NSF Native Cases Project

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For more Information

http://www.evergreen.edu/tribal/cases/home.htm

Summary

This project is an NSF CCLI Educational Materials Development (EMD) program as a Phase 2 Expansion Project. The lead institution for the project is The Evergreen State College. The project also involves two tribal colleges, Northwest Indian College, Salish Kootenai Tribal College), Grays Harbor College, and Washington Online, the distance learning consortium for the 32 colleges of the Washington State Community and Technical Colleges. The project focuses on creating new learning materials and teaching strategies, developing faculty expertise, and implementing educational innovations.

The project builds on a successful three-year pilot program (the Enduring Legacies Project) funded by Lumina Foundation for Education. The previous project developed an effective case format and field testing procedure, offered three successful four day summer institutes for faculty on writing and teaching cases, and produced and implemented 26 cases in both online and face-to-face classes. The cases were extremely successful with Native students.

Project Goals

In terms of intellectual merit, the project addresses a significant void in the literature in appropriate curriculum focusing on American Indians. Developing culturally relevant educational materials is important in improving the participation and graduation rates of Native American students and in supporting Native American efforts towards self-governance. We propose to develop at least 16 original teaching cases focused on issues confronting Native American people and communities. The content focus will be on the environment, natural and cultural resources, and health and wellness. Many of the cases will also be developed specifically to enhance student's abilities in quantitative reasoning. Teaching notes will accompany each case and include detailed information on how to teach interdisciplinary cases in different modes of delivery (face-to-face and online, large and small classes, etc.). Faculty development activities include an Annual summer institute as well as off-site workshops to reach out to other tribal colleges and colleges and universities with substantial enrollments of American Indian students. Web-based dissemination methods include a substantial website and dissemination through Washington Online's newly emerging online course repository which will produce materials to complement the more than 650 online courses it sponsors.

Project Design/Elements

This is a significant project for a number of reasons: first, it addresses a significant void in the literature and develops, field tests, and disseminates new learning materials and teaching strategies; second, it implements and assesses a new educational approach; third, it addresses the important issue of educating Native Americans, a population that is seriously under-served in higher education. Finally, it demonstrates how institutions can collaborate and work with Native American communities and leaders to improve higher education.

Evaluation and Assessment Strategies

The project will be subject to a rigorous formative and summative evaluation plan. Formative evaluation is critical to the iterative cycle built into a project that focuses on faculty development and the development,

implementation, and refinement of educational materials. It is also critical to team building and organizational learning. In our pilot project we used a continuous improvement process (described in our article "Effective Ways to Promote Learning and Program Improvement" see references) which was labor intension but remarkably successful. This same process will be used in this project with Barbara Leigh Smith acting as the internal evaluator playing this role.

Evaluation procedures will allow us assess progress against schedule, whether the steps of the grant were realized, and whether the goals of student learning and faculty development were accomplished. Measurable outcomes and evaluation procedures are described in the following table: [to be included later}.

Products, Key Findings, Publications

see project website for the cases written: http://www.evergreen.edu/tribal/cases/home.htm

Smith, B L. Understanding of Sovereignty and Identity Improved by Learning with Cases. Tribal College Journal. Vol 20, No, 1. Winter 2008, pp 38-41.

Preparing Students for Citizenship: Fostering Critical Thinking and Problem-solving Skills through Quantitative Reasoning and Scientific Literacy

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For more Information

http://www.gg.uwyo.edu/geol1600/

Summary

Through the creation of a new integrated science course entitled **Global Sustainability: Managing the Earth's Resources**, this project will prepare students for their roles as active and effective citizens in an industrialized democracy. This course, which is aimed at both STEM and non-STEM students in the first and second years of their academic careers, will create connections to the social sciences by presenting science in global context. In addition to integrating the natural sciences, i.e. biological, physical and Earth, it will focus on improving student critical thinking and problem-solving skills. To reduce or eliminate the barriers to student success posed by inadequate literacy skills, training in the literacies necessary to master scientific content will be an integral and explicit component of the course. Armed with improved quantitative reasoning and scientific understanding, students will be better prepared to apply their critical thinking abilities and problem solving skills to the multifaceted and complex issues of global sustainability, a topic critical to all inhabitants of the planet.

Project Goals

The primary goal of this project is to prepare students for citizenship by improving their critical thinking abilities and problem-solving skills while expanding their capacity to reason quantitatively at a variety of cognitive levels and in a range of real world situations. By focusing on societal issues routinely reported in the media, the project will also foster an understanding of the importance of scientific and quantitative literacies in making sound personal as well as political choices. Simultaneously, the project's sustainability focus will introduce students to the variety of perspectives (often conflicting and competing) that must be considered when devising solutions to the many facets of global sustainability. In this manner, the project will foster a sense of global community.

