Introduction

Modern industrial societies use a wide variety of Earth resources, often in astounding volumes. Unfortunately, their irregular distribution can cause conflict between nations and the host of the large international trade in valuable critical resources, e.g., petroleum. At the same time, the extraction and use of many Earth resources often with severe environmental consequences. Yet until the human race decides to return to a pre-industrial state, we must produce these resources where they are found and then deal with what might occur. Increasingly, citizens of a democracy are faced with issues of resource availability, extraction, and use. To educate citizens about the geopolitical aspects of these issues, one of us (Myers) has long taught a course on Earth Resources. Although well received by students, Myers has heard comments about how well the course prepared students to deal with these issues. As part of the FIPSE grant, Myers and Massey conducted an analysis of the tools (literacies) students need to turn the geologic knowledge of this course into institutional understanding and in the future to apply it systematically, naturally, and effectively to a wide range of resource issues. Our analysis identified three literacies critical to this goal: (1) fundamental literacies to handle data, observations and fact; (2) technical literacies to master geologic principles; and (3) citizenship literacies to apply geologic understanding to specific resource problems. Our analysis also suggested the best place to provide the students with continuous and extensive practice with these literacies in is in lab. Thus, we designed a new interactive lab module for the course in the spring of 2005.

GEOL3300: Earth Resources is an upper division course for both geology and non-geology majors and is a focus on the interrelatedness of geological, economic, and social science. The non-majors are exposed to four distinct disciplines as an introduction into the complex and various sciences. This mix of technical and non-technical students provides a refreshing aspect to the course, but can create pedagogical challenges.

The course covers all aspects of resource issues including energy, metals, water, chemical and industrial minerals as well as building materials. For each topic, the geologic processes that create the resource, the production techniques used for extraction and the impacts of the resource’s use are all examined. Because of the breadth of the topics and the desire to incorporate a more complete and extensive treatment of the literacies into the course, Earth Resources will be split into six smaller units (Earth and Mineral Resources and Energy: A Geologic Perspective) beginning in the fall of 2005. These new courses will maintain the format of the current course, but will cover each subject in greater depth.

As part of the course redesign, we have significantly revised the lab component. From the older course we kept a number of characteristics:

- group learning
- peer instruction
- problem solving
- written and oral presentations
- repetition and practice

All of these are good pedagogical practices that have been shown to improve student learning. To these we added connected real-life problems and situations. The extensive use of case studies provides this connection. In this paper, we will design the labs so that they build on previ-ous work and so that the complexities of the lab increase throughout the course. In this manner, we will provide students with ample practice with each of these literacies while providing them with a wealth of geologic knowledge.

The Lab Module Prototype

The major new addition to the lab will be the introduction of an interactive lab module. A lab module will focus on one resource issue but address it from three different aspects: geologic, economic, and social. A single module will cover three weeks with each week addressing a different focus. The concept of the lab module can be illustrated by the lab we plan for gold.

Gold Mining: Jewelry’s Enduring Legacy

Introduction

1. Department of Geology & Geophysics, 2Department of Sociology & International Studies Program, 3Ellbogen Center for Teaching & Learning University of Wyoming

The Course

The Geology

The geology component of each lab module has students applying geologic principles discussed in lectures to hypothetical resource problems. In particular, they are to locate and assess several potential resources. They will give oral and written presentations.

For the last part of the exploration, students are required to complete a geologic prospect evaluation project. This package spanning 3 lab sessions. Each session focuses on a different resource aspect, (geology, economics and social) and the student teams are required to design and complete a prospect evaluation plan for each field. Based on these results, they must make an economic decision about drilling or not drilling.

The Lab Module Components

The Focus Groups

• understanding the complexities of Earth resource issues requires master- ing a set of literacies
• literacies fall into three classes: fundamental, technical, and citizenship
• to provide students with practice using these literacies on real Earth resource problems, we have designed a new interactive lab module
• a module spans three weeks of lab sessions and covers a single broad topic such as gold, petroleum, nuclear power, etc.
• each component of a module focuses on a different aspect of the resource, e.g., geologic, economic and social
• class observations and focus groups suggest students like the module approch and recommend it for all labs in the course

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The Focus Groups

To get an independent assessment of the new lab module prototypes and a comparison of the integrated topic approach to the traditional stand alone labs, Jane Nelson of the Ellbogen Center for Teaching and Learning conducted focus groups with the two lab sections during the last lab period of the semester. The sessions took about 90 minutes each. Before the focus group, Myers and Massey pre- pared a set of questions about the module for Nelson to address during the focus groups.

The overall conclusion is that the students felt the new module is a much better way of learning about Earth resources. Specifically, the peer component was more engaging and helped them remember topics better. Almost unanimously, the students felt activities in the course should be taught using this new approach even though it com-plexes more work for them.

The Social Impact

The last component of a lab module takes the extraction not extract decision one step further. It considers the potential social impact of extraction on various populations living near the resource. It uses extensively the various citizenship literacies.

There is a great need for training students to work with these literacies as well as providing for continuous and extensive practice with them.

The Evaluation

To assess the new lab module prototypes, Myers observed all three labs of the petroleum module whereas Massey sat in on only the last component of the module. Some of our observations include:
• students were actively engaged in all aspects of the project;
• web delivery of supporting material was successful - students routinely followed the web for information during work;
• oral presentations were well received and peer pressure resulted in improved presentations through feedback;
• engagement among these labs was much greater than during the traditional labs.

Classroom Observation

To test the concept of the lab module, we kept the introductory labs from previous semesters, but developed one prototype lab module on petroleum (see schedule below). After running both types of labs this semester, we evaluated from the students the two types of labs. Our evaluation consisted of class- room observations by Myers and Massey as well as focus groups conducted by Nelson and observed by Massey. Both forums indicat- ed that the new module an effective teaching mechanism, at least from a student viewpoint.

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