REPORT ON USE OF RESULTS OF THE GLRCINSF SUMMER PRACTICUM IN GEOGRAPHY AND GEOLOGY CLASSES

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Technique Keywords: environmental impact analysis

Pedagogy Keywords: course-introductory, student-centered learning, educational materials

Overview: Dr. Helgeland revised several introductory geography and geology courses to incorporate Great Lakes ecosystem dynamics concepts, and she created an environmental analysis project for students concerning storage of nuclear wastes by local power plants. She also created an “essay problem chart” to easily identify problem areas in students’ writing.

Introduction

When I applied for the Great Lakes Research Consortium’s Ecosystem Dynamics practicum, I intended to use the information primarily in Geology 169, Earth Science and the Human Environment. I had taught the course during the spring semester of 1992. Because the UWC-Manitowoc County is a small campus (head count of 500), many of our classes, including Geology 169, are taught on a two-year rotation. Since I will not teach the course again until the spring of 1994, I have started, but not yet finished, developing materials for use in the class. These materials will be revised during the fall of 1993, using the experiences to be gained in teaching Geography 350 (discussed below) as a guide since the 350 class has been extensively restructured using the practicum concepts.

Geography 350

In January 1993, our campus curriculum committee requested that I teach Geography 350, Environmental Conservation, in fall 1993. The course has not been offered since 1985 and because of changes in the state of Wisconsin mandates for education majors, we did not anticipate offering it again at all. However, the state recently revised (again) their mandates and 350 once again satisfies significant requirements for our education majors.

The GLRC-ED program will be extremely useful for teaching 350; it is certainly serendipitous that I attended the practicum since I gained many ideas for updating and invigorating the course. I have completely revised its structure compared to the last time I taught it; all topics are now organized around the completion of an environmental impact statement on a topic of current interest in the Manitowoc area, the storage of spent nuclear fuel in above ground facilities. The materials appended to this report include the course syllabus (Appendix 1) showing the structure of the class and the integration of the EIS project throughout the semester. Also included are detailed instructions to students for actually doing the EIS (Appendix 2). This material will be revised during the latter part of summer 1993 to incorporate advice received during the practicum “reunion workshop” in May 1993.

Other Uses of Practicum Information
Although I did not apply for the GLRC-ED practicum with the intent of using information in classes other than Geology 169, there have been numerous instances in which discussions of the concepts, techniques, and methods have spontaneously arisen in all of my other classes. For example, in Weather and Climate (Geography 123), we talk about the use of models in predicting climatic change. This spring I began that topic with a lecture on the use of models in scientific inquiry in general, citing the use of the models in the practicum as concrete examples. The class discussion brought out numerous concepts related to modeling, such as different types of models including theoretical, computer, and statistical models. We also looked at the difficulty of constraining sophisticated models, at assumptions underlying models, and at the variability of results depending on those assumptions.

We talked about the reliability of data used in predictions and models. The problems that practicum participants had with getting reasonable results from some of the chemical analyses prompted a very useful discussion of how real life data, computers, and models interact. This created what I believe was a much deeper appreciation on the parts of my students for the roles that weather and climate models can (and cannot) play in climatic predictions.

In Weather and Climate, we also discuss soil properties in general and soil types associated with various biomes. Although the emphasis in Weather and Climate is on soil properties useful for plant growth, I did mention in our general discussion of soil properties the interrelationship of soil types and toxic chemical movements. In Physical Landforms (Geography 124) and Physical Geology (Geology 101), we also discuss soil properties. In these classes, I spent some time discussing soil porosity and permeability and their relationship to toxic chemical movements, especially the migration of polluted groundwater in carbonate-based bedrock. Again, the information from the practicum was useful.

Even in Cultural Geography (Geography 101), I found myself using examples and information from the practicum. One chapter in the students’ current text deals with society’s responses to environmental issues. We talked about why pollutants are produced, how we detect those pollutants, how we might remedy the situations, and the roles citizens can play in pollution issues. Information and slides from the practicum were perfect for illustrating all of these topics.

Cooperative Learning

In all of my classes this year, I have spent much more time using group work as a teaching tool than I ever did in the past. Although I did not do so solely as a result of the practicum experience, the work that we did in the practicum using teams for the chemical analysis and for the EIS project was useful and encouraging. It gave me practical experience in setting up teams effectively, and it showed me that the team approach does, indeed, result in excellent learning environments. I have been delighted with the results of the group teaching and learning in my classes this past year, and so have the students. In April 1993, I presented a paper at the Annual Meeting of the Association of American Geographers in Atlanta, Georgia, on the results of group learning in Physical Landforms. The presentation engendered much interest, and I intend to formalize the concepts and submit the paper for publication this fall.

After returning from the practicum, I prepared a proposal for the UW Undergraduate Teaching Improvement Grant program (Appendix 3). The proposal incorporated a number of ideas developed from the practicum, including an EIS unit. Although the proposal was not funded for 1993, I will probably revise and resubmit it in the future (EDITOR’S NOTE: It was funded the next year.).

Summary

I have been surprised at how frequently I have used some aspect of the practicum, from new concepts to which I was exposed, to examples that illustrate concepts that I have taught about for years, to slides of the work we did, or to the techniques we used. I have been particularly surprised at the usefulness of the practicum, since I have not yet taught the course for which I intended to use the practicum material.
certain that when I do I will be even more impressed with all that we learned. A sincere thanks goes to NSF and the Great Lakes Research Consortium and its instructors for making the experience possible.

