Discovering the Library and the Librarian in Science Textbooks: Representations and Implications

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Charleston Conference ~ November 7, 2018
Learning Outcomes

- Identify which introductory science classes have the most potential for information literacy courses in order to facilitate faculty/staff relationships.
- Explain how the library and the librarian is represented in introductory, science textbooks in order to advocate for information literacy in science courses.
- Identify options for improving the representation of the library and librarians in textbook.
- Align scientific literacy with information literacy in order to be better advocates for information literacy in the science classroom.
Why Is This Important?

- Info lit is desired by employers (Hart Associates for AACU)
- Transferable critical thinking skills
- Science education and the Receivership model
- Boyer Commission on Undergraduate Education
Method

**IDENTIFY**
Required physics, chemistry, and biology textbooks

Compiled a textbook list

**ACQUIRE**
Required edition or next oldest

Used ILL, reserve lending, and online previews

**READ**
Established coding categories

Created reading protocol:
- front matter/intro
- first/last chapter
- index/glossary

**CODE**
Qualitative coding: thematic and categorical

Wrote summarization statements for each category in physics, chemistry, and biology
Identifying the Sample

Aims
- High Student Enrollment
- Diversity of Student Body
- Geographic Reach
Identifying the Texts

- Identify “intro” courses
  - 100-200 and 1000-2000 level courses
  - Any course using “introductory”
  - Non-major and major specific
- Used bookstore tools
  - Found 75 textbooks
  - Did NOT include course manuals, packs, workbooks, or web content
- Created a spreadsheet

Example Search Tool: University of Illinois at Urbana-Champaign bookstore “textbook finder” application.
Identifying Information about Textbooks

- University Name
- Course Name & Number
- Instructor
- Textbook Title & Author
- ISBN
- Required or Suggested
Acquiring the Textbooks

- Found most items in I-SHARE consortium or reserves
- Specific edition when possible
  - OR next newest edition available
- Three textbooks requested through ILL
- Examined 74 texts overall
  - Both e-books and physical books
Reading the Textbooks

- Table of Contents
- Preface/Front matter
- Chapters 1 and 2
- Conclusion chapter
- Glossary
- Index
- Other chapters as necessary

READING PROCEDURE
Reading the Textbooks

CONCEPTS & THEMES OF INTEREST

- Library
- Librarian
- Peer Review
- Primary Literature
- Research
- Science Literacy
- Scientific Method
- Secondary Literature
- Other
Coding the Textbooks

- Filled in spreadsheet - one column per concept/theme
- Followed reading procedure and documented:
  - Title
  - Concept/theme
  - Page number
- Included direct quotations
- Wrote summarization statements for physics, chemistry, and biology by concept/theme
Are libraries and librarians mentioned in these texts? 

Yes!
Findings by Theme

Library
- Libraries are digital spaces that students can access.
- Libraries are warehouses that store the supplemental resources students need.
- Libraries are spaces students can go to solve difficult problems or receive help.

Librarian
- Librarians are mentioned but their expertise is equated to a undergraduate student’s ability to use search tools like Google Scholar or library databases.
- Convenience of off-campus resources like databases are weighed against the expertise of library professionals.
Quotes about Libraries

“Eaton went to her local library and came home with a stack of books, including a thick vaccine textbook so that she could learn the underlying science of how a vaccine works inside the body.”
*Biology Now, p. 333*

“Many chemical databases are available, usually through your school. The CRC Handbook of Chemistry and Physics is the standard reference for many types of data and is available in libraries.”
*Chemistry the Central Science, p. 30*

“Many college libraries and learning centers have Internet resources, computer programs, audiotapes, workbooks, and other learning aids that are helpful for practice with using chemical formulas, balancing equations, solving problems, and other routine skills.”
*Introductory Chemistry, p. 10*
“thanks Suzon O. Kisler for her ‘Valuable reference work’"

*Modern Physics, p. xiv*

"Before the chamber is built, you also have to think carefully about how to test the effectiveness of the process...At this stage, you would undoubtedly do more library research and consult with other experts, such as a paper chemist your company hires as an outside consultant."