Specific Project Objectives:

Objective 1. Implement an integrated, interdisciplinary sustainability course.
Objective 2: Design, develop and construct learning materials to support meaningful learning.
Objective 3. Develop a catalog of sustainability case studies to create a meaningful lab experience.
Objective 4. Disseminate our learning objects for use by other science instructors.
Objective 5. Develop, test and distribute assessment tools for measuring scientific and quantitative literacy

Project Design/Elements

The likelihood of students achieving deep and meaningful scientific understanding, and applying it effectively to societal problems, is grounded on three sound foundations: mastery of literacy skills, contextualized scientific content knowledge and social relevancy. Like any other profession, science has a

set of literacies that must be mastered before scientific problems can be addressed in an effective and successful manner. The three literacy classes that students must master to achieve scientific understanding and their relation to each other is illustrated by the***literacy triangle*** (see attached file). At the base of the triangle are the ***fundamental literacies*** that allow individuals to interpret and manipulate facts, data and observations, i.e. read a table or interpret a graph; 2) make qualitative assessments; and 3) perform simple quantitative calculations. These tools are a subset of the larger quantitative reasoning skills (Steen, 2001) and important in the physical and social sciences as well as the real world. The ***technical literacies*** are those skills/abilities necessary to master the content of a particular scientific discipline. When combined with scientific content, the literacies lead to scientific understanding. Successful application of scientific understanding to societal issues requires ***citizenship literacies***. They permit an individual to use their scientific understanding to evaluate the impact of human activities from a range of perspectives (economic, social, cultural, etc.).

A sound factual knowledge basis is also important for understanding a scientific discipline (NRC, 2000). However to be useful, this knowledge must be organized or contextualize so relevant information can be retrieve quickly and applied effectively. This knowledge organization comes only with a deep subject understanding. The broad-brush, fast science coverage so common to introductory courses does not build this type of knowledge. Thus, lasting sciencific comprehension comes down to content depth vs. breadth. To help students build the type of factual knowledge a subject expert has access to, the student must be given sufficient time to explore a subject. Thus, material must be omitted from the course to produce long-term retention and use. Scientific content must be strained through a simple sieve. "Is a citizen likely to need to know this information?" Disciplinary breadth is sacrificed for meaningful depth.

Responsible citizenship is not an abstract concept. It is an active involvement in the issues and problems a democratic society routinely faces. Because many of these issues are scientific in nature, students must be scientifically literate to address them . Thus, introductory science courses should place scientific content in social contexts highly relevant to active citizen participation. Rather than providing fabricated contexts, students must encounter science in the economic, political, cultural and social settings they may encounter in the media. Active global citizenship requires students to be aware of, and capable of understanding other, situations in both their scientific complexity and their social dimensions.

Supported by a FIPSE grant at the University of Wyoming, Myers and Campbell-Stone (Geology & Geophysics) in collaboration with Professor Garth Massey (International Studies) used these three fundamental foundations to develop a new course paradigm: Literacies and Scientific Content in Social Context ($L(SC)^2$). $L(SC)^2$ redefines and expands the concept of the interdisciplinary course. It addresses scientific literacy while promoting mastery of fundamental quantitative and qualitative skills, as well habits of mind necessary for active civic engagement. Literacy (skills) training provides the quantitative and qualitative tools necessary to function in a numbers-oriented, technological society. Scientific content illustrates the limitations imposed by the natural world on what can be accomplished through science, technology and engineering. Science in real-world social context also explicitly reveals draws connections to students' everyday lives. At the same time, experience in addressing realistic, real-life problems instills a sense of social and political efficacy and responsibility. Case studies set in local, regional, national or international situations teach citizenship literacies while demonstrating the social relevance of science. By helping students acquire fundamental, technical and citizenship literacies in a scientific and social framework that engages them in discussions, role playing, negotiations and the formulation of alternative strategies, the $L(SC)^2$ paradigm encourages active citizenship extending well beyond students' academic careers.

During the first year of this project, we have developed four case studies. This first round of cases examines issues of water, energy (coal and petroleum) and metal mining and processing (gold). The four case studies currently in our sustainability catalog are: Water in Bangladesh: Tube Wells and Arsenic; Energy: Coal, China & Climate Change; Gold: Satisfying a Global Demand; and Energy: Petroleum – A Critical Resource. Each case study consists of two parts focused on different aspects of a sustainability problem. In most cases, the first part of a case study examines the geologic and scientific components of the issue. Building on this new scientific understanding, the second part normally examines a social or economic component of the problem. In both parts, students are assigned a role that a professional working for different organizations might carry out as part of his/her job. In this manner, students get multiple perspectives on different issues and explore some of the complexities and uncertainties

surrounding nearly all sustainability issues.

Evaluation and Assessment Strategies

Evaluation and assessment will be conducted on the: 1) digital content produced; and 2) learning materials developed. The latter includes, but is not restricted to: a) literacy tools; b) case studies; c) lecture activities; as well as d) the Global Sustainability course. We will also evaluate the impact of these teaching methods and activities on student learning. Finally, we will continually evaluate the effectiveness and progress of the entire Global Sustainability project throughout its lifetime.