Appendix 1

Geography 350: Environmental Conservation
Fall 1993

Instructor: Cathy Helgeland
Office: W262
Office Hours: Tuesday 1-3; Wednesday 10-12; Thursday 9:30-10:30 and by appointment.
Phone: 683-4729 (my office); 684-9553 (home); 683-4700 (campus office, for messages if I am not available).

Date: Topic: Assignment*
9/2 Intro: History of Env. Movement; Basic Concepts in Environmental Issues Chs. 1-4; handout from Sand Co. Al.
9/9 Human Population: Trends and Causation Chs. 5-6; handout from Pop. Bomb
9/16 Human Population: Consequences and Responses Chs. 7-8
9/23 Feeding the Billions: How Will We Do It? Chs. 9-10
9/30 Exam I
10/7 Environmental Choices: How Do We Make Them? Discussion of EIS Project Ch 17; Ethics Boxes on pp. 183, 250, 374, 389, 473
10/14 Nuclear Fuels Ch. 22
10/21 Field Trip to Point Beach Nuclear Plant/EIS Progress
10/28 Fossil Fuels Ch. 21
11/4 Renewable Energy Sources/EIS Progress Ch 23
11/11 EXAM II; Nuclear Drill Preparation/EIS Progress
11/16 Kewaunee Nuclear Drill; EIS Section Report Due
11/18 Solid &Toxic Wastes; Pickup copy of report from each group Chs. 14,20
11/25 Thanksgiving - No Class
12/2 Water Pollution; Draft EIS due (bring 2 copies) Chs. 11-13
12/9 Air Pollution; Draft EISs to be returned Chs. 15,16
12/16 EIS Hearing and Wrap-up; Final EISs due

FINAL EXAM: Wednesday, 12/22, 3:30-5:30 p.m., W260

* All assignments are in the text, *Environmental Science: The Way the Work! Works, 4th ed.*, by Nebel
and Wright, Prentice-Hall, 1993, unless noted as a handout. Reserve readings may be assigned periodically during the semester.

**SOME GROUND RULES FOR THE SEMESTER**

**Description and Goals of the course:**

Environmental Conservation is a 3-credit lecture course. My primary purpose in this class, in addition to fulfilling credit and program requirements for the student, is to make the student more aware of the environment, the problems with which it is beset, and the role of humans in coping with those problems. Hopefully, the student will leave the course with an enhanced appreciation for the wonder of nature and the for our ability to disrupt it, but also with an awareness of the steps we can take to minimize or repair that disruption. I hope that students will become aware of the urgency and controversy that pervades most environmental issues - the study of the environment is truly exciting!

The course will consist of five major parts:

1) A discussion of environmental *ethics and politics*;
2) A discussion of *global population growth*, its causes, characteristics, and problems;
3) A discussion of *energy resources* and problems associated with their use;
4) A discussion of various forms of *pollution*; and
5) The development of an *environmental impact statement* as a tool for assessing practical responses to environmental issues.

Topics one and five will be woven into our discussions for the entire semester, while the other topics will be limited to particular portions of the semester, as shown on the syllabus.

By the end of the semester you should have a much more sophisticated knowledge of how the environment works, how each of us can enhance or protect the environment, and how the average citizen can have effective input into environmental issues. Finally, a primary goal of the course is the development or refinement of a land ethic and an environmental conscience on the part of each student.

**Environmental Impact Statement (EIS) Project:**

An environmental impact statement is a document that details the impacts on the physical and cultural environment that a proposed project will entail. Impact statements are required for all projects that involve the state or federal governments. The environmental impact statement is the document that is produced by the project proposers following a lengthy analysis and appraisal period that includes significant public involvement. Thus, if individuals wish to make known their concerns about any given project, their opportunity to do so is through the EIS process. Therefore, it is important for everyone concerned with environmental issues to be cognizant of the EIS process. To that end, this class will go through an EIS process and will prepare an EIS on an issue of intense and growing concern in the Manitowoc area - the storing of nuclear wastes on-site at the nearby nuclear plants.

**Grading:**

During the semester we will have two in-class exams and numerous quizzes. *No make-up quizzes will be allowed*, but in calculating your final grade I will automatically drop your lowest quiz grade, so if you must miss a quiz, the missed quiz grade (0) will be the grade dropped. A final exam will be given during the exam period at the end of the semester. Each exam is worth 100 points, and each quiz is worth 20. *If you must miss an exam or be late for an exam, you MUST notify me prior to the exam (683-4729, 683-4700, or 684-9553) If you wish to take a make-up. All make-up exams are essay in format.*

In addition to the exams and quizzes, the EIS project will be worth 100 points. Students will be divided into groups of approximately four each, and each group will be responsible for two parts of an EIS. EIS reports are due the last week of class (December 15) at the time of each group’s oral presentation.

Semester grades will be calculated on a total point basis, converted to a percentage, and curved.

**Attendance:**

It’s required, folks. I don’t take attendance each week, but it is impossible to do well in this course if you miss class, as most points on exams come from class discussion and lecture which is not
repeated in the text. Furthermore, we will be working in groups for the EIS project so if you miss class you will be handicapping your group. Class begins promptly at 2:20 and runs until 5:00 on Thursday afternoons, with a ten-minute break in the middle. Please do not be late as late arrivals disrupt everyone’s train of thought.

