$MLIS_1$ + $Students_{145}$+ PhD_1 → ∝Critical Thinking

Teaching critical thinking and library skills to students at a medium sized public university.

Ann Zeidman-Karpinski, University of Oregon, Science Library, annie@uoregon.edu

ABSTRACT: How can 1 librarian best teach large numbers of students the skills needed to be critical consumers of scientific information? Thanks to good interactions with faculty the opportunity to do this has been created, but it is unclear how to sustain a class where there is actual contact between a librarian and the students. Educational technology, like using chat software, blogs, wikis and automated tours are considered, but ultimately inconclusive. More research needs to be done to determine the feasibility of this kind of an undertaking.

KEYWORDS: scientific literacy, critical thinking, Library partnerships, information fluency, Green Chemistry

INTRODUCTION:

What are we doing?

The Chemistry professor (hereafter known as. The Professor) and I (the Librarian) proposed creating six (6) one-credit discussion sections for Chemistry 111. This non-lab class is a prerequisite for a number of required courses in biology, human physiology and psychology. Chemistry 111 typically enrolls 145 students per term (fall and spring), from over 45 majors. This diverse student population includes both the well prepared looking for an easy class and the under-prepared who need this class to continue in their chosen major.

Why did we decide to do this?

Our primary learning objective for this collaboration, and one of the overall course goals, is to make the students more astute consumers of scientific information. By tying library and research skills to an assignment in an introductory chemistry class, we are having students grapple with the primary and secondary literature in the context of their overall college education. This would go a long way towards addressing some of the concerns raised in the Chronicle of Higher Education article "Bridging the Chasm: First-Year Students and the Library" by Betsy Barefoot (view the full article at this URL: http://www.webster.edu/~kennelbr/FreshmanTransferSeminars/BridgingTheChasm.pdf). Specifically, the author found that current college students think that the library is irrelevant due in part to not being required to use the library's resources during the course of an undergraduate curriculum. She calls for closer collaboration between librarians and professors so that we are able to make "…librarian instruction an integral part of courses across the curriculum."

What are we trying to achieve?

We intend to teach the skills using hands-on learning problems that are driven by compelling stories and with concepts that unfold as the quarter progresses.

METHODS:

The primary objective of the class is to prepare the students for the task of writing a life-cycle assessment of a topic of their choosing. As a way of introducing information literacy in a scientific context, the class will cover:

- How to search more effectively
- How to evaluate sources
- How to read peer-reviewed scientific journal articles
- Students will be encouraged to share research strategies with each other, creating a "lab like" learning environment.

In order to teach students about research and the scientific process, discussion sections will make extensive use of:

- computers
- asynchronous assignments
- web 2.0 tools
- weekly meetings to talk with the librarian and others in the class

To complete the research for a life-cycle assessment they will learn about:

- Library research
- Information management
- Effective use of networked technologies in the academic setting.

Learning Outcomes:
By the end of term, students will:

- Know how scientific information is created and communicated.
- Understand how the topic we talk about in class has unfolded.
- Know how to prepare a chemical life-cycle assessment and more about the topic they researched.
- Have acquired skills in library research and in evaluation of information in many formats.
- Have presented their findings to an audience using technology-based presentation tools.
- Gain experience using network applications such as bulletin boards and collaborative editing tools in an academic context.

RESULTS/DISCUSSION:

The goal is to reinforce the critical thinking and scientific literacy skills that are an important part of this course in specific, and of a scientific education in general, early in the students' undergraduate education.

