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Using Problem-based Learning Techniques to Develop Thinking and Writing Skills in a the Natural Resource Management Curriculum

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UNIVERSITY OF
DELAWARE

COLLEGE OF AGRICULTURE
& NATURAL RESOURCES



NATURAL RESOURCE MANAGEMENT (NRM)

Relatively new interdisciplinary major in the College of Agriculture and Natural Resources.

Co-sponsored by Entomology and Applied Ecology, Food and Resource Economics, and Plant and Soil Sciences.

In response to increased awareness of the benefits of problem-based learning techniques, faculty have incorporated problem-based learning techniques into several courses in the NRM major.



BRIEF HISTORY OF THE NRM MAJOR

First freshmen students were admitted in the Fall of 1997.

Goal – to produce graduates with:

- an understanding of the social, physical, economic, legal and political problems of managing the use of natural resources in the 21st century and**
- the skills and capabilities to address those problems in both public or private forums.**



DESIRED CHARACTERISTICS OF GRADUATES

- **the skills required to solve "real world" problems;**
- **the ability to write and speak effectively;**
- **a solid understanding of natural sciences, mathematics, statistics, economics and public policy;**
- **a sound knowledge of the world's biodiversity;**
- **a competence in using computers to manage information and solve problems;**
- **a broad interdisciplinary education in the arts, humanities and social sciences; and**
- **an awareness of the ethical issues in natural resource use.**



CURRENTLY

NRM major has 21 majors and 22 graduates (Spring 2003).

The graduates have been successful in finding jobs in both the private and public sectors as well as attending graduate and law school.

Employers of recent graduates:

- **Clayton Group Services (national consulting firm)**
- **Environmental Alliance (regional consulting firm)**
- **Maryland Environmental Services**
- **Kent County (Delaware) Conservation District**
- **Horne Engineering Services**
- **Department of Natural Resources and Environmental Control (Delaware).**

NRM Web Site:

<http://www.udel.edu/FREC/hastings/nrm/index.html>

NRM Graduates at Work





PROBLEM-BASED LEARNING INITIATIVES AT THE UNIVERSITY OF DELAWARE

Introduction of problem-based learning into courses and curricula at the University of Delaware began in 1992 (Duch, Groh and Allen, 2001).

University of Delaware has become a national and international leader in the use, training and development of problem-based learning.



RECENT ACTIVITIES AT U OF DE

- **continued training of faculty in active learning via the Institute for Transforming Undergraduate Education (ITUE);**
- **funding from both the National Science Foundation and the Pew Charitable Trusts to support training and development;**
- **developed (and hosting) the Problem-Based Learning Clearinghouse, a peer-reviewed online repository of problem-based learning problems; and**
- **in June 2002, hosted PBL 2002: A Pathway to Better Learning, an international conference on problem-based learning.**



PROBLEM-BASED LEARNING IN THE NRM CURRICULUM

The problem-based learning process is:

- **students are presented with a problem;**
- **groups identify “learning issues” or aspects of the problem;**
- **issues are ranked and assigned to be investigated by the group or individually;**
- **the issues are explored and new learning issues developed as the process continues.**

Numerous operational models exist: a problem to be solved / explored, student’s working in groups, independent exploration by the students, and discussion and/or presentation of findings.

These techniques have become popular with faculty who teach courses in the NRM major.



COURSES IN NRM CURRICULUM

FREC 408 – Statistical Research Methods

FREC 249 – Community Economic Development

FREC 450 – Topics in Environmental Law

FREC 467 – Capstone: Interdisciplinary Natural Resource Management



FREC 408 – Research Methods

Purpose - Emphasizes Research Methodologies and covers elementary statistics from descriptive statistics through regression.

Designed for upper-class students in our College.

Typical enrollment - 50 students from a diverse set of majors.



PBL Components of FREC 408 –

- **Nine assignments done by student groups.**
- **One, of three, classes per week, allocated to these assignments.**
- **Instructor and a graduate teaching assistant circulated among the groups for assistance.**



Student Evaluations

- **Group assignments were rated as *Very Useful* or *Useful* by over 80% of the students.**
- **Over 50% rated the group assignments as *Very Useful*.**
- **On a scale of 1 – 10, students rated the “effectiveness of the group assignments in helping the student understand the material” as 7.7.**



Instructor Assessment

- **Group assignments are beneficial - break up the monotony of lectures; challenge the students; and gives them an opportunity to work together.**
- **Being able to write and explain statistical results is important, “the bottom line” of analysis– often challenging for students.**
- **These are “acquired” skills that come with practice.**



FREC 429 – Community Economic Development

Purpose - introduce students to: the principles of community economic development in the United States and to enhance students' ability to recognize, understand and respond to economic development issues.

