Science Information Literacy Instruction across the Undergraduate Curriculum

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Overview of the Indiana University system

- 7 campuses
- Cost sharing of some resources
- “Request Delivery” System
Indiana University-Purdue University, Indianapolis (IUPUI)

- Urban research and academic health science university
- 17 degree granting schools
- 29,000 students (21,600 undergraduates)

University Library
- Main library on campus
- 1 of 5 libraries on campus. Also have Medical, Dental, Law, Art libraries
This presentation will address undergraduate programs in Chem and Psychology as examples.
Curriculum mapping of information skills

Integrating Information Literacy (IL) instruction at key points in a degree program
Why?

- **Proactive**

- **Wholistic - building students’ IL skills at key points as they move through their degree**

- **Student centered**

A few reasons....

**Proactive**

Instead of waiting for faculty to reach out to you for instruction, you can approach them with logical, comprehensive plan

**Wholistic - building students’ IL skills at key points as they move through their degree**

Often just a one shot (in isolation of other courses)

Instead, more purposeful – building skills at key points when needed

**Student centered** –

More meaningful/relevant for students, delivers information skills when needed for coursework, and at the appropriate time
How?
Examine curriculum - Take a look at the big picture, What courses are students required to take in order to obtain their degrees

Investigate what courses make sense for IL instruction, for example, intro course – orientation to library services, spaces, resources, Courses w/ research component - paper, presentation, poster, needing to cite sources

Relationships are key, good relationships with faculty greatly increase chance of success. Variety of avenues for this. For example, Department Chair, Curriculum Committee, key teaching faculty.
Example – Chemistry, Bachelor of Science

• SCI-I 120 Windows on Science (First Year Seminar)

• CHEM-C 294 Intro to Cornerstone in Chemistry

• CHEM-C 344 Organic Chemistry Laboratory

• CHEM 494 Capstone in Chemistry

Let’s look at an example. Chemistry, Bachelor of Science degree students at IUPUI

I identified 4 courses as logical candidates...
Example – Chemistry, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- CHEM-C 294 Intro to Cornerstone in Chemistry
- CHEM-C 344 Organic Chemistry Laboratory
- CHEM 494 Capstone in Chemistry

SCI-I 120 Windows on Science (First Year Seminar)
Intro to science and strategies for success as science major

  Key avenue for providing orientation to library services, spaces, resources

  Have a mini research project requiring science news articles

  How to cite sources
Example – Chemistry, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- CHEM-C 294 Intro to Cornerstone in Chemistry
  Covers intro to science communication
- CHEM-C 344 Organic Chemistry Laboratory

- CHEM 494 Capstone in Chemistry

CHEM-C 294 Intro to Cornerstone in Chemistry
Covers intro to science communication

  A portion of this class introduces students to the primary literature
  Examine parts of a scientific paper
  Have to locate one on their own and summarize it
Example – Chemistry, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- CHEM-C 294 Intro to Cornerstone in Chemistry
  Covers intro to science communication
- CHEM-C 344 Organic Chemistry Laboratory
  Chemical information in the lab setting
- CHEM 494 Capstone in Chemistry

CHEM-C 344 Organic Chemistry Laboratory
- required of Chemistry majors, where students learn advanced laboratory techniques of organic chemistry
- Course involves laboratory emphasis on isolation, and identification of organic compounds, spectroscopic methods of compound identification, qualitative organic analysis, multistep synthesis and reaction mechanisms.
- Students at this level now have a grasp of chemical terminology and processes such that it affords a prime opportunity for introducing chemistry specific information skills into their laboratory research.
Example – Chemistry, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- CHEM-C 294 Intro to Cornerstone in Chemistry
  Covers intro to science communication
- CHEM-C 344 Organic Chemistry Laboratory
  Chemical information in the lab setting
- CHEM 494 Capstone in Chemistry
  Independent research projects
Information Literacy guidelines and standards

- Chemical Information Skills, Committee on Professional Training, Undergraduate Professional Education in Chemistry. American Chemical Society

- Information Competencies for Chemistry Undergraduates: the elements of information literacy. Special Libraries Association, Chemistry Division and American Chemical Society, Division of Chemical Information