Keep in mind that missing one class day in this class is the equivalent of missing an entire week of class in a three-credit course which meets three times per week. If you must miss a class, try to arrange for a fellow student to tape the class and then be certain to obtain notes from a classmate. Finally, please see me to pick up any handouts or assignments which might have been given out You are responsible for all material missed, and I will assume that you have made up all missed work prior to the following class period.

A word of caution here - I expect that your education is a very high priority at this time in your life. That means that, except for health or critical family matters, I expect your class work to come ahead of other commitments. Work schedules, concerts, trips to Florida (or anywhere), deer hunting, car troubles, taking your little brother to his scout meeting, etc. need to take a back seat to your commitment to school. You need to be here, fully alert, on time, and ready to work hard every class day, and you need to get your assignments done well, on time, and in a thoughtful manner ahead of the class meeting.

**Time Commitment:**

College instructors assume that students will spend approximately two to three hours outside of class for every three hours in class. Thus, since this is a three-hour course, I am calculating that the average student will spend six to nine hours per week outside of the classroom reading the text and other assignments, studying for quizzes and exams, and working on the EIS project. Be aware that some weeks will likely require fewer hours, but others (such as exam weeks and EIS due date weeks) will require significantly more.

**Oops!**

I just reread what I wrote, tried to think of myself sitting in the first day of the class reading this handout, and decided that the teacher in this course sounded like a real task-master who expected me to work, work, work, take an exam, and then work some more. Well, sort of. This is an intermediate level course, and I do expect you to work hard. At the same time, I want to assure you that the class will be fun as well. Environmental topics are fascinating - I know of few issues that combine science, values, controversy, politics, and drama as do environmental questions. Watching and being part of that interplay is always exciting.

In addition, I am doing something that I love doing - teaching - and I am doing it exactly where I want to do it- on a small campus where I have day to day contact with my students and can become involved with what they are working on. As students at the Center, you people have a tremendous advantage compared to students on large campuses, in that you can have regular contact with faculty and staff members who know who you are. Students at large campuses don’t receive that advantage until they are graduate students (if they ever become one). Take advantage of the faculty and staff get to know us quickly (those of you who don’t already), and let’s work together so that we can all (including me) learn as much as possible (I learn lots from you people)!

**Now:**

Why would the Point Beach Nuclear Plant petition the government to allow them to store spent nuclear fuel above ground, outside the spent fuel pool?
The environmental impact statement (EIS) project will occupy a significant portion of our work for the rest of the semester. For this project class will be divided into working groups of approximately four or five students. The entire project will be worth 100 points.

**Short Description of EIS Process:**

The first step in an environmental impact process is to do an environmental Impact Assessment (EIA) of a proposed project, a relatively brief analysis to determine whether or not the project will impose significant impacts on the environment or whether it will entail significant environmental controversy. If the assessment determines that it will, then a lengthier, more formal environmental impact statement (EIS) is required.

Once a draft EIS is prepared, it must be reviewed by state and federal agencies, and hearings must be scheduled to allow the public to respond to the document. Following the reviews and hearings, a final EIS is prepared, after which work on the project may begin.

**EIS Contents:**

The accompanying outline shows the content required in all EISs. Since there are eight major divisions, each working group in our class will be assigned two divisions for which they are responsible. The assignment for each group is to compile information to enable the group to write a concise, well-organized, and coherent report responding to their assigned section. Before each group begins work, I will meet with the group to discuss the contents of the reports. On November 18, the report of each group will be distributed to the rest of the class for each group to use in writing their final EIS.

**Obtaining Information:**

To obtain the information necessary, students may consult their own text book, class notes, and library materials at the Center or at the Manitowoc Public Library. Don’t forget that our interlibrary loan system enables you to access materials from the entire UW System. However, to do so, you must allow a couple of week’s time from the date of your request until you receive the information. Therefore, it is imperative that you begin your work promptly.

Another important source of information in the information gathering phase of the project is local individuals. As good starting points, you may wish to contact the Pt. Beach Nuclear Plant (Loretta Krcma, Public Information Officer, 755-2321), the Nuclear Regulatory Commission (1-312-790-5500, collect), and the Manitowoc Office of Emergency Government (Nancy Crowley, Director, 683-4207). With each call, ask the person to whom you are speaking for additional contacts who might help you with your project.

You may wish to interview your contact over the phone or, perhaps, in person since personal contacts often produce insights and relationships that phone contacts cannot. Whether the interview is on the phone or in person, be certain to have the questions you wish to ask in hand. Explain your purpose briefly, ask your questions courteously, and take notes on the responses of the person being interviewed. If you visit an official in person, a follow-up thank-you letter is always appreciated, so be certain that you note the official’s name, position, and address. Also be careful to note the date, as the date, and the person’s name and title, will be necessary ingredients of a citation in your list of references in your EIS.
Organization:

Your group should plan to meet weekly between now and the end of the semester to discuss progress and plan the next week’s activities. Your weekly meeting is a good time to discuss the results of your library research and interviews with your team members. Following your discussion, the team should come to conclusions about the input from each article or interview, and those conclusions should be noted. (It might be useful to appoint one member of the team as a recorder.) Following your weekly team meeting, each team should plan to meet with me for approximately ten minutes to report on your progress and to briefly outline the steps for the next week’s work.

