

Data Collection at ACS Institutions

The following information is needed:

1. Raw evaluation data for the courses, including institutional quantitative and qualitative course evaluations, and instructor-designed evaluations, which could include supplemental questions, pre- and post-tests, focus groups, etc., depending on the course.

Cancer – Biology and Beyond (BI 149) is offered during the spring semester of odd years. The ACS Science Reform Mini-Grant was obtained in May 2005, so the instructional materials developed are only now beginning to be used. Representative samples of course assessments *prior* to obtaining the grant are provided below, as well as some formative assessment of the instructional materials used to date. Additional assessment will be provided when the final report for this project is submitted on April 30, 2007.

Quantitative Assessment of BI 149 prior to receipt of ACS Science Reform Funding:
The following data was obtained through institutional, anonymous, course evaluations.

Question	Excellent	Good	Average	Fair	Poor
This course's influence on my critical thinking and reasoning ability was:	2005: 6	2005: 5	2005: 2	2005: 0	2005: 0
How would you evaluate the organization of this course?	2005: 11	2005: 0	2005: 2	2005: 0	2005: 0
How would you evaluate the professor's ability to facilitate comprehension?	2005: 10	2005: 1	2005: 0	2005: 2	2005: 0

Evaluations from 2003 are not included, because Birmingham-Southern's administration only provided this data in hard copy, and these forms are currently being used by Birmingham-Southern's Promotion and Tenure committee. If desired, these materials can be made available at a later date.

Qualitative Assessment of BI 149 prior to receipt of ACS Science Reform Funding:
The following data was obtained through institutional, anonymous, course evaluations.

Qualitative assessment of BI 149 is currently not available, as these hand-written student evaluations are currently being used by Birmingham-Southern's Promotion and Tenure committee. If desired, these materials can be made available at a later date.

Description and assessment of two teaching modules developed through the grant:

A basic hypertextbook is in development. This web-based resource is designed to provide an introduction to basic concepts in biology, chemistry, and physics while focusing on the theme of cancer biology. Links to other valuable on-line resources are also provided. Furthermore, the "Breaking News" features allow students to relate the material they are learning to current events, while examining the ethical, social, and legal implications of advances within the field of cancer biology.

Since obtaining funding from the ACS Science Reform initiative, two new lab modules have been developed.

The first such module uses molecular modeling to reinforce what students have learned about atoms, elements, and chemical bonds. Upon completing this exercise, 8 out of 9 students agreed or strongly agreed that the molecular modeling exercise helped them visualize the three-dimensional nature of molecules. Furthermore, 8 out of 9 students agreed or strongly agreed that the molecular modeling exercise helped them visualize the electronegativity of atoms of different elements. Some of the comments obtained in anonymous evaluations include:

"It allowed me to see exactly how atoms in a molecule will be arranged and what shape the molecule would take."

"I gained a better feel for the shape of molecules and how atoms and molecules interact."

"It did help me see electronegativity firsthand and the hands-on aspect did help me to visualize the molecules."

"I understand better how the different bonds work and their electronegativity."

"I enjoyed having the clear visual aid."

"I could see the electronegativity and actually create the bonds and molecules myself."

"It helped me see which atoms made how many types of bonds and which could go together."

A second molecular modeling lab module was also developed as part of this grant. This second module focused on modeling the oncoprotein Ras. This exercise was designed to help students visualize protein structures while relating protein structure to protein function. After completing this exercise, 6 out of 8 students agreed or strongly agreed that the molecular modeling exercise improved their overall understanding of protein structure. Furthermore, 7 of 8 students agreed or strongly agreed that the molecular modeling exercise helped them visualize the structure of the G-protein Ras. Some of the comments obtained in anonymous evaluations include:

"It let me visualize the structure of Ras and how mutations can affect it."

"I saw how changing one codon can have the potential to drastically change the protein."

"I can visualize the structure better, it helps me to connect what we've learned in class."

"It gave me a much clearer understanding of Ras."

2. How many times and when the courses have been offered; numbers of students taking the courses.

Interim 2002 (prior to grant): 12 students enrolled
Spring 2003 (prior to grant): 17 students enrolled
Spring 2005 (prior to grant): 15 students enrolled
Spring 2007 (during grant period): 10 students enrolled

Enrollment in this course is capped at 16. The unusually low enrollment is due to several factors, including an unusually small freshman class at the college overall, and a larger than usual number of course offerings for non-science majors.

3. The dissemination efforts used on-campus, regionally (meetings), and nationally (meetings, journal publications, books).