- Framework for Information Literacy for Higher Education. American Library Association/Association of College and Research Libraries

- Information Literacy Standards for Science and Engineering/Technology. American Library Association/Association of College and Research Libraries/Science and Technology Section Task Force on Information Literacy for Science and Technology

Several sets of IL guidelines/standards to consider
Information Literacy guidelines and standards

- Chemical Information Skills, Committee on Professional Training, Undergraduate Professional Education in Chemistry. American Chemical Society

- Information Competencies for Chemistry Undergraduates: the elements of information literacy. Special Libraries Association, Chemistry Division and American Chemical Society, Division of Chemical Information

- Framework for Information Literacy for Higher Education. American Library Association/Association of College and Research Libraries

- Information Literacy Standards for Science and Engineering/Technology. American Library Association/Association of College and Research Libraries/Science and Technology Section Task Force on Information Literacy for Science and Technology

For this presentation, let’s focus on this one.
American Chemical Society - Chemical Information Skills

- Efficiently locate chemical and physical properties of substances, including spectra.
- Efficiently locate references for the detection, characterization, or reactions, including syntheses, of desired compounds or classes of compounds.
- Be able to obtain information on a substance through a variety of searching strategies, including structure searching, and searching by molecular formula and name.
- Identify key references and use citation searching of articles to locate more current articles on the topic of interest.
- Complete a comprehensive subject search.
- Compile a complete bibliography of an author's publications.
- Locate recent review articles on a subject.
- Know the importance of patents and be able to search for patents on a subject.
- Use a bibliographic program to organize information and prepare a scientific paper.
- Students need to develop the ability to determine the quality of the information obtained. Students should especially learn how to evaluate the validity of on-line sources.

It is impossible for a student to learn all of this in a one shot, or even two instructional sessions.
Therefore, think about how best to divide it up logical places in curriculum

American Chemical Society - Chemical Information Skills

300  •  Efficiently locate chemical and physical properties of substances, including spectra.
300  •  Efficiently locate references for the detection, characterization, or reactions, including syntheses, of desired compounds or classes of compounds.
300  •  Be able to obtain information on a substance through a variety of searching strategies, including structure
300  •  searching, and searching by molecular formula and name.
200  •  Identify key references and use citation searching of articles to locate more current articles on the topic of interest.
200/400 •  Complete a comprehensive subject search.
300  •  Compile a complete bibliography of an author’s publications.
400  •  Locate recent review articles on a subject.
300  •  Know the importance of patents and be able to search for patents on a subject.
400  •  Use a bibliographic program to organize information and prepare a scientific paper.
100/300 •  Students need to develop the ability to determine the quality of the information obtained. Students should especially learn how to evaluate the validity of on-line sources
Course title/number: Organic Chemistry Laboratory / CHEM-C 344

Learning Outcomes

Library Day 1 (2 hr. session)

• Students will be able to use the name of a chemical substance, in order to locate alternative names and the CAS Registry number for the substance in the SciFinder database.

• Students will be able to use the name of a chemical substance, in order to locate analytical data (e.g. melting point, boiling point) using SciFinder.

• Students will be able to use the CAS Registry number of a compound, in order locate spectral data (C or HNMR, and IR) in the Spectral Database for Organic Compounds.

• Using the author search feature in SciFinder, students will be able to obtain the Full Text for the 2 research articles for an assigned author.

• Students will be able to identify and list the basic elements of a journal article citation.

Here is an example of one course, Organic Chemistry Laboratory / CHEM-C 344
The class has two sessions in the library per semester
Here are learning outcomes for Day 1
Course title/number: Organic Chemistry Laboratory / CHEM-C 344

Learning Outcomes

Library Day 2 (2 hr. session)

• Using a chemical structure, students will be able to draw the structure in Reaxys and conduct substructure searching and an exact structure search using this database.

• Students will be able to locate journal articles discussing the synthesis of a chemical compound in Reaxys.

• Students will be able to locate journal articles discussing the use of a reagent in Reaxys.

• Students will be able to cite sources using the American Chemical Society citation style.