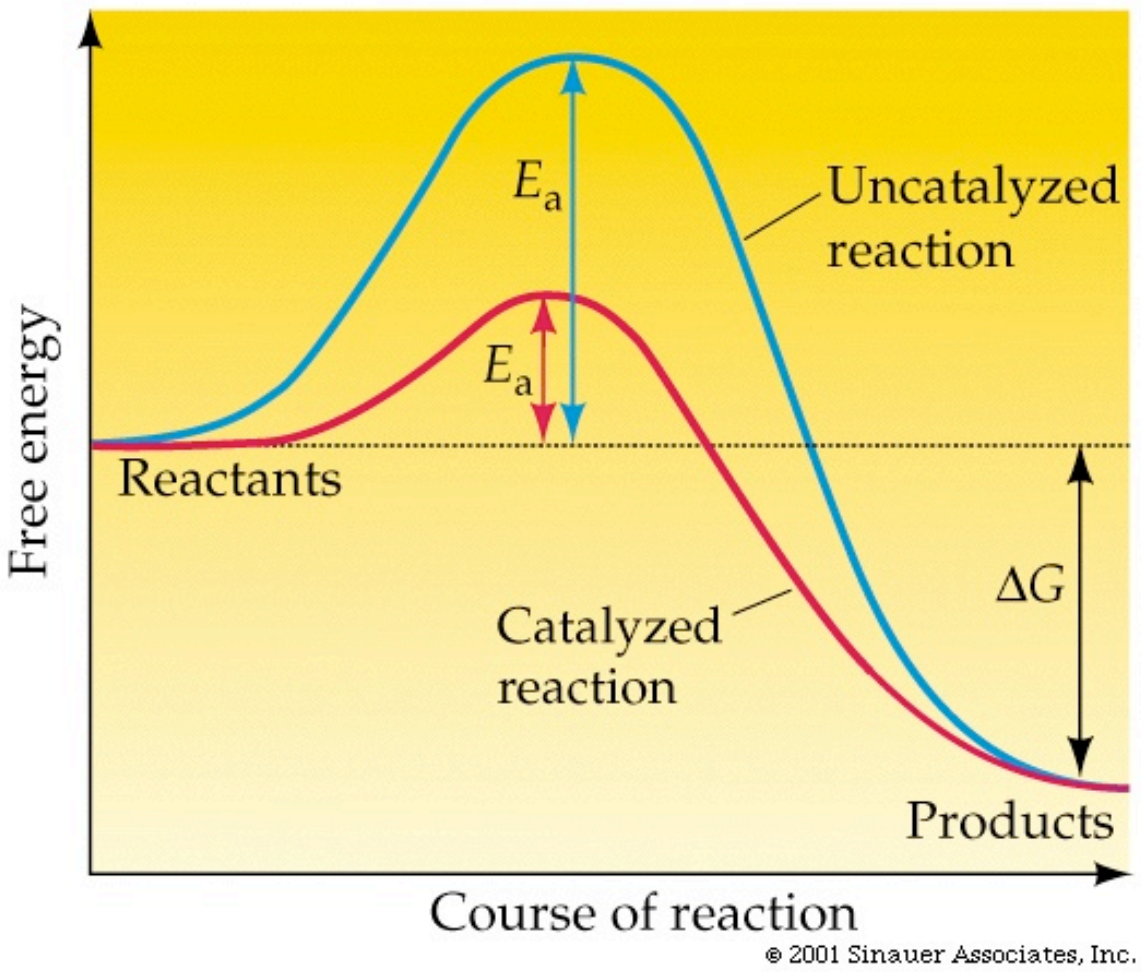
The challenges:

- Developing faculty relationships

This project was only possible due to the trust between the Professor and me, which was a by-product of having been a student in this class. Since this is a slow and inefficient way of establishing these relationships, it is hard to know how to make this more effective or more scaleable.

- "Energy of Activation" problem

Like in chemistry itself, getting something this complex going, requires quite a lot of energy to start and maintain. Chemistry is full of these kinds of quandaries:



from **http://www.columbia.edu/cu/biology/courses/c2005/purves6/figure06-14.jpg** [accessed 6/20/06]

- Building tools for asynchronous learning.

Few of them are readily available, so these would take time, money and considerable effort to develop and then make into useful formats.

