Baccalaureate Nursing Education* (2008), the Institute of Medicine's report on the future of nursing (2010), the National League for Nursing's position statement on informatics (2009), and the Technology Informatics Guiding Education Reform Initiative (2007). Each speaks to the importance of information literacy for nurses and nursing education.

Practical Advice

In any field, tips from other practicing professionals are helpful. This section provides practical advice on integrating information literacy into the life sciences curriculum, incorporating active learning, and working with faculty in the life sciences. Lastly, the section includes some advice for librarians without a science background.

Integrating Information Literacy

A variety of approaches is useful when working to integrate information literacy within a curriculum. An effective way for librarians and faculty to think about these options is as a menu, similar to what one might find in a restaurant. This approach has been used by a number of institutions; for a summary and analysis of instructional menus, see Benjes-Small, Dorner, and Schroeder (2009). Consider developing a list of options that may be used on their own or in combination with other approaches. Circumstances of the course, the professor, and student needs will dictate the appropriate combination of strategies. These run the gamut, from the simple, and perhaps less effective, mention of available librarian help in the syllabus to several in-class library presentations. Some options include:

- Mention librarian/reference and information desks/open labs in syllabus
- In-class instruction, from 5 minutes to several hours in length
- Out of class instruction: required, extra credit, or optional
- Instruction in laboratory or recitation sections
- Several instruction sessions (see Petzold et. al 2010)
- Online course guides
- Tutorials (see Schroeder 2010)
- Blackboard or other course management systems (see DaCosta and Jones 2007)
- Assignments (see Ferrer-Vinent and Carello 2008)
- Drop-in research labs: with or without associated course credit

Several examples used in practice are presented in Table 1.

Table 1. Examples of Integrating Information Literacy in to the Curriculum.

Type of Course	Strategies
Freshman-level Introductory Biology, with variety of instructors and assignments	Tailored to each professor, including: • 20-minute in class presentation on finding peer reviewed literature for environmental solution

	paper • 2-hour in class presentation on evaluating sources and library basics for brief, weekly, subject-based writing assignments • 1-hour out of class, optional presentations on flow of information and finding peer reviewed literature for traditional research paper assignment; extra credit received for attending • Section-specific online course guides
300-level Tissue Biology, with research paper assignment	Required 50-minute library instruction session during the first week of course lab session. In library classrooms.
Nursing Curriculum (see Hopkins et. al 2011)	2nd semester Gerontology class: 10 minute introduction to the nursing librarian and to CINAHL as the main nursing database 3rd semester Nursing Research class: • First 2-hour session: 40-minute lecture, the remainder hands-on work time • Second 2-hour session: case study, with mixed hands-on work time, class discussion, and chunked lecture 4th semester Nursing Ethics class: 2-hour work session in the library, no lecture

Incorporating Active Learning

Instruction of any kind is more effective when it is active rather than passive. Table 2 lists some techniques that may be used when teaching science information literacy. Most of these strategies can be used to teach a number of principles, although the table lists examples for standards previously identified as important in the life sciences. The STS Information Literacy wiki (STS Information Literacy Committee (STS-IL), 2011) also has a collection of active learning tips based on the performance indicators for each of the Standards.

Table 2: Active Learning Strategies

Performance Indicator	Active Learning Tip	Example

1.3 and 3.2.a	Questioning. This simple technique breaks up a lecture while still delivering information. Be sure to wait for responses from your students.	"What are the advantages of a secondary source as compared to a primary source?"
1.3 and 3.2.a	Pop quiz.	Display abstracts and require students to identify the source as primary, secondary, or tertiary.
2.1.b	Case studies (particularly effective in the health sciences).	Present a scenario and ask students to investigate which database is best suited to the information need.
2.2.b	Worksheets. Think about a process you want the students to follow and create a worksheet to guide them through the process.	Identifying and searching with subject headings. Worksheet might include space for initial keywords, number of associated results, a list of subject headings, and the number of results from this new search.
2.2.f	An assignment. This works best if you can tie it to course credit. Build work time into your session.	Ask students to identify high impact articles using times cited information.

Working with Life Sciences Faculty

Opportunities to teach in life sciences courses are more likely to come from systematically built relationships with the life sciences faculty. Try these strategies as good starting points:

- Make appointments with all faculty in assigned departments and schools. Start with the department chair and other administrators. Ask about research assignments and related learning outcomes. Offer tailored suggestions for how you can help students develop research skills.
- Visit or regularly attend department faculty meetings. Faculty meetings can be a good place for department-wide curriculum discussions.
- Pay attention to the reference questions you receive and ask students about their assignments and professors. Then follow up with those faculty, discuss student needs, and offer assistance.
- Standardize across a department or college curriculum if possible. Without standardization, students may be exposed to multiple settings for the same library lecture, which they find annoying and inefficient.

- Obtain copies of course syllabi and research assignments where possible. Some departments keep a central copy of all syllabi.
- Ask to be added to faculty listservs for the college and department. This will keep you informed about initiatives and trends among the faculty.
- Become friendly with department secretaries and other support staff. These key personnel can also help you stay informed.