As a hypertextbook, this project several built-in dissemination advantages. First of all, the site was tagged with substantial metadata (keywords, etc.), to increase the likelihood of being

found by search engines. Furthermore through the ACS Science Reform web-site, I have received several inquiries from individuals around the country regarding the development and use of this resource. When I receive inquiries, I can simply e-mail the address of the web-site, making it freely available to all interested parties.

To improve the visibility of this project, I gave a poster presentation on this work at the 2005 American Society for Cell Biology Meeting in San Francisco. I also plan on giving a poster presentation and demonstration of the site at the "Computers in Teaching" session of the Annual Experimental Biology Meeting in Washington, D.C. later this spring.

4. Whether a grantee has requested or received additional funding for the project, or is planning a proposal, and if not why.

While working on the *Cancer – Biology and Beyond* hypertextbook at an ACS Technology Workshop, I met and established an exciting collaboration with Mike Roy, the Director of the Learning Objects Studio at Wesleyan University. In the Fall of 2005 we submitted a proposal to the Center for Educational Technology which granted \$34,540 to collaboratively develop interactive learning objects related to teaching cancer biology to non-science majors. After many months of research and development, as well as two trips to Wesleyan, the *Perspectives on Cancer* Learning Object went live in February 2007. This dynamic teaching resource can be seen at <http://learningobjects.wesleyan.edu/cancer/>.

5. Level of support and encouragement from the Dean/Provost throughout the project, according to grant recipient and institutional representative.

When the proposal for this project was first developed, Birmingham-Southern's Interim Provost was very supportive of the idea. Since that time I have had very little interaction with the administration when it comes to this project.

6. Syllabi, laboratory and field protocols, and other relevant course materials, including assessments and evaluations, as **PDF** documents to be uploaded onto the ACS website.

See attached documents:

- 1) course syllabus
- 2) molecular modeling lab protocols
- 3) 2005 course evaluation
- 4) CET grant proposal for funds to develop *Perspectives on Cancer* learning object

7. The Keck Foundation may also request additional information in the next two weeks.

Prior Concerns and Updated Information

1. Has there been adequate dissemination – on campus to inform faculty about the initiative and encourage them to apply for mini-grants, at regional meetings to communicate the goals of the program in the South outside the ACS, and at national meetings and in refereed publications to reach the widest audience possible and to provide additional independent evaluation of the courses and the program?

This project has been disseminated through poster presentations at two national meetings, as described in #3 above and in #1 below.

2. Has there been adequate evaluation of the courses, including SAM-VI and other pre and post test evaluations that get at the questions of the faulty paradigms that students bring to classes and how the class addresses science literacy, both process and content?

This semester the course is being taught for the first time since receiving funding from the ACS Science Reform program. Assessment of the project will occur primarily at the end of the term.

Additional Information

1. What publications, presentations at regional and national meetings have resulted or are planned or in progress? Provide as much detail as possible.

Oral Presentation at Regional Meeting

Hanson, P.K. (2005) Cancer biology textbook for non-science majors. *Associated Colleges of the South Science Reform Workshop*; Greenville, SC.

Poster Presentations at Regional and National Meetings

Hanson, P.K., Loyer, A., and M. Roy (2007) Development and assessment of web-based resources for teaching cancer biology. *Experimental Biology Annual Meeting*, Washington, DC

Hanson, P.K. (2005) Prototype textbook for teaching cancer biology to non-science majors. *American Society for Cell Biology*, San Francisco, CA

Hanson, P.K. (2004) Cancer—Biology and Beyond: A thematic course for non-science majors. *Associated Colleges of the South Science Literacy, Course Design, and Course Assessment Workshop*, Jackson, MS

Planned Publications

Martha Grossel, one of the editors of the journal *CBE-Life Sciences Education* has encouraged me to publish an article on the collaborative development of the *Perspectives on Cancer* learning object, a teaching resource that would not have been created without the initial *Cancer – Biology and Beyond* project funded by the ACS-Keck Science Reform Program.

2. How many times have the funded courses been offered?

This spring, BI 149 is being taught for the first time since obtaining funding from the ACS Science Reform Program. This will be the third time that the class has been offered during a regular semester, and the fourth time it has been taught overall. The first offering was as an Interim (January-term) course.

3. How many students have been enrolled?

January 2002: 12
Spring 2003: 17
Spring 2005: 15
Spring 2007: 10

4. Has enrollment been increasing?

No, enrollment in this particular course has not increased. Enrollment in this course is capped at 16. The unusually low enrollment during Spring 2007 is due to several factors, including an unusually small freshman class at the college overall, and an unusually large number of biology course offerings for non-science majors.

5. Will the courses continue to be offered?

Yes, for the foreseeable future, this course will continue to be offered during the spring semester of odd-numbered years.