And here are learning outcomes for Day 2
Course title/number: Organic Chemistry Laboratory / CHEM-C 344
Assessments

Library Day 1
• Library Assignment “Introduction to Techniques in Chemical Information” (Graded by Teaching Assistants using grading rubric)
  • https:// lupui.libguides.com/id.php?content_id=24723909
  • https:// lupui.libguides.com/id.php?content_id=24741130

Library Day 2 (several weeks beyond)
• Library Assignment “Introduction to Techniques in Chemical Information – Part 2” (Graded by Teaching Assistants using grading rubric)
  • https:// lupui.libguides.com/id.php?content_id=44334914
  • https:// lupui.libguides.com/id.php?content_id=44334923

Final Exam for course
• Items from the library sessions are included for the course final exam.

Here is a snapshot of some of the assessments
Course title/number: Organic Chemistry Laboratory / CHEM-C 344

**Teaching Methods**

**Library Day 1**
- Brief lecture with discussion
- Demonstration
- Hands-on exercises

**Library Day 2**
- Brief lecture with discussion
- Demonstration
- Hands-on exercises
Example – Chemistry, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  1 class visit - 1 hour 50 and minute session
- CHEM-C 294 Intro to Cornerstone in Chemistry
  2 class visits - 45 min. and 1 hour and 30 min.
- CHEM-C 344 Organic Chemistry Laboratory
  2 class visits, each 2 hours
- CHEM 494 Capstone in Chemistry
  No class visit, individual appointments with students

6 classroom hours of library instruction with every Chemistry major
Example – Psychology, Bachelor of Science

- SCI-H 120 Windows on Science (First Year Seminar)
- PSY 203 Ethics and Diversity in Psychology PSY-B 203
- PSY 311 Research Methods in Psychology
- PSY 433 Capstone Laboratory in Psychology PSY-B433
Example – Psychology, Bachelor of Science

- SCI-H 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- PSY 203 Ethics and Diversity in Psychology PSY-B 203
- PSY 311 Research Methods in Psychology
- PSY 433 Capstone Laboratory in Psychology PSY-B433

Key avenue for providing orientation to library services, spaces, resources
Students conduct basic research on a career of choice
Intro to searching general database, intro to evaluating sources.
Example – Psychology, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- PSY 203 Ethics and Diversity in Psychology PSY-B 203
  Key avenue for focusing on issues in citation/plagiarism
- PSY 311 Research Methods in Psychology

- PSY 433 Capstone Laboratory in Psychology PSY-B433
At the 300 level students learn to conduct search strategies in discipline specific databases (PsycINFO, PsycTESTS) for a variety of projects.

Example – Psychology, Bachelor of Science

- SCI-I 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- PSY 203 Ethics and Diversity in Psychology PSY-B 203
  Key avenue for focusing on issues in citation/plagiarism
- PSY 311 Research Methods in Psychology
  Research design – key avenue for teaching literature search
- PSY 433 Capstone Laboratory in Psychology PSY-B433
Example – Psychology, Bachelor of Science

- SCI-H 120 Windows on Science (First Year Seminar)
  Intro to science and strategies for success as science major
- PSY 203 Ethics and Diversity in Psychology PSY-B 203
  Key avenue for focusing on issues in citation/plagiarism
- PSY 311 Research Methods in Psychology
  Research design – key avenue for teaching literature search
- PSY 433 Capstone Laboratory in Psychology PSY-B433
  Independent research projects

At the capstone level, students learn advanced search strategies for their independent research.
Challenges

• Faculty buy in
  • Even if you get everyone on board faculty may move or rotate courses they teach

• May result in higher instruction load
  • Not everyone likes to teach, or has time to teach

• Takes considerable time to plan
Many Benefits

- Makes learning more relevant
- More meaningful assignments
- Delivers library instruction at specific points of need

Students learn best when what they are learning has meaning to them. The more we can tap into this the more we can increase the chance that material learned is retained in long term memory. The curricular approach works toward this goal delivering library instruction at the point of need.

Breaking up information literacy instruction across a degree program helps me to have more focus as a teacher. Instead of feeling like I have to cram too much material into a one-shot session, the curricular approach allows for a gradual, purposeful, meaningful approach. This allows students to build upon their information skills at appropriate points throughout the years as they pursue their major. This enhances the student experience as well as their ability to master science information skills.
Thank you!

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