- Assessment tools used to evaluate learning outcomes.

It is unclear how to effectively use the available tools to ensure that students are remembering the material, absorbing it and reflecting on implications for use.

- Most important of all is the **sustainability** issue.

Would we have enough time to develop this course and then would the Librarian have enough time to teach this course on a regular basis? The culture of the UO Libraries is to try these things, but the culture of the Chemistry Department is more hesitant to change.

The solutions:

We applied and were considered for a 3-year, $50,000 a year internal grant. =This funding would provide the Librarian with the release time needed to:

- prepare for and deliver six one-credit discussion sections of approximately 24 students per group
- develop the content and format of the asynchronous learning tools in partnership with the University's in-house interactive media development group (also a library department),.

Sadly, none of these things addresses the sustainability issues. How would one Librarian do this in addition to the rest of her duties on an ongoing basis? Is this even reasonable without re-thinking the position?

However, getting to engage these students at this point in their academic career seems well worth the effort. Students learn concrete skills for researching a topic in chemistry and how to evaluate the quality of what they find. These skills are essential to their success throughout college and later in life. They will also learn more about how scientific knowledge is created, which will be of great relevance regardless of their eventual choice of major.

Any thoughts, suggestions or contacts for others who have worked on this kind of a project are most welcome.

Acknowledgements

Andrew Bonamici, UO Libraries
Julie Haack, UO Chemistry Department
Linda Yamamoto, Librarian, Stanford University
Karen Munro, Librarian, UC - Berkeley

Literature Cited

Barefoot, B. (2006). Bridging the Chasm: First-Year Students and the Library. *Chronicle of Higher Education, 52*(20), B16.

Department of Chemistry (2004, Monday, June 19, 2006). Greener Education Materials for Chemists. from http://greenchem.uoregon.edu/gems.html

Appendix:

Suggested structure of the class (syllabus and assignments)

For example, if we were to use the story of the Korean researcher who was famous first for his work in cloning and then infamous for the data he falsified, the lessons might be something like this:

Objective: Students will be able to identify, locate and critique sources relating to the cloning scandal of Dr. Hwang Woo-suk. They will then apply these techniques to doing a Life-cycle assessment of their chosen topic.

Lessons might include:

Week 1: Objective: To emphasize different research strategies and basic information literacy skills have students learn where information comes from by looking for more on an event.

How do you find the earliest news stories about this scandal?
Where and how do you find more complex analysis of what happened?

Talk about basic searching, expanding search with more words, and narrowing search with more precise words.

Have students start thinking about a topic for their life cycle assessment. This is a paper that describes the life cycle of two products or processes and compares and contrasts their impact on human health and/or the environment. Have them write down what they are researching and what their connection to the topic is.

Week 2: Objective: Introduce Life Cycle Assessment. Do exercises in brainstorming topics. Review where the information they are looking for might be. Talk about how to start and then where to go next for the project.

Week 3: Objective: More explicit emphasis on scientific literacy. Talk about what is a high quality scientific article – of either the peer-reviewed variety or edited by a credible source.

Week 4: Objective: Show students more about the accuracy of scientific research. Show students the elements of a citation. Life cycle topic due.

Week 5: midterm

Week 6: Objective: Have students submit an annotated bibliography of resources on their topic. The goal will be to have students identify a variety of sources and then help students assess the quality of the sources they identified and to determine whether they will need to identify additional information.

Week 7: Objective: Develop scientific community around sharing information. Break students up into groups based on folks covering similar topics (this will be organized before class, using Blackboard). Have students talk about what they have found, problems, and success stories.

Week 8: Objective: Continue fostering scholarly community. Have students review each other's life-cycle assessment paper. Check that all the elements needed are in there. Troubleshoot problems students are having. Use group editing software to mark up papers.

Week 9: Objective: Show and tell. Have students talk about what they found, what they think is important, what they learned along the way. This would be a semi-formal format, much like a weekly lab meeting.