Due Dates:

The report (minimum of four pages and a maximum of eight pages, single-spaced, set on a work processor) covering your group’s assigned portion of the EIS outline is due November 16, at the Kewaunee Nuclear Drill. It will be copied and will be given to other groups at class on November 18.

A draft of your group’s complete EIS will be due on December 2. This draft will include all eight portions of the CEQ-prescribed EIS, using the reports of all the groups in class and integrating those reports into one, coherent EIS written by each group. I will distribute each draft to another group, who will review and critique it, and return it to your group on December 9. Your group then has the last week of class, from December 9-16 to make revisions or additions to improve the document. Feel free to use ideas from the draft which your team is reviewing to improve your own document. The goal here is for every group to complete as superior an EIS as possible. (Each group will have already gotten credit for their original contributions on the November 16 report).

The final EIS will be due the last afternoon of class, December 16, at which time we will also role-play an EIS hearing.

Your grade for the project will be based on the following:

- Your contribution to your team’s efforts, including completing agreed-upon tasks and attendance at and participation in weekly team meetings (i.e., were you a responsible and contributing team member?) (20%).
- The insightfulness and completeness of your team’s report due November 16 (i.e., how good are your ideas? (20%).
- The clarity of your team’s November 16 report (i.e., how well written is the document?) (20%).
- Your final US document (20%).
- Your active participation in the public hearing (in class, 12/16) (10%).
- Your attendance at the November 16 nuclear drill (10%).

Writing:

A well-written EIS is essential because poorly written material is often discounted. Therefore, if you wish to have your ideas considered seriously, it is imperative that they be presented professionally and accurately. This is especially true in environmental controversies.

The attached Essay Problem Chart will help you assess your writing. Using the chart as a checklist, your team should review your portion of the EIS with everyone contributing comments and suggestions for improvement. This task needs to be done before the November 16 report is turned in, again before the draft EIS is submitted on December 2, and finally, before the completed EIS is turned in on December 16.
To help you with your writing and thinking, several pages of comments on writing in general and on the writing process in doing EISs are appended to this handout. Also included are examples of proper citation form which you will need to use in your November 16 report and in your EISs. They are from Dr. James M. Haynes, State University of New York (SUNY) College at Brockport who teaches a course in Environmental Impact Analysis. His suggestions are very helpful, and I would encourage you to make extensive use of them.

A Final Note:

One of the main advantages you have as a student on this campus is access to professors. Please feel free to consult with me for ideas, help, stories and anecdotes, nagging, inspiration, or whatever else I can provide to help you with this project. My goal is for you to understand the many facets of how the assessment process works, and I am willing to do whatever I can to further that goal.

Now - have fun, work hard, and good luck!
# ESSAY PROBLEM CHART

## PURPOSE
1. Thesis statement unclear or missing
2. Main idea too broad
3. Main idea too narrow
4. Relationships not stated
5. Relationships not explicit

## CONTENT AND DEVELOPMENT
1. Cause/effect relationships need support
2. Geographic concepts need clarification
3. Discussion incomplete
4. Geographic concepts confused
5. Diagrams needed
6. Specific examples needed
7. Subtopics not connected to main idea
8. Some ideas not related to subject

## ORGANIZATION
1. Needs better introduction
2. Needs better conclusion
3. Needs transitions (thus, therefore, etc.)
4. Needs better division of paragraphs
5. Needs reorganization of paragraphs
6. Needs reader helps (summary, definitions, etc.)

## SENTENCES
1. Fragments (frag)
2. Run-ons (RO)
3. Too simple, choppy
4. Too complicated, complex
5. Misplaced modifiers
6. Dangling modifiers
7. Unclear pronoun reference (REF)
8. Needs sentence variety
9. Inaccurate pronoun-antecedent agreement (AGR)
10. Inaccurate subject-verb agreement (AGR)
11. Tense sequence problems
12. Fuzzy writing—not specific
13. Poor punctuation

## VOCABULARY
1. Words used incorrectly (MALAPROPS)
2. Unnecessary filler
3. Abstract words not clarified
4. Geographic terms not defined
5. Spelling errors
6. Incorrect capitalization
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Teaching Improvement and Assessment through the Use of a Teaching Portfolio and the Development of a Laboratory Manual for Geology 169

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Geography and Geology
University of Wisconsin Center - Manitowoc County

TIMEFRAME: SUMMER 1993-JUNE 1994
BUDGET REQUEST: $7,477.50

Abstract

Geology 169, Earth Sciences and Human Environment, is a four-credit laboratory science in the UW Centers. Traditional environmental geology courses do not adequately address the issues of human response and recovery to geologic hazards. Neither do existing laboratory manuals use many of the learning techniques recently found to be very effective. This project is designed to enhance learning through the restructuring of the course, guided by the development of a teaching portfolio for formative purposes in a laboratory science. Since a large portion of learning in a lab science takes place in the lab, the project will also involve the development of an innovative manual which integrates learning techniques with a human-response-to-geologic-hazards model. The restructured course and manual will be evaluated on an on-going basis by the proposer, students, and colleagues. Evaluations will become part of the portfolio. Following completion of the course, teaching techniques will be comparatively analyzed; the most effective techniques will be identified, and the manual will be revised to incorporate them. The portfolio experience and the manual will be widely shared at the departmental, campus, UW System, regional, and national level.

