

ACS Reform of Introductory Science courses for Non-Majors Course Mini-grants
This program is supported by the W. M. Keck Foundation of Los Angeles

FINAL REPORT
Reform of Introductory Science Courses for Non-Majors
Funded by W. M. Keck Foundation of Los Angeles
Administered through the Associated Colleges of the South

Name of Person Submitting Report: Kelly Agnew, Ph.D.

E-mail: agnew@hendrix.edu Phone: (501) 450-1443

Institution: Hendrix College

Title of Project: *Redesign and Re-implementation of Environmental Biology*

Date(s) of Project: 1 May 2004-May 31, 2005

The time table in the original proposal I submitted proposed that the course be taught after May 2005 (the teaching schedule for the next year had already been determined up to that point). When I submitted the grant, I was uncertain of my tenure status, and therefore, when the course would be taught. Happily, I have been granted tenure and am scheduled to teach the course as soon as I return from sabbatical in Fall 2006. Accordingly, I will submit an additional report in January of 2007 to the ACS with lessons learned after having taught the course through a semester. I have developed the syllabus—it is included at the end of this report.

ORIGINAL GOALS AND OBJECTIVES

Environmental Biology is currently offered at Hendrix College as a non-science majors lecture course. The course addresses a wide range of issues, including biodiversity preservation, human population growth, pollution, global climate change, environmental triggers for emerging disease, the potential challenges and benefits of GMOs, sustainable development, and federal and international environmental policies.

However, the current course suffers from a lack of emphasis on the *process of science*, and how science informs policy decisions and drives the development of new technologies. The reforms proposed here include a semester-long series of field and bench laboratory experiences that will include hypothesis generation, experimental

design, data collection, data analysis (including basic statistics) and the presentation of results and their implications.

The proposed implementation of a laboratory experience will provide a hands-on, question-driven approach to real local problems, fostering non-major students DOING science. The labs will examine human impacts on freshwater ecosystems in Arkansas. Students will study the history of water quality issues in the region, and then assess water quality at several sites. After learning basic water chemistry, fundamental ecological principles, and some natural history, students will be expected to generate testable hypotheses about water quality, aquatic vertebrate and invertebrate community diversity, and predicted resistance to environmental perturbation. Because several of the freshwater sites considered for study are slated for either development or remediation in the next few years, the student results over successive semesters will also provide longer-term data on trends in environmental quality.

GOALS: *To engage non-science major students in the scientific process by conducting a series of field and bench laboratories to investigate water quality as an environmental issue.*

Students will:

- 1) explore the history of each site tested and investigate the societal impacts and cultural contexts for changes in water quality;
- 2) conduct basic water quality assays, including water chemistry, clarity, flow and seasonality;
- 3) assess ecosystem diversity using algae, zooplankton, plants, invertebrate and vertebrate communities;
- 4) understand the concepts of endemism, habitat specificity, tolerance limits, and the dangers posed by introduced/exotic species;
- 5) generate hypotheses about population dynamics (competition, predation, etc.) and then design and conduct experiments in a controlled laboratory setting;
- 6) conduct basic statistical analyses to determine whether results are significant;
- 7) draw conclusions from the data, and discover what can (and can not) be concluded from a data set;
- 8) present the results so that others can understand them.

Changes since proposal submission:

There have been no changes made in these goals since writing the proposal. However, limited travel funds dictated that I consider an alternative for the studies I had

planned on heavy metals in drinking water in mining communities in the northern Arkansas. The time and money required to take *all* students to the region would have proven excessive. I shifted the focus to chemicals used in pulp and paper mill processing and their effects on watersheds, and plan to have students sample near the processing plant in Oppelo, Arkansas, about 40 minutes away.

However, I think student awareness of chemicals in drinking water is critical, and so I have developed an additional pair of exercises to be conducted as a project outside of class. The first involves the condemnation of land surrounding the water supply for the city of Little Rock. A current course case, *Deltic Timber v. City of Little Rock*, is wending its way through the courts now, but I want students to investigate the history of the dispute and why the City is seeking to condemn the land owned by the timber development company in order to protect the land surrounding Lake Maumelle, the principal source of city water. The second exercise asks students to navigate the Environmental Protection Agency's website to discover what Superfund sites are in Arkansas and what threats and clean-up efforts are involved at each site. Although these sites are too distant to visit with the class, the students will have been exposed to the basic water chemistry issues by this point in the semester, so they will have a better grasp of what risks are present (and which are no longer a threat). I have scheduled this exercise late in the term because 1) it will be deep winter by this point and field exercises are difficult to conduct; 2) the students will have the benefit of the whole semester's information to integrate and apply with this study.