For the Librarian without a Science Background

Science librarians without a science background can use several techniques to provide effective services to their assigned departments. First, realize that many upper-level students will be able to explain the science related to their questions. Even librarians with science backgrounds cannot be familiar with everything and must rely on students to explain the basics of their information need. Second, identify regular assignments used by faculty at your institution. Improve your knowledge of these topics by reading several review articles and/or a popular book, if available. Third, stay aware of major developments in science by watching the major publications in the field. The life sciences are splintered into many sub-disciplines, but news articles in the journals *Science* and *Nature* can help. Take advantage of table of contents alerts for more specific fields. Fourth, observe trends within science librarianship. *Science and Technology Libraries* and *Issues in Science and Technology Libraries* are good publications to monitor. In the health sciences, try the *Journal of the Medical Library Association.*

Conclusion

Information literacy in the life sciences is an engaging discipline, with numerous opportunities. Despite some challenges from life sciences students and faculty, an increased emphasis on understanding the flow of information in the field has provided an opening for librarians to have a significant impact on student learning. Relevant performance indicators and outcomes from the Standards for the life sciences highlight skills for evaluating and managing results sets. Specifically, students should be able to match the type of source, primary or secondary, to their particular information need. In addition, students should be able to use cited reference searching to identify high impact papers. Indicators important for the health sciences include the use of Boolean operators, truncation, and subject headings. Life sciences librarians both new and experienced will benefit from practical advice on incorporating information literacy into the curriculum, integrating active learning techniques, and working with faculty. Lastly, a few suggestions for librarians without a science background can help them be successful. Creative and effective life sciences librarians will equip students with skills that will benefit them throughout their careers as scientists and biomedical professionals.

References

ALA/ACRL/STS Task Force on Information Literacy for Science and Technology [STS-TFILST]. (2006). Information literacy standards for science and engineering/technology. Retrieved from http://www.ala.org/acrl/standards/infolitscitech

American Association of Colleges of Nursing. (2008). *The essentials of baccalaureate nursing education for professional nursing practice*. Washington, DC: American Association of Colleges of Nursing.

Benjes-Small, C., Dorner, J. L., & Schroeder, R. (2009). Surveying libraries to identify best practices for a menu approach for library instruction requests. *Communications in Information Literacy, 3*, 31-44. Retrieved from http://www.comminfolit.org/index.php?journal=cil&page=article&op=view&path[]=Vol3-2009AR2

DaCosta, J. W., & Jones, B. (2007). Developing students' information and research skills via blackboard. *Communications in Information Literacy, 1*, 16-25. Retrieved from http://www.comminfolit.org/index.php?journal=cil&page=article&op=view&path[]=Spring2007AR2

Ferrer-Vinent, I., & Carello, C. A. (2008). Embedded library instruction in a first-year biology laboratory course. *Science & Technology Libraries, 28*, 325-351. doi:10.1080/01942620802202352

Ferrer-Vinent, I., & Carello, C. A. (2011). The lasting value of an embedded, first-year, biology library instruction program. *Science & Technology Libraries, 30*, 254-266. doi:10.1080/0194262X.2011.592789

Flood, L. S., Gasiewicz, N., & Delpier, T. (2010). Integrating information literacy across a BSN curriculum. *Journal of Nursing Education, 49*, 101-104. doi:10.3928/01484834-20091023-01

Guillot, L., Stahr, B., & Meeker, B. J. (2010). Nursing faculty collaborate with embedded librarians to serve online graduate students in a consortium setting. *Journal of Library & Information Services in Distance Learning, 4*, 53-62. doi:10.1080/15332901003666951

Hopkins, B., Callister, L.C., Mandleco, B., Lassetter, J., & Astill, M. (2011). Librarians as partners of the faculty in teaching scholarly inquiry in nursing to undergraduates at Brigham Young University. *Science and Technology Libraries, 30*, 267-276. doi:10.1080/0194262X.2011.593416

Institute of Medicine. (2010). *The future of nursing: Leading change, advancing health.* Retrieved from http://www.iom.edu/Reports/2010/The-Future-of-Nursing-Leading-Change-Advancing-Health.aspx

McGuinness, C. (2007). Exploring strategies for integrated information literacy. *Communications in Information Literacy, 1*, 26-38. Retrieved from http://www.comminfolit.org/index.php?journal=cil&page=article&op=view&path[]=Spring2007AR3

National League for Nursing. (2009). *Position statement: Preparing the next generation of nurses to practice in a technology-rich environment: An informatics agenda.* Retrieved from http://www.nln.org/aboutnln/PositionStatements/informatics_052808.pdf

Petzold, J., Winterman, B., & Montooth, K. (2010). Science seeker: A new model for teaching information literacy to entry-level biology undergraduates. *Issues in Science & Technology Librarianship,* (63), 49-58. Retrieved from http://www.istl.org/10-fall/refereed2.html

Phillips, R. M., & Bonsteel, S. H. (2010). The faculty and information specialist partnership: Stimulating student interest and experiential learning. *Nurse Educator, 35*, 136-138. doi:10.1097/NNE.0b013e3181d95090

Schroeder, H. (2010). Creating library tutorials for nursing students. *Medical Reference Services Quarterly, 29*, 109-120. doi:10.1080/02763861003723135

STS Information Literacy Committee (STS-IL). (2011). Science information literacy [wiki]. Retrieved from http://wikis.ala.org/acrl/index.php/Science_Information_Literacy

Technology Informatics Guiding Education Reform Initiative. (2007). *The TIGER initiative: Evidence and informatics transforming nursing: Three year action steps toward a 10-year vision.* Retrieved from http://tigersummit.com/