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A. Background and Problem Statement

Geology 169, Earth Sciences and the Human Environment, is a four credit laboratory science in the University of Wisconsin Centers. The UW Centers’ catalog description of Geology 169 states, “The physical environment and our interaction with it. Emphasis on earth processes that affect humans, such as rivers, erosion, groundwater, landslides, and earthquakes. The impact of humans upon the environment. Air, water and soil pollution studied from a physical-chemical standpoint. The depletion of energy and mineral resources and the need for humans to design with nature.” The catalog description obviously emphasizes the interaction of people with the environment.

However, most environmental geology courses traditionally deal with earth processes or materials in terms of environmental disruption. The roles of humans in causing the problems or in minimizing impacts are de-emphasized (or ignored), and when human interaction is discussed, impacts are reported as deaths, injuries, or dollar losses. Over the past few years I have become increasing dissatisfied with the traditional approach to the course because it does not adequately address the human interaction with earth systems. For example, conventional environmental geology courses fail to address the critical questions of environmental assessment, planning, prevention, and incident management that must be the cornerstones of sensible responses to geological hazards.

Thus, I propose to restructure the course, using a teaching portfolio to guide the restructuring. As part of the portfolio development, general course goals will be delineated stressing the proactive responses of humans to preventable geologic hazards and the effective management by response agencies of the consequences of unavoidable hazards. Teaching and learning improvement will be the primary objective of the entire project; thus, a wide variety of learning styles and techniques will be considered for inclusion in the reorganized course. Because the bulk of class hours in any lab science is spent in the lab, many of these learning techniques will be utilized in the lab component of the course. Therefore, a lab manual will be written that address two issues not found in other manuals. First, learning techniques and the students’ use of those techniques will be discussed. Second, background information (which is not available in environmental geology texts) will be presented that stresses the roles of humans in the prevention of geologic hazards or their role in effective responses to unavoidable hazards.

The assessment by students and professor of the lab manual’s effectiveness will be ongoing. This assessment will be directed at the course goals, the learning techniques and topics that underlie each lab chapter, and the effectiveness of the course as an entire entity in enhancing an awareness of human interaction with the environment.

B. Project Description

1. Purpose:

The purpose of this project is simple: an improvement in teaching and learning in Geology 169 through the development of a teaching portfolio and a laboratory manual, and in laboratory sciences in general through the development of a teaching portfolio that can serve as a model for portfolios to be developed in all science disciplines. All activities planned will be designed with the goal of enhanced learning as the
primary focus. Through dissemination of project results, improved teaching and enhanced learning can be expected in other disciplines and in other geographic areas in addition to the proposer’s home campus.

2. **Relationship to Existing Environmental Geology Courses:**

Topics commonly covered in traditional environmental geology courses include ones that can be broadly divided into two categories:
- those dealing with earth materials (rocks, ores, soils, waters) and those dealing with earth processes (earthquakes, vulcanism, erosion, etc).

Some specific topics include:

- mineral resources: recovery (mining), use, and disposal
- nuclear power generation
- waste disposal (including toxic wastes)
- volcanic eruptions and earthquakes
- landslides and related phenomena
- flooding

This traditional stress on materials and processes is being broadened as more disciplines become active in environmental studies. Questions of human involvement in damage causality and mitigation now figure prominently in environmental work. The immediate response once a hazard occurs, in particular, will influence the damage toll from earth processes. Effective incident management requires response planning, political cooperation, hazard response plan development and practice, and education of the populace likely to be affected. However, today’s environmental geology texts rarely address such interdisciplinary questions. I propose to restructure Geology 169 to truly emphasize human interaction with the environment, combining expertise from numerous disciplines to enhance the learning and practicality of the course for the student.

3. **Implementation:**

This proposed project is a two-part undertaking. One part consists of the development of a teaching portfolio in a laboratory science, concentrating on improving teaching and learning in the context of a human-response-to geologic-topics model. The second part entails the development of a laboratory manual to facilitate that learning.

Using the information from the 1992 UTIC conferences, plus a variety of literature on teaching portfolios, I will draft goals for the course and for teaching improvement. In order to most effectively enhance the teaching and learning, I will research different learning styles and teaching techniques applicable to a laboratory science. From this review, I will then select those techniques that I feel will best facilitate the students’ overall learning. The goals and a rationale for the choice of learning techniques will become part of the portfolio.

I have solicited input from departmental colleagues. Thomas Bitner, chair of the Department of Geography and Geology, and Keith Montgomery, a 1992-1993 Teaching Fellow, both of whom have attended 1992 UTIC conferences, have agreed to consult with me on the portfolio development and the techniques to be used in the restructured course. They will evaluate the class, and their evaluations will become part of the portfolio.

A major portion of the project will involve research on appropriate assessment measures because student evaluation will be actively sought regarding the success of each major unit in fulfilling the goals of the
restructured class. Measures to be considered include questionnaires for the students, class discussions on the effectiveness of the learning tools, interviews with individual students, and consultation with colleagues. Student responses to assessment instruments, combined with grades on exams and quizzes, can then be analyzed to determine the techniques that are most successful in enhancing learning. Ongoing assessment will also allow “mid-course corrections” should they be necessary.

