A Final Project Report : ACS Information Fluency Grant, 2002

Integration of Information Fluency into a Two-Semester Introductory Biology Laboratory Series

Personnel

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Background

This project is a follow-up to a 2000 ACS Information Fluency proposal on Fostering Information Fluency in the Introductory Biology Laboratory. That project involved modifying exercises that had been in practice for several years and integrating library instruction and pre- and post-course assessment of the information fluency of some 120 students enrolled in one semester of introductory biology. The course was taught in the Spring of 2002. During the Summer of 2002, the Department of Biology restructured its introductory curriculum and developed entirely new syllabi for its two-semester introductory laboratory series. This project funded a half/day workshop to focus discussion and foster ideas on how to fully integrate the objectives of the information fluency initiative into the laboratory exercises and assignments of the new courses.

Project Overview

The Project Director supplied a schedule (Appendix I: Workshop Schedule) and set of reading materials (Appendix II: Contents of Information Packet) to participants prior to the workshop. On the appointed day, the Project Director presented opening remarks. (Appendix III: Outline of Opening Remarks). The departmental participants discussed the skills it felt students should have and how prepared they were prior to the course. Darlene Brooks and Bill Short from the library joined the group to discuss what information fluency training students are getting in other courses and to share their perspective on student readiness. Based on the previous discussions, the Project Director assigned participants to three groups for breakout discussions: Information

Hierarchy, Creating and Interpreting Graphical Data, and Population Level Thinking. After the breakout sessions, session leaders summarized discussion for all participants. Following the workshop, teams worked during the summer to develop course and laboratory syllabi with an eye to fostering information fluency.

Outcome

What skills must our biology students have; what skills are they coming in with; what skills must we teach them? (Note: The latter three points below identified topics for breakout sessions.)

- Students need basic computer skills (network use, internet use, word processing, spreadsheet, presentation software). Most incoming students have experience in most or all of these areas and what they don't have, they can easily pick up from other students. Therefore, they don't need to receive basic training as a formal part of the course.
- Students (even seniors) have difficulty in using proper referencing and paraphrasing. We should have a departmental standard Instructions to authors
- Students can use general search engines but need training in proper search strategies and evaluation of the validity of information found on the Internet. They are unfamiliar with the hierarchy of information in science and how to use discipline-specific reference databases.
- Many students have a rudimentary understanding of the scientific method, yet they must receive training in the proper formulation of hypotheses, experimental design including use of controls, analysis and interpretation of data, and contextualization within the current body of knowledge.
- Students come in with little experience in working with data on populations. They need training in population-level thinking including the ideas of sampling, inference, distribution of data, probability, and significant differences.

What relevant training are students getting from the library and/or in courses required of all students?

- There is no college-wide training of students in the use of the library's resources.
- Many sections of the introductory writing course utilize instruction by library staff. Other sections include instruction by the professor. Still other sections include little or no formal library instruction. Finally, many students receive AP credit and opt out of the introductory writing course.
- Discussions are underway toward including general information fluency training in the Search/Life program, a two-year program in the humanities that is required of all students and/or to include training in a newly developing academic orientation program for first-year students.
- The library staff finds point-of-use training to be an effective approach with one-on-one instruction related to an assignment. However, this is very time consuming for the staff.
- Perhaps what is most desirable is to train small working groups ("learning communities" or "focus groups"). This works well if the students have topics in hand, each student has a different topic, and the library staff member assists each in developing search strategies. With different topics, the students are exposed to different topic-specific strategies and are more likely to be able to apply their training to different situations later.

Focus Group Notes: Information Hierarchy

- Real-time problem searching; finding literature in context

- Seeing that research literature is importance to success in a lab
- Search strategies – Boolean and others
- Concept of databases and their manipulation– incorporate use of GenBank?
- Ability to write scientifically through journal and/or lab notebook; test completeness of info in notebook by assigning a spur-of-the-moment paper based solely on their notes.
- Stump-the-chump game – instructor gives question and student or group of students seeks answer through appropriate search tools
- Incorporate tutorial leading to directed project/search
- Learn to appreciate the wealth of accumulated knowledge, how to access it, how to place current work in its context

Focus Group Notes: Creation and Interpretation of Graphical Data

- Each lab exercise should be designed with this goal in mind.
- Students have some Excel skills but may need some specialized training in how to set up data tables and how to generate graphs, esp. those with error bars. This could be set up as a written tutorial and/or in a non-linear html format
- Distinguish between graphs, figures, and tables
- In lecture sections, use figures in manor as used in scientific presentations to emulate their proper presentation (including controls if appropriate)
- Train students how to enter data in tables properly to facilitate the type of graph appropriate to the data
- Bring in examples of data (or have students find them on the Internet) and discuss why the examples are structured as they are
- Emphasize concepts of dependent vs. independent variables
- Know when to use different types of graphs, e.g. line vs. bar
- Use appropriate captioning and legends.
- Much of the interpretation falls in the next category.