*Chemical Principles, p. 6*
Findings by Theme

Peer Review

- Mostly mentioned in acknowledgements section (especially for Physics and Chemistry).
- Peer review is used to uphold the integrity and the high standards of published research and is conducted by experts or peers of the researchers in their respective biological fields.
- Peer review helps to mitigate bias and make sure that mistakes are caught and reversed before publication.
“‘Peer-reviewed’ means that after scientists have conducted their research and submitted a written article to a journal, the article was examined in detail by several experts in the particular field and found to be sound in methodology, experimental design, and analysis of results”

*Becker’s World of the Cell*, p. 14

"Submitting your ideas to the **criticism (at times blunt) of your peers is crucial to the advancement of science**...One person working alone cannot hope to think of all the possible ramifications, alternative explanations, or potential mistakes in an argument or theory"

*The Physics of Everyday Phenomena*, p. 5

"Careful observations and measurements are essential, but **scientific work is not fully accepted until it has been verified by other scientists.**"

*Chemistry for Changing Times*, p. 4
Findings by Theme

Primary Literature

- Primary literature is often cited in the end of chapters and referenced as “scientific literature.”.
- Scientific journals are mentioned as a good place to start research and a common place to find primary literature which are referred to as “original research articles.”

Secondary Literature

- Book-length works are usually mentioned as secondary sources.
- Defined as review articles, textbooks, and popular magazine articles.
- Secondary literature helps ground researchers in the current research available in a field of science.
"First, a researcher will typically conduct a study of the **scientific literature** to determine what is known in the specific area of interest. **Such information usually comes from peer-reviewed scientific or medical journal**, rather than from a nonreviewed site on the Internet."

*B Becker's World of the Cell, p. 14*

"When scientists get ideas, they **most often try to determine if anyone else has had the same idea or perhaps has done some research on it**. They do this by reading the many scientific journals in which researchers report the results of their work. Modern scientists communicate with each other through technical literature. **Scientific periodicals are also a major source of new ideas**, as well as talks and presentations at scientific professional meetings."

*Introductory Chemistry, p. 5*
“When investigating a scientific claim, your first stop should be the Internet or the library to get a basic overview for the topic from the secondary literature, which summarizes and synthesizes an area of research. Textbooks, review articles, and popular science magazines such as National Geographic, Popular Science, and Scientific American are good secondary sources.”

*Biology Now, p. 333*

“You might look up 'rainbow' in a textbook on physics or on the internet, and read the explanation found there. Are you behaving like a scientist? The answer is both yes and no. Many scientists would do the same if they were unfamiliar with the explanation. When we do this, we appeal to the authority of the textbook author and to those who preceded the author in inventing the explanation.”

*The Physics of Everyday Phenomena, p. 5*
Findings by Theme

Research
- Research is inextricably tied to the concepts of experimentation, asking the “right” questions, observation, and inquiry.

Scientific Method
- Iterative process.
- Observation and hypothesis are emphasized.
- Process with steps: observation, hypothesis, experimentation—and sometimes—communication.
- Way to test potential or established theories and laws.
"if experiment does not verify our predictions, then the theory or law is wrong, no matter how elegant or convenient it is."
College Physics, p. 10

"The primary story line is the scientific process, or how we know. Science is more than a body of knowledge. It is a process for proposing, testing, and refining ideas. The notion that knowledge comes from experience and is subject to testing by observation and rational thought is science's most basic value--and probably its most important benefit."
Physics: Concepts and Connections, p. xii

“Finally it is worthwhile to point out that science is a social discipline. After performing observations and experiments, biologists communicate their results in different ways. Most importantly, papers are submitted to scientific journals...Another social aspect of research is that biologists often attend meetings where they report their most recent work to the scientific community"
Principles of Biology, p. 18
Findings by Theme: Science Literacy in Physics

Most physics textbooks do not explicitly mention scientific literacy:

- Reframed as strategies to “think like scientists”
- Outlines scientific process as scientific method
- Emphasis on proper units and measurements
- Critical thinking for transfer
- Warns of pseudoscience
Findings by Theme: Science Literacy in Chemistry

Chemistry textbooks mention skills that are needed to “do” science:

- Emphasis on scientific naming and measuring
- Science as a transferable process
- Warn against bias in science
- Science literacy is learned by practicing chemistry
Findings by Theme: Science Literacy in Biology

Biology textbooks emphasize the importance of scientific literacy as a defense against fake news and pseudoscience:

- Stress observation and critical thinking of literature and experimentation
- Emphasis on real-world tech and environment problems as examples
- Determining fact from fiction
Quotes about Science Literacy

“you will take from the course not just the knowledge of physics but also an understanding of the process of science that will help you in all your scientific endeavors...you will learn to reason scientifically and be able to transfer those reasoning skills to many other aspects of your life”

*College Physics*, p. xlv

"For the second edition, new modules were added to help you critically evaluate scientific-sounding claims that constantly bombard you, about everything from diet and nutrition to cancer and heart disease"

*Biology: The Core*, p. iv

“to help students become literate in science. We want our students to develop a comfortable knowledge of science so that they find news articles relating to science interesting rather than intimidating”

*Chemistry for Changing Times*, pp. xxiii-xxiv
Case Study for Information Literacy: Physics


How should science be presented?