I will design and implement a summative assessment instrument for this particular course, in addition to the general required student evaluations. At the end of the semester, I will use this summative instrument, plus the unit assessment tools, to do a comparative analysis of the success of each teaching technique. Of particular interest will be comparisons of successful learning in men versus women and in traditional versus nontraditional students. The assessment instruments and the analyses of the comparative success of different teaching techniques will become part of the portfolio. Additional measures of successful learning may include pretests and post-tests, completed student projects, and videotapes as well as other assessment instruments adopted as a result of my research.

To implement the course goals in the laboratory portion of the class, I will design a lab manual that concentrates on a variety of learning techniques and on the human-response-to-geologic-problems theme. The manual will follow a format that I developed many years ago for laboratory manuals in Weather and Climate (Geography 123) and Physical Landforms (Geography 124). The format has been amplified to include information on learning styles and techniques. (The reader should note that although the format of the previously developed manuals will be used, in part, the content will be entirely different) Each lab chapter will consist of seven parts, including:

I. A list of references.
II. A statement of the learning and content aims of the chapter.
III. Background Information on the learning technique(s) being used in the chapter. The manual will present a selection of learning techniques. Class discussions of human variation in success with different learning methods will be bolstered by a discussion in each lab chapter of different learning technique(s). Techniques that will be considered for selection include:
  • traditional college learning methods such as lecture, text, etc.;
  • the use of physical models, including stream tables, block models, and tectonic process models;
  • the development of physical models;
  • video and slide analysis;
  • the development of spatial perceptions through the use of maps, air photos, and satellite imagery;
  • computer modeling of toxics;
  • conceptual modeling;
  • group preparation of environmental impact statements.

IV. Background information on human responses to geological hazards and geological materials use. Examples of topics that will be discussed include:
  • effective incident response;
  • damage mitigation techniques such as zoning, hazard response drills, warning systems, etc.
  • the development of hazard response plans, inter-agency plans that involve all levels of government;
• long-term effects of hazards and of materials use
  in terms of complex human systems (ecological, political, economic, sociological, etc.),
  environmental impact assessment preparation.

V. Laboratory exercises that will require students to use laboratory materials, the learning
techniques of the chapter, and the information on human responses to assess geological hazards
and to develop effective response strategies. In other words, knowledge gained from Parts III and
IV of the lab manual, from lecture, and from readings will be required to outline effective
problem-solving responses.

VI. Supplementary exercises that will challenge the students who wish to explore the topics of the
chapter in more depth. These exercises will frequently involve group projects.

VII. Review questions.

To assist students with the development of a problem-solving approach, Mr. Jeff Brown, Senior Staff
Hydrogeologist at Radian Corporation, a national environmental consulting firm with laboratory facilities,
has agreed to facilitate a class field trip to the corporation’s Milwaukee offices to illustrate assessment
instruments and environmental responses in “the real world.” Similarly, Nancy Crowley, Director of
Emergency Government of Manitowoc County, has pledged her support for involvement of the class in
response-planning activities of the county. These activities involve state and federal government agencies
and the local nuclear power utilities.

In summary, this project will involve research on teaching and learning, the restructuring of Geology 169
to pursue a human-response-to-geologic problems model, the development of an innovative lab manual,
and assessment of the effectiveness of a variety of teaching methods. The entire project will be guided via
the development of a teaching portfolio.

4. Expected Results:

The expected results of this project are two-fold and relate directly to the goals of the project:

1. An improvement in teaching and learning in Geology 169 through the use of a teaching
   portfolio as a formative tool to guide the restructuring of the course and through the
   development and use of a innovative laboratory manual stressing realistic problem-
   solving approaches.
2. An improvement in teaching in other laboratory sciences through adoption of the teaching
   portfolio process.

5. Innovative Features of the Project:

There are several innovative aspects of this project. One is a teaching portfolio, especially one combined
with the development of a lab manual in a newly restructured course. This approach to the enhancement
of learning bears potential for a significant improvement in learning in lab sciences.

A second innovative aspect of the project will be the utilization of a wide variety of teaching techniques,
especially a significant amount of group work since recent literature and the proposer’s work in other lab
sciences have indicated that group work can effectively enhance learning. Models of many varieties,
including computer models and conceptual models, will also be stressed. Models have long been used in
geology courses, but the traditional models have been physical ones such as maps and landform block
models. The use of computer models and the incorporation of environment impact assessments in an
An introductory environmental course is quite new; their use in this course is a direct outgrowth of the proposer’s attendance at a 1992 Summer practicum in Environmental Problem-Solving at SUNY-Oswego. The practicum was sponsored by the National Science Foundation and had as its primary goal the development of problem-solving techniques to be integrated into environmental curricula.

The laboratory manual itself will be unique in two respects: 1) It will stress learning styles and 2) it will integrate an emphasis on human response to geologic issues with the traditional information given in most texts. Information on learning and on human response to hazards will be presented every lab chapter, as well as in classroom discussions and lectures. Students will then be required to work with this material in fashioning their answers to the Laboratory Exercises themselves.

