

Integrating Science and Society into Non-majors Science Courses

Jane Beiswenger and Mark Lyford
University of Wyoming

Abstract

In today's fast changing world it is becoming increasingly important for citizens to understand the complex connections and interactions between science and society. In three of our science courses for non-majors at the University of Wyoming we have placed an emphasis on integrating societal issues with course content. Each involves a different approach with varying scale of engagement. In one biology course of 40 elementary education majors, students are required to give a short presentation about an article they find in a newspaper, popular magazine, or reliable web source. Following the report, each student formulates questions about what they have heard. Questions are categorized as fact, opinion, or explanation questions and are tracked throughout the semester. In an integrated science course of 60 students, discussion sections serve as the means for integration of societal issues. During the semester, students investigate three issues that are complex from both a social and scientific standpoint. Different methods are used in training students on each issue, such as concept maps and cost/benefit analyses. Pre- and post-surveys are given to assess student learning. In a larger biology course (100-150 students), the entire semester is centered on three questions about issues that involve both science and society, such as genetic engineering. Through integrated lectures, discussions and laboratories, students investigate the aspects of biology and related sciences that are needed to answer the questions and understand the societal impacts of each issue.

Biology 1020

Biology 1020 is a biology course designed specifically for elementary education majors at the University of Wyoming. The course meets during two 3-hour blocks each week, during which time intermixed lecture, laboratory and discussions focus on key principles of biology and overlapping societal issues. One of the assignments for the course focuses on the quality of students questioning, as questions ultimately drive scientific endeavors. Throughout the semester, each student is required to provide a short presentation on a biological topic as it relates to society, such as genetically modified foods. Following each presentation, students formulate one question to be posed to the presenter. Questions are categorized as fact or explanation, and each category is tracked throughout the course of the semester. It was hypothesized that repeated exposure to socially relevant topics will influence the type of questions the students ask about these topics.

Initially, the hypothesis was supported (Figure 1). However this did not continue (Figure 2). This may be due to the differences in topics used across these courses. As the procedure became less onerous for the students, their attitude toward the project improved (Figure 3).

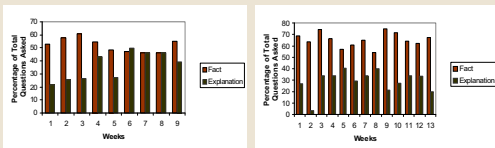


Fig. 1. Percentage of fact and explanation questions asked in Biol 1020, Fall, 2003. Fig. 2. Percentage of fact and explanation questions asked in Biol 1020, Spring, 2004.

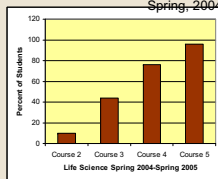


Fig. 3. Percentage of students who were positive about the assignment, Biol 1020.

Biology 1002

Biology 1002, Discovering Science, is an integrated science course for non-majors at the University of Wyoming. During lecture, central concepts of Physics, Chemistry, Biology, and Geology are interwoven around five issues. Laboratory sessions are designed to engage students in the process of science. While societal issues are referred to in lecture and lab, weekly discussions provide the critical forum for linking science and society. The primary goal is for students to become more thoughtful citizens, ones who form opinions on complex issues by thinking from a scientific and social standpoint.

Discussions focus on three complex issues; Energy Use, Global Warming, and Genetic Engineering. Students complete pre- and post-surveys for each issue, and are trained through a variety of techniques (creating concept maps, developing energy plans, completing cost/benefit analyses, compiling pro-con lists) to further their thinking both scientifically and socially. Students also complete pre- and post-surveys on three issues on which they are not trained to determine if they are capable of transferring the thought process to other topics.

On the survey, students must respond to a question on each topic and back their opinion with scientific evidence. With each issue, students support their opinions with more evidence on the post survey (Figure 1). Although the number of points raised is fewer as the semester progresses, data indicates the quality of points increases. Similarly, as the semester progresses, students are able to identify more societal issues on the post surveys (Figure 2). Unfortunately, when completing surveys for 3 issues in which they are not trained, students do not appear to be transferring this thought process to new situations (Figures 3 and 4).

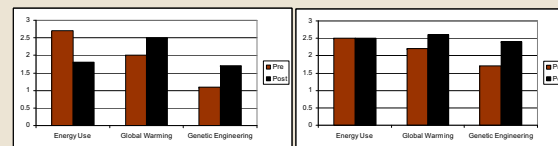


Fig. 1. Number of scientific points used as evidence to support opinion on issues. Fig. 2. Number of points raised linking each issue to societal issues.

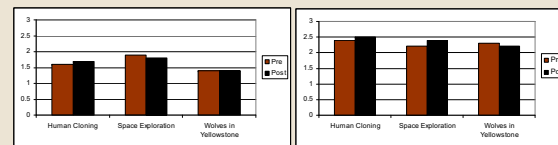


Fig. 3. Number of scientific points used as evidence to support opinion on issues. Fig. 4. Number of points raised linking each issue to societal issues.

Biology 1003

Biology 1003 is a new non-majors biology course at the University of Wyoming. Throughout the semester, the course will address three central questions:

Antibacterial products seem like a good idea. Why would anyone worry about using them?

There are plenty of resources in the United States. Why worry about population growth?

Scientists have mapped the entire human genome. Can they now engineer cures for heart disease and cancer and for fruits that resist all pests?

Each question is posed from a social perspective. Hence, in answering each, social issues must be addressed. However, to truly understand each issue, fundamental biological concepts must be addressed, including cell structure and function, genetics, DNA structure and function, population growth models, evolution, natural selection, among others.

Students will complete pre-and post-course assessment of their ideas about these questions. These surveys will include social awareness variables as well as understanding of central biological concepts.

During the course of the semester, we will utilize a wide variety of active learning techniques, and rely very little on traditional lecturing practices. Group work, discussion, and hands-on laboratory activities will drive the majority of the semester.

Acknowledgements

We wish to thank Julie Cook-Griffith, Melanie Forbes, Beth Rintz, and Yvonne Schlaman for their assistance with Biology 1020 and Biology 1002. Amy Krist (University of Wyoming) has been instrumental in the development of Biology 1003. We also wish to thank our colleagues at the University of Wyoming who have collaborated on a Foundation for the Improvement of Post-Secondary Education grant and have helped shaped the ideas for each of these courses: Jim Myers, Erin Campbell-Stone, April Heaney, Garth Massey, and Rod Garnett.