Traditional science courses focus on presenting the results of the scientific process rather than the story of how scientists arrived at these results. This is why the general public often sees science as a collection of facts and established theories. To some extent, that charge could be made against this book, since it describes theories that have resulted from the work of others without giving the full picture of their development. Building on the work of others, without needing to repeat their mistakes and unproductive approaches, is a necessary condition for human and scientific progress.

This book attempts to engage you in the process of making your own observations and developing and testing your own explanations of everyday phenomena. By doing home experiments or observations, constructing explanations of the results, and debating your interpretations with your friends, you will appreciate the give-and-take that is the essence of science.

Debatable issue

We are often told that there is a strong consensus among climate scientists that global warming and climate change are being caused by human activity that is producing growing amounts of greenhouse gases, particularly carbon dioxide, in the atmosphere. Does a strong consensus among scientists imply that this idea is correct? Why or why not?
Case Study for Information Literacy: Physics

Case Study for Information Literacy: Biology


After reading this chapter, you should be able to:

- Evaluate a scientific claim using the process described in the chapter.
- Explain the importance of scientific literacy for making informed decisions.
- Distinguish between secondary and primary literature, and explain the role of peer review in the latter.
- Compare and contrast basic and applied research, and give an example of each.
- Determine whether a scientific claim is based on real science or pseudoscience.

Figure 1.5

**Testing hypotheses using multiple approaches**

Scientists set up an underground laboratory in Tennessee’s New Mammoth Cave to test hypotheses about white-nose syndrome (WNS) using descriptive, analytical, and experimental approaches.

Q1: Give a possible hypothesis that could be tested by weighing the bats.

Q2: State the hypothesis being tested in the photo on the bottom right.

Q3: Explain in your own words why an experimental study is the only way to show a cause-effect relationship.
Case Study for Information Literacy: Biology


An inquiry-based approach that builds science skills—asking questions, thinking visually, and interpreting data.
Case Study for Information Literacy: Chemistry


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The success of science has much to do with an attitude common to scientists. This attitude is one of inquiry and honest experimentation guided by a confidence that all natural phenomena can be explained.

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We humans are very good at observing. We are also very good at explaining what we observe. What we recognize today as modern science, however, began not with our powers of observation, nor with our creative explanations. Rather, modern science began when people first became skeptical of their observations and explanations. They wondered whether their observations were accurate. They wondered whether their explanations were correct. To resolve their doubts, they turned to experimentation.
Implications for Information Literacy Programs:

As librarians, we must have critical conversations about the texts students read. Talk with science professors about potential collaboration opportunities.

Information literacy—just like scientific literacy—is the responsibility of EVERYONE.

Increase mentions of libraries as service points and librarians as service providers and educators.

Authors of these textbooks often invite feedback in their front matter; give it!
Implications for Publishers & Editors:

Consider the opportunity to “market” other publications as the cited primary/secondary literature.

*Scientifically literate, lifelong learners are your future customers.*

Provide guidance to authors.

If a textbook doesn’t incorporate information literacy in the content, consider an Appendix (e.g., *Biological Science* by Freeman et. al)

*Librarian as source of assistance for students.*
*Library as source of additional information on the topic.*
Information and Science Literacy Checklist

- The scientific method is written as an iterative, social process that incorporates the social aspects of science as well as inquiry as a method of discovery.

- Science literacy or information literacy are explicitly mentioned and defined alongside learning objectives for these literacies.

- The field of science (chemistry, biology, physics, etc.) is identified as a complex, social process that goes beyond experimentation; the textbook also includes communication in this process.

- The library and librarians are part of the textbook's narrative.

- The author(s) reference and cite primary and secondary literature throughout the work or at the end of chapters.
Questions?
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References – Textbooks


References from the Noun Project

books by David
case-study by Priyanka
Code by Roselin Christina.S
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Research by Chameleon
Research by Cuby Design
Research Process by Vectors Market
Science Book by Creative Stall
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Shake by Demetria Rose
Writing by pongsakorn