Products, Key Findings, Publications

Myers, J.D., and G. Massey, 2008, Earth Resources: What's Sociology Got to Do with It?: in Hartman, H. (ed.), Integrating the Sciences and Society: Challenges, Practices, and Potentials, Research in Social Problems and Public Policy, vol. 16, pp. 76-98.

Campbell-Stone, E.A., and J.D. Myers, 2008, Teaching Sustainability from a Scientific Standpoint at the Introductory Level: Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract ED31A-0584.

Myers, J.D., E.A. Campbell-Stone and G. Massey, 2008, Redesigning Introductory Science Courses to Teach Sustainability: Introducing the L(SC)2 Paradigm: Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract ED21A-0609.

Related or Similar Projects

Energy: A Geological Perspective (http://www.gg.uwyo.edu/geol3650/)
Earth and Mineral Resources (http://www.gg.uwyo.edu/geol3600/)

The Math You Need, When You Need It

Resources For Students in Introductory Geoscience

Eric Baer, Highline Community College, and Jennifer M. Wenner, University of Wisconsin Oshkosh
Funding provided by NSF Grant Numbers DUE-633755 and DUE-633402
Sponsored by the National Association of Geoscience Teachers

For More Information

The Math You Need When You Need It

Summary

The Math You Need, When You Need It modules cover quantitative topics that are important in introductory geoscience courses. Each topic includes a page for the instructor, quantitative information for the students, a set of practice problems and culminates in an on-line quiz that is automatically graded and submitted to the instructor. The project is designed to give introductory geoscience students the quantitative knowledge that they need, just before they need to use it in their concurrent geoscience course. This program includes pre- and post-testing and self-paced modules.

Project Goals

- Production and use of appropriate "the math you need, when you need it" modules
- Improving introductory geoscience students' mastery of, and comfort with quantitative skills.
- Increased retention and student success in introductory geoscience courses
- Facilitating the addition of more quantitative materials in introductory geoscience courses.

Our project is designed to increase quantitative literacy of geoscience students by facilitating use and transfer of mathematical concepts to multiple geologic contexts.

Project Design/Elements

This project is designed to include stand alone modules covering quantitative concepts that can be used in conjunction with a concurrent introductory geoscience course. The modular nature of this project makes it readily adaptable to any introductory geoscience course that involves quantitative concepts - instructors can choose which modules work with their syllabus and which subjects are covered on the final quiz. These modules are designed to be completed by the students who need them most, just before quantitative concepts are covered in class.

Each module consists of an explanation of the quantitative concept (e.g., unit conversions, rearranging equations), a number of sample problems for the student to work through (e.g., unit examples, equation examples), and a culminating exam testing whether the student understands the concepts. The explanation

and problems are written from the perspective of geoscientists who teach these concepts regularly. Each module uses best practices in teaching college level mathematics and are all in the context of the geosciences.

Instructors can readily adapt these modules for use in any geoscience course. The modules are designed so that they could be used in any order and have an instructor page explaining what is important on the page (e.g., calculating density, trigonometry). Questions on the pre-test and the post-module quizzes can be adopted from a bank of questions that address a given quantitative concept in multiple geoscience contexts. The multiple contexts speak to the issue of transfer of mathematical concepts to new and distinct topics. We also encourage instructors to author their own questions for the quizzes/tests.

What does the program do, why is it important, why was it designed this way. Challenges, great success, tips for others doing this? How is it done. Collaborating partners. Research questions

This is the place to tell us all about what you are doing, how you are doing, and why you are doing it that way. Also what is working, what is challenging, and what you have learned about doing it better or more easily.

Evaluation and Assessment Strategies

Project evaluation focuses on three outcomes:

1. the production and use of the modules in geoscience courses
2. student performance in modules and in geoscience courses
3. faculty comfort with the addition of quantitative content of introductory geoscience courses.

Formative assessment of the project relies on quantitative and qualitative measures of these outcomes in the form of pre-and post-module data collection, walk-throughs, surveys and interviews. Feedback from these assessment are used to modify our product during the development phase of the project and as summative feedback for final project evaluation.

Products, Key Findings, Publications

The Math You Need When You Need It modules

Assessing Quantitative Learning with The Math You Need When You Need It, AGU Annual Meeting 2008 (to be presented December 18, 2008, 12:05 pm)

The Math You Need When You Need It: Web-Based Modules to Help Students Succeed in Introductory Geoscience Courses, GSA Annual Meeting 2008, download poster (Acrobat (PDF) 41.8MB Nov14 08)

The Math You Need, When You Need It: Student-Centered Web Resources Designed to Decrease Math Review and Increase Quantitative Geology in the Classroom, AGU Annual Meeting 2007

Related or Similar Projects