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

Mini-Grant Awarded May 2004

Bringing Evolution into the curriculum for non-science majors at the University of Richmond

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Date(s) of Project: June 2004-May 2005

1. Original Goals and objectives

The original goals of this course were to provide students with an understanding of evolution and how it shapes our lives and our planet. It intended to cover a broad range of topics including: what is evolution? The importance of evolutionary biology, natural selection and adaptation, origin of life, fossils, plate tectonics, biogeography, the genetics of evolution and biodiversity, human evolution, and cultural versus biological evolution.

2. If goals/objectives changed during the course of the project, please state the revised goals/objectives.

Goals of the course did not change during the course of the project.

3. In what ways were the goals/objectives met?

A critical step accomplished was for students to clearly differentiate between a scientific theory and a non-scientific theory. I think this is very critical and at the base of a lot of misconceptions about Evolution and science in general; starting with: what is a theory? What is a hypothesis? What do we mean by scientific data? This was accomplished by contrasting scientific and non-scientific theories, by analyzing the different theories statements of facts and the process/mechanism to explain those facts. Students were asked to formulate both what would be considered scientific and non-scientific theories.

Also, in order to better understand the impact of evolution on our everyday lives, students were required to perform 2 surveys. Each student was required to ask 10 adults (could not be family members, neither other students on campus) their views on a number of questions related to evolution. Guidelines requested that students would pay close attention to the demographics of the respondents (e.g., gender, race, age, political and or religion affiliation if any, level of formal education, etc.). Subsequently students typed a summary of their findings, the raw data response sheets, and a discussion of what the responses seemed to indicate about society's knowledge of, and relationship with, evolution. This individual activity was followed by an in-class discussion of the results of the survey that gave the students the opportunity to compare their results, and these in class discussion resulted in some very lively exchanges. These two surveys were done one at the beginning of the semester and the second one almost at the end of the semester. Although the questions on the survey were different, the time span between them gave me the opportunity to include in the discussion of the second survey an assessment of how the students views and understanding of evolution have changed over the course of the semester.

During laboratory exercises students learned to assess genetic diversity and their role in natural selection through a variety of hands-on exercises that included protein electrophoresis, DNA amplification and sequencing, crime and paternity test, etc. Also the sequence data collected was used to introduce the students to bioinformatics, through blast searches and gene identification.

4. Describe the evaluation/assessment process used. Summarize the results of this process. Include any instruments used to evaluate/assess your project.

Evaluation of the students consisted of: two tests, analyses of two written surveys, a written report that consisted of the evaluation of a movie review, students' class presentations, a written report on a hominid project, and weekly laboratory reports. The course had the University required student evaluation at the end of the semester. In addition, I found it very useful to assess how much the students understood about evolution by reading their report on movie of their choice. For this assignment each student wrote a five-page paper reviewing a movie relating to evolution. Guidelines indicated that students would be graded on their ability to explain how the movie incorporates evolution, evolutionary theory, evolution and society, etc, and the movie choices could include any movie based on medical procedures, scientific techniques, or biological topics, as long as they related to evolution.

Reading these reviews led me to believe that students grasped and understood two critical points that were previously misunderstood by the majority of the class. First, students got to frame evolution on more realistic time framework; this is by far the most common criticism in their movies reviews. The second most common criticism they presented in their reports was the implication of "progression" or "tendency towards improvement" presented in the films. The lack of goal or progression is a very common misunderstanding of the evolutionary theory.

NOTE: Please contact Dr. de Sá [rdesa@richmond.edu] directly for further information on the student surveys and evaluations.

5. If you were to redesign your project, what would you do differently and why?

One thing I would change is that I would give the students additional deadlines throughout the semester for those projects that were given to them early on to work throughout the semester. I think some of the students would have benefited from forcing them to write short progress reports on their progress. A few students just did not take the time to work on a topic throughout the semester and tried to get things done at the last minute.

I also may take some additional content out of the lecture and place it in the laboratory exercises that would give me time for additional class discussions. Another thing that took me by surprise was that out of 39 students in class about 4-5 self identified as having strong conservative religious views. I did not expect these students to choose to take evolution as one of their electives. In a way, some of their behaviors were disruptive to class discussions and activities. I had never encountered before students who would not answer questions on a test just because they did not "believe in evolution." Because of my experiences in this class, I think I now am better prepared to address such student concerns than I was before I taught this class.

6. How have you shared the results with ACS colleagues and beyond ACS?

I participated in the ACS workshop that took place in November 2004, at Millsap College in Jackson, MS. At that meeting I presented a poster on the development of the non-major evolution course. I also plan to attend the ACS workshop that will take place in September 2005 to share this experience with the next group of colleagues that received mini grants to develop their courses. At that meeting, I will be interested to find out other mechanisms to share results beyond ACS.

7. What are the next steps (follow-up) in your project?

One of my current goals for this course is to find additional readings that I can incorporate into the course to stimulate further class discussion. I ran into the problem that the primary literature I had selected for class discussions was far beyond the students' background and ability to understand. They would have been more appropriate for a freshman, introductory, biology majors course, but were beyond the reach of the non-majors. Part of the problem was that one of the books 1 wanted to use in the course to stimulate class discussion is out of print, and there are no plans to reprint it.

8. **Please include a statement than you give ACS permission to post your original proposal and the results of your work on the ACS Science Reform website.**

I give ACS permission to post the original proposal on the ACS Science Reform website and this modified final report.