Also innovative in this project is the involvement of the students in their own learning. The UTIC conferences stressed the importance of this involvement, and I have already found that it pays dividends. In a Physical Landforms course this semester, I have held class discussions with the students on their learning. I have combined these discussions with a slightly revised lab format. Students now work in groups and at the end of the lab period answer oral quiz questions based on the lab chapter. The grade results this semester are significantly higher for the group as a whole than in past years. The students are a more cohesive group than in past years, and the level of fun and excitement in the classroom has been enhanced. Thus, based on my own recent mini-experiment in changing teaching techniques, I believe that further work can enhance learning in Geology 169 as well.

6. Administrative Considerations:

The proposed project is to be implemented in Geology 169, an existing course in the UW Centers’ catalog. Therefore, no course approval procedure is necessary. However, because the teaching portfolio and the lab manual must be written, the project is not merely course development in the traditional sense of preparing lectures and assignments. Rather, a significant amount of research on teaching, learning, and assessment must underlie the restructuring of the course. These activities will take time not generally available as part of my normal faculty workload.

C. Impact on Students

The primary impact on students that I am anticipating is an enhancement of student comprehension of the complexities of environmental geology and of their ability to design effective responses to those complexities. The solutions must be broadly conceived and realistic, focusing on human involvement to geologic hazards.

The initial beneficiaries of this project will be Geology 169 students who will be exposed to a progressive, interdisciplinary course in environmental geology that will also stress the importance of learning techniques. Because other geographers and geologists in the Centers teach Geology 169, the lab manual that is developed may be more widely used than only in my courses. The two laboratory manuals that I have written for Weather and Climate and for Physical Landforms have been used in whole or in part by colleagues in the department, and I would be pleased to make this manual available to any Centers faculty.

The expertise to be developed in assessment and portfolio development will be shared with colleagues. Initially, Tom Bitner and Keith Montgomery will be beneficiaries as a result of their involvement with the portfolio development; eventually colleagues in the Department of Geography and Geology as well as those in many disciplines on my home campus will be recipients of the information. Should those faculty members choose to use the portfolio process, their students, in turn, will benefit from this project.
Information on the integration of learning enhancement methods and problem-solving techniques into an environmental science course will be available for dissemination throughout the UW System, perhaps in a format such as the UTIC’s 1987 “Looking at Labs” conference. Another potential format for distribution is a conference on teaching portfolios. Should I be accepted to participate in such a conference, students beyond the Centers could also benefit from the project. The completed portfolio will be made available to UTIC as an example for others to use as they see fit. Thus, students throughout the UW System stand to benefit from the project.

The discipline of geology will be a beneficiary of this project, in that the expertise of many disciplines will be brought to bear on geologic problems. Students educated in such a manner will be more likely as professionals to incorporate their interdisciplinary, realistic approach to problem-solving, benefiting the discipline and the public, as well.

A review of the Department of Geography and Geology’s enrollment figures shows that many students can be influenced by the project, especially by the portfolio. Approximately 750 students enroll in lab sciences in the department per semester. If enrollments in other Centers lab disciplines were included, the number of students who might benefit would be many times that figure, and the number would increase dramatically if the project is disseminated to the entire UW System and, through articles or presentations, to other areas.

D. Assessment Procedures

Because assessment is part of this project, many of the assessment procedures that will be used were described above. Enhanced learning will be evident through the students’ responses on unit assessment tools, questionnaires that will ask them to indicate which learning techniques were most effective and why. Enhanced learning will be displayed in group reports, on oral quizzes that result from group work, in well written essays on exams, and in lively class discussions. The use of pretests combined with exam analysis will also provide information on enhanced learning and the ability to apply problem-solving techniques to geologic issues.

From class discussions on learning that I have held this semester I have discovered that once students become accustomed to the idea of analyzing their learning, many are quite perceptive about what is and is not effective for them. Therefore, part of the evaluation of the project will result from on-going documentation that I will keep on class discussions and interviews with individual students. Relevant documentation will be included in the portfolio.

Students’ grades on exams can be compared to those from previous classes, but because a significant change in focus from traditional environmental geology to a human-response model will accompany the restructured course, a direct comparison of grades might not accurately indicate enhanced learning. It is more likely that the students’ own assessments will be more indicative of the project’s success. A content analysis of summative student evaluations done the last time they were administered compared to those to be administered at the end of this class will give an indication of the students’ awareness of environmental geology’s complex nature and its adaptability to problem-solving approaches. Last but certainly not least, colleague evaluation of the materials and visits to the classroom will also give an indication of the success of the project.

E. Plans for Dissemination

Plans for dissemination will cover three basic topics:

- the use of a teaching portfolio in a formative fashion, especially in a lab science setting;
the impact of student participation in learning concepts on the enhancement of learning; and
the manual to be developed, stressing the techniques that proved most successful in
enhancing an appreciation of the complexities of environmental geology and the ability to
use that appreciation in a problem-solving approach.

Forums for presentations include:

- a Spring Seminar department meeting of the Department of Geography and Geology of the
  UW Centers
- the UW Center - Manitowoc County Faculty/Staff Seminar, a bi-weekly series of programs
  presented by local staff and faculty. Presentations were designed to disseminate research,
  especially pedagogical research, since education is our primary mission.
- the UW Centers Faculty Colloquia, held bi-annually in Marinette.
- UTIC conferences such as “Looking at Labs” or conferences on teaching portfolio
  development or assessment.

Dissemination outside the UW System is also anticipated through:

- meetings of the Geological Society of America;
- meetings of the Association of American Geographers;
- meetings of the National Council on Geographic Education.
- the Journal of Geography, the primary journal dealing with education in geography.