Assessment:

I will be adding the SAM-VI assessment tool to the project. SAM-VI was developed by Don Deeds and Bruce Callen at Drury and was showcased to the ACS-Science Reform workshop at Millsaps College in Jackson, MS in mid-November 2004. The course will also have the standard Hendrix end-of-course evaluations conducted. The results of these assessments will be made available to the ACS.

The Associated Colleges of the South may post my proposal and any materials associated with it on its website. Additionally, as the course develops, I will communicate any changes, results, and “what worked and what didn’t” information with the ACS office.

ENVIRONMENTAL BIOLOGY (NSCI 130)

Fall 2006

Dr. Kelly Agnew

Office: DWREY 316, 450-1443

Office Hours: xxxxxxxx

email: agnew@hendrix.edu

Lecture meets xxxxxxxx in DWREY xxxx. Laboratory meets xxxxxx in DWREY xxxxxx. This course satisfies the NS-L (Natural Science with laboratory) and the CW (Challenges of the Contemporary World) requirements.

TEXT: Wilson, E. O. and D. L. Perlman. 2000. Conserving Earth's Biodiversity. CD-ROM. Island Press. I will also provide short readings from the primary literature throughout the term.

OFFICE HOURS: I encourage you to come to my office for any questions or concerns you may have. If your schedule conflicts with posted hours, we can work out a mutually convenient time to meet. However, please make an appointment ahead of time! My teaching schedule is posted on my office door.

EXAMS: Exams will include objective questions as well as math problems, essay and data analysis. Please write your exams in ink. I will provide calculators--please do not bring your own. Do not bring cell phones into the classroom.

MISSED EXAMS: Students are allowed to drop their lowest exam, so generally, I will not allow students to make up missed exams unless they have notified me *well in advance* that they will not be present in class for some legitimate reason. If you practice a faith that does not allow you to attend class on high holidays, you must notify me by XXXXXX of any classes you will miss and make arrangements to complete the required work ahead of time.

QUIZZES: There will be ten weekly written quizzes over material covered during the previous lectures and in the reading assignments. These quizzes will be short and relatively easy if you have reviewed the material. You will have about eight minutes to complete them. Each quiz will be worth no more than ten points. We will go over the quizzes immediately in class, so you will know how you did. I will calculate your quiz average halfway through the term so you know where you stand.

INDEPENDENT PROJECTS: Each student will take part in an independent project on some environmental issue. Students may work individually, in pairs, or in groups of three. The topic ideally should be either one of local interest or of significance in your hometown. Each group or individual must submit a project proposal not to exceed two pages, a draft of the resulting research paper, and a final version of the paper (two copies). Additionally, each student or group will present their results to the class and other interested members of the Hendrix Community during a ten- to fifteen-minute presentation toward the end of the term. All students in a group will earn the same grade for their project; each student in a group will also evaluate every member's individual contribution to the project. The point breakdown is as follows:

proposal = 10
paper draft = 20
final paper = 20 (2 copies)
presentation = 50

ACADEMIC HONESTY: I am *very* serious about this! Cases of academic dishonesty will be dealt with according to the guidelines set forth in the Hendrix College Catalog. If you are at all unsure what constitutes academic dishonesty, *ask me!*

LABORATORY: Some of the laboratories will be field trips. The vans will leave at 1:10pm from the parking lot behind Greene Chapel. If you miss the van, you will be counted absent from the lab and your final grade will be reduced by 50 points. Dress appropriately for the field conditions. There is no smoking on field trips.

CLASS STRUCTURE: It is your responsibility to review the relevant material before class, so that lecture time can be spent clarifying difficult concepts and generating productive discussion. Active discussion and participation in lecture is expected, and failure to participate will negatively affect your grade via course total point deductions. Excellent participation is frequent, enthusiastic and demonstrates that you are paying attention and have prepared carefully in order to be able to contribute constructively in class. If you have questions about the material, don't hesitate to ask--chances are that if you have a question, there are others in the class with the same question.

STUDENTS WITH DISABILITIES: If any student feels that he or she has a disability that qualifies under the Americans with Disabilities Act and needs special accommodations, please let me know by XXXXX. It is your responsibility to alert Counseling Services at 450-1448 for the proper documentation in order to be granted special policies or procedures.

GRADING: A total of 830 points is possible for the course:

Four exams during term (100 points each, best three)	300
Comprehensive final exam	150
Quizzes	100
Independent Projects	100
Laboratory exercises (point values vary w/exercise)	<u>180</u>
	830

The grading scale will be as follows:

90% and above	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
≤ 59%	F