**Not a required course for any major - offers breadth.
Optional requirement for majors in NRM .**



PBL Components of FREC 429 -

- **Mini-lectures by the instructor and presentations of articles by students.**
- **Teams of 3- 4 students are required to function as “economic consultants”.**
- **Each team “adopts” a county and addresses various economic development issues about the county.**
- **Initial questions are provided to assist the process.**
- **Teams organize themselves and assign roles and responsibilities for each of the projects.**



Student Evaluations

- **Group work is a “strength” of the course.**
- **Course material is applicable to the “real world”.**
- **Student thought they could apply what they learned in class to economic development issues.**



Instructor Assessment

- **Overall, the group activities are beneficial. After some hesitation, most students “get into them”.**
- **Increase student awareness of local economic issues.**
- **Sometimes intervention is necessary to address unequal effort by team members.**
- **Class time must be allocated for group work – less time to lecture!**
- **Assigning credit and grades for group activities is difficult.**



FREC 450 Topics in Environmental Law

Purpose – seminar style course that focuses on the institutions and processes of environmental conflict resolution in the United States.

A very popular course in NRM and Wildlife Conservation.

Typical enrollment is 15 – 25 students.



PBL Components –

- **Students are divided into five permanent groups.**
- **Class activities include 50-minute problems, role-playing advocacy, group reflection, and peer review.**
- **Students select an environmental conflict to study in a semester-long assignment focusing on student analysis and the assimilation of peer and instructor reviews.**
- **A Web-based interface allows students to submit six components of the assignment for peer and instructor review and evaluation.**



Student Evaluations

- **The individual project spanning the semester was very useful.**
- **The Website aspect of the course was useful.**
- **I really enjoyed the class. I definitely have a new view and way of thinking about environmental problems.**



Instructor Assessment

- **The effect of the PBL activities on student learning is positive.**
- **The incentive to produce a higher quality product is quite strong when all work submitted is available for peer (student) review.**
- **Overall, the students learned more, spent more time learning, enjoyed class more, and produced higher-quality projects.**
- **The process tends to screen out poor writing and weak argumentation.**
- **In the last five years, over 10 of these papers have placed as finalists in the University's Undergraduate Legal Studies paper competition.**



ENTO 467 – Capstone: Interdisciplinary Natural Resource Management

Purpose - course focuses on an interdisciplinary approach to examining the White Clay Creek Watershed (Delaware and Pennsylvania).

Capstone course for NRM, Wildlife Conservation and Environmental Soil Science majors. Eight students in the first offering.



PBL Components in ENTO 467–

- **Instructor and local experts introduce issues via mini-lectures.**
- **Assignments focused on using collaboration to solve natural resource management problems.**
- **Students used text, government reports and studies, and Web resources.**
- **Students groups were changed for each assignment (3).**



Student Evaluations

- **Group assignments, individual assignments and guest speakers were *Very Useful* aspects of the course.**
- **Group work was *Very Effective* (8.65 on a 10 point scale) in helping understand the course material.**
- **“Best” parts of group work are dividing up work and hearing alternative ideas and views.**
- **The strengths of the course were “teamwork”, “real-life problems” and applying what they had learned.**



Instructor Assessment

- **Students gained skills in finding relevant resources for problems.**
- **Sharpened group activity skills.**
- **Improved oral/written communications using "real world" problems.**



SUMMARY

Many faculty who teach required and optional courses in the NRM major have incorporated problem-based learning techniques into their courses.

The changes have added new dimensions to students' learning processes. The changes are viewed as positive by both students and the instructors.

The use of these problem-based learning techniques help produce NRM graduates with many desired skills including the ability to solve (think) "real world" problems, the ability to write and speak effectively, the use of technology to manage information and an interdisciplinary understanding of the world around them.



COURSE WEBSITES

FREC 408- <http://www.udel.edu/FREC/ilvento/FREC408/>

FREC 429 - <http://udel.edu/~hastings/frec429/429infowimage.html>

FREC 450 - <http://www.udel.edu/FREC/duke/B/450main.html>

FREC 467 - http://copland.udel.edu/~dmcaron/ENTO_FREC467.htm