(Note: Although the project is designed for Geology 169, geologists and geographers in the Centers teach
in both disciplines. The geographic professional organizations have a wide audience for the issues dealt
with here and will reach both physical geographers and environmental geologists teaching at the
undergraduate level. Professional societies and journals in geology would not reach as many physical and
environmental geographers.)

F. Statement of Non-Duplication

I have reviewed the Undergraduate Teaching Improvement Grant Abstracts through 1992 and have not
found any previously-funded project that combines the various aspects that are part of this proposed
project. UTIG Project Number 812015 (C. W. Fetter, UW-Oshkosh, Wisconsin-Based Curriculum in
Environmental Geology) deals with environmental geology but does not use a teaching portfolio. Existing
commercial lab manuals are available in environmental geology, but they do not address the course in a
human-related or problem-solving fashion.

G. Personnel

I have attached a Curriculum Vitae to this proposal, but want to highlight several aspects of my
background that I think are pertinent. All of my graduate coursework emphasizes environmental issues.
This past summer I attended a National Science Foundation-funded Applied Environmental Problem-
Solving Practicum sponsored by the Great Lakes Research Consortium (GLRC), a group of universities
surrounding Lake Ontario. It provided in-depth training on toxics assessment, use of ecosystem modeling
via computers, and environmental impact statement development. Participants were given diskettes of
programs for the computer models used and were encouraged to use the models in teaching. Thus, the
UWC currently possesses the computer models to be used in the manual exercises and will not be
required to purchase additional computer software for the modeling exercises. In addition, practicum
participants are free to use the numerous practicum instructors, experts in their fields, as resources for
continued development of projects related to the practicum. The incorporation of the computer modeling and the environmental impact assessment components of the manual are a direct outgrowth of the NSF/GLRC practicum, and will continue to have the support and advice of the practicum faculty.

I have attended the 1992 UTIC conferences on teaching and the teaching portfolios, and will present a paper on the changes I have undertaken this semester as a result of the UTIC conferences at the Annual Meeting of the Association of American Geographers in April 1993 in Atlanta, GA. Further, I am planning to take UW-Madison’s Curriculum and Instruction 714, Research and Evaluation Paradigms in Curriculum and Instruction, this spring.

Since 1985 my research has concentrated on hazard response and mitigation. I am the Chief Radiological Officer for the Division of Emergency Government of Manitowoc County. In this capacity I am in regular contact with Manitowoc County emergency services as well as with the State of Wisconsin Division of Emergency Government. I also serve as a radiological monitor instructor for the state. These roles give me insights into hazard response that I would be unable to obtain in any other way. They also give me significant advantages in designing the manual since I am able to plan hazard response exercises that I know are realistic. Further, my connections with individuals at the local and state level have assured that my students will be able to participate in “real-life” planning exercises.

Consultants for the project include:

Thomas Bitner, Associate Professor and Chair, Department of Geography and Geology, UW Centers
Keith Montgomery, Assistant Professor, Geography and Geology, UWC- Marathon County
Jeff Brown, Senior Staff Hydrogeologist, Radian Corporation, Milwaukee
Nancy Crowley, Director of Emergency Government, Manitowoc County

None of these personnel will receive salary remuneration.

H. Schedule

July 1993: Develop course goals; research learning styles; select teaching techniques to be used in restructured course; plan laboratory experiences; develop assessment tools.

July/Aug. ‘93: Write laboratory manual for Geology 169, incorporating information on learning and on effective human responses to environmental issues.

Spring 1994: Teach Geology 169, assess manual and teaching techniques; consult with Bitner and Montgomery; select teaching portfolio materials. Request permission to present project ideas and format to Department of Geography and Geology and to Faculty/Staff Seminar, UWC-Manitowoc.

June 1993: Complete analyses of teaching techniques; compile teaching portfolio, revise manual to reflect use of most effective teaching techniques.

Post-project: Pursue forums for presentations and papers on project results.

I. Budget Narrative

The major budget item is the salary of the proposer for two-ninths salary during the summer of 1993 (or one-ninth during 1993 and one-ninth during 1994) to support the development of the course restructuring. Included will be conducting research on learning styles and teaching techniques, development of assessment tools, the writing and revision of the lab manual, analysis of teaching effectiveness, and the development of the portfolio. This amount is $7234, plus 35% for fringe, $2532, for a total of $9766 for
Additional expenses include travel money for the two consultants (Bitner and Montgomery) who will travel from Marshfield and Wausau, respectively, to review the class. The Marshfield-Manitowoc-Marshfield trip is approximately 300 miles, and the Wausau-Manitowoc-Wausau trip is 280, a total of 580 miles at $.26/mile for a total of $150.80. Lunch ($6.85) and supper ($14.50) meals are budgeted for each trip for a total of $42.70. Fifty dollars for laser printing, copying, and binding of the final manual has been included under Supplies and Expenses.

The UWC-Manitowoc Co. will underwrite a number of expenses. Secretarial costs, estimated at $8 per hour for 40 hours, to type and copy assessment tools and the manual, will total $320. Non-labor copying costs will be absorbed by the campus, as will the purchase of one or two videos for use in the laboratory for an estimated additional cost of $400. Office and computer use, phone calls, and library support will be provided by the campus.