Focus Group Notes: Population Level Thinking

- Biometry Course Option
    - new College curriculum may make this possible
    - substitute for Math 111
    - in lieu of a 105 for a teaching commitment
    - critical role of experimental design
    - a number of faculty (5) are capable of teaching this - recruitment criterion
    - 200 level course
- Term II option more appropriate for relevant exercises? Although most examples came from term I lab possibilities
    - staffing most appropriate with term II folks
    - populations more appropriate in term II
- Hands on data collection important
    - students should not be swamped by methodology
    - perhaps a lab should be devoted to several small exercises
    - population genetics - in term I
- null hypothesis: student height of lab section x = student height of lab section y or male = female

    - other morphological characters, e.g., wing lengths
    - goodness of fit and Chi-squared test in genetics lab
- micro experiments
    - number of cells/volume using a hemocytometer
    - hemocytometer versus optical density (correlation and regression)
        - effect of sample size, using hemocytometer and cells/volume
        - regression and correlation with growth rate, i.e., cells/volume versus time
        - light-lethal yeast mutants - UV effects (ecological context too)
        - LD50 for yeast (lethal dose that kills 50% of the population)
        - 1/2 Vmax = 1/2 Vmax for enzyme reaction under different treatments
- -pH prediction for reaction and test range - use of error bars to look at differences
- Role of null hypothesis in world view - thought to be very important
- Term II
    - may already be doing but need to focus more clearly
    - nongroup task assignments to prevent student parasites and falling through cracks
    - mark and recapture for population estimates
    - genomics
    - behavioral observations, e.g., crickets - need for quantification of behavior
- What do error terms really mean? Exercise to calculate and use
- Experimental design – importance of planning experiment with particular data analysis in mind
- Experimental design needs to have student ownership - students' own initiative
- Evaluation - projects at term's end, if statistics are appropriate then they need to be expected and graded accordingly.

Current Syllabus for the Biology I Laboratory

- http://stinemetz.biology.rhodes.edu/10130labsyl.htm

Conclusion

The department agreed that as we worked to formulate our new introductory lab series, an important consideration would be how to integrate into these core courses the instruction of library basics, information hierarchy in biology, critical evaluation of sources, reference rules and formats, presentation, and other issues related to information fluency.

One of the overriding goals of our introductory lab courses will be to provide students with an understanding of and practice in the scientific method. This includes the ability to find and evaluate secondary and primary (peer-reviewed) information and use that information in supporting hypotheses and conclusions; to conduct experiments and analyze results; to present results and conclusions verbally and in writing, and to appropriately document and reference information. Therefore, we will approach information fluency in a discipline-specific manner. The triad of information literacy, critical thinking, and computer skills will be reflected in the use of scientific literature, independent use of the scientific method, and computer analysis and reporting tools.

Report submitted by Gary Lindquester
August 30, 2002

Appendix I: Workshop Schedule

Integration of Information Fluency into a Two-Semester Introductory Biology Laboratory Series
Friday, April 26, 2002

11:30-12:00 Lunch (Alburty Room)

12:00-12:30 Introduction (Alburty Room)
Participants in the workshop will have been provided with the ACS definition of Information Fluency and the ACRL Information Literacy Standards for review prior to the workshop. Introductory remarks and discussion will focus on the definition and how these issues have been addressed in the introductory course sequence in the past. The structure of the workshop will be presented.

12:30-1:15 What skills must our biology students have? (Alburty Room)
Group discussion centered on the ACRL Standards and the proposed course goals will result in a specific list of skills we will require of our students upon culmination of the course.

1:15-1:30 What skills are our students coming in with and what skills must we teach them? (Alburty Room)
Group discussion will divide the list into two parts. The remainder of the workshop will address the skills we must teach them.

1:30-2:15 Librarian's perspective (Alburty Room)
Darlene Brooks and Bill Short will lead a presentation and discussion of the library's perspective on what skills the students are coming in with, what they are lacking, and how the library can assist with developing skills that students lack.

2:15-2:30 Break (Biology Library)

2:30-3:30 Breakout sessions (Biology Library, Seminar Room, FJ-104)
How can we help students develop the skills they lack within the introductory course curriculum? The tentative format will be to have three concurrent breakout sessions, one each related to accessing information, evaluating information, and using information. Accessing information includes library skills; evaluating information includes information hierarchy in the field of biology and determining the validity of print and on-line sources; using information includes formulating hypotheses, providing background to proposed studies, formatting citations, and presenting results. A faculty volunteer will lead each session.

3:30-4:00 Breakout session results (FJ-104)
Presentation and discussion of the breakout session results and how the resulting ideas might be integrated.

Appendix II: Contents of Information Packet

Integration of Information Fluency into a Two-Semester Introductory Biology Laboratory Series
Friday, April 26, 2002

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Appendix III: Outline of Opening Remarks

Introduction to Workshop 12:00-12:30

Background

- Computer literacy issues several years ago (e.g. ACS tech grant) - not now
- Information literacy issues more and more prominent
- Critical thinking skills always a focus at liberal arts schools

Information Fluency definition

- Venn diagram
  - reflects skills by students
  - and personnel interactions
- Jim Rettig's diagram
- Susan Hagans hierarchies
  - Class standing
  - Audience
  - Disciplinary
  - Depth of analysis
  - Breadth of use

Info Flu and Introductory Biology

- Prior work along these lines
- Info Flu initiative focused thought and money on the problem
- Info Flu Grant I
  - Review literature reference worksheet and info hierarchy in bio
  - Includes lit citation format and plagiarism info
  - Other exercises to develop aspects of scientific method
- Info Flu and Grant II - this workshop
  - Goals
    - Discuss where our students stand,
    - Where we want them to be
    - How to get them there
- Proposed outcomes
  - Departmental consensus on info flu, ref. format, plagiarism policy, etc.
  - Coordination of info flu focus in intro courses
  - Ideas to take to intro workshops