Rough Draft

Partnering to Teach Environmental Science and Communication: A Strategy for Empowering the People

(A Strategy that Gives Power to the People)

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I. Introduction

The vast majority of Americans receives little or no education about environmental issues, despite its relevance to our lives and reported high levels of public interest in such issues. In fact, only 21% of American adults surveyed in 1999 felt that they were very well informed about environmental pollution issues, a figure that is below the 32% who felt very well informed in 1990 (National Science Board, 2000). Carol Browner, former Administrator of the Environmental Protection Agency says that, if we are to meet the environmental challenges of the next 25 years, we must deepen the environmental awareness of all Americans. An informed and involved local community, she states, always does a better job of environmental protection than some distant bureaucracy (Browner, 1995).

But instilling environmental awareness in our students is hampered by the U.S. system of compartmentalizing school subjects, which, according to David Orr (1994), fosters the misconception that one discipline has nothing to do with another. Orr (1994) contends that, without interdisciplinary learning, students won't learn to think in whole systems and will fail to recognize our dependence on natural systems. Environmental Science must be taught in all disciplines at the general education level if we hope to improve the environmental literacy of the American public (Wilke, 1995).

Consequently, researchers have developed interdisciplinary models for environmental education that offer students opportunities to learn critical thinking, problem solving, and effective decision making skills towards achieving sustainability (Chaffee, 1996; Cortese, 1992; Foster, 1999). Additional benefits for students who participate in interdisciplinary courses include an increased ability to appreciate different perspectives, to evaluate expert testimony, to respond with sensitivity to ethical issues, and to analyze, synthesize, and integrate the complexities of real world problems (Eagen, Cook and Joeres, 2002).

Unfortunately, environmental education research indicates that knowledge alone, however integrated, is not enough to promote learners to take actions that will enhance our environment’s quality and sustainability. Especially with business majors, who have
been shown to be least likely of all college undergraduates to undertake environmental action (Smith 1995), teaching must go beyond mere content to address affect, or attitude, towards the environment. Ownership variables, elements that make environmental issues personal, are critical to responsible environmental action. Although in-depth knowledge is a component of ownership, a sense of empowerment is integral to action, that is, humans must believe they have the ‘power’ to use citizenship strategies to help resolve issues. Thus, teaching environmental education must mean more than providing sufficient ecological knowledge. It must include developing a conceptual awareness of how individual and collective actions can influence environmental quality, and practicing the communication skills and persuasive strategies necessary to take positive environmental action (Hungerford and Volk, 1990; Iozzi 1989).

II. Description of the Project Undertaken + Goals

To combine environmental knowledge with communication skills and persuasive strategies, an interdisciplinary project under the Sustainable Universities Initiative (SUI) was undertaken involving students in Environmental Science, Technical Communication, and Business Writing courses. A particularly significant target of our project was the large number of business majors who, according to research, are less likely to participate in earth sustaining activities than students majoring in other areas (Benton, 1994; Smith, 1995).

The project addressed a prominent local concern and integrated environmental science, photojournalism, technical communication, and business writing with the needs of the community by designing documents centered around the theme of water quality and human health. The PowerPoint presentation and photoessay were used to command attention, effectively substantiate warnings about fish consumption due to mercury contamination, and provide much-needed scientific information to citizens who can be harmed if they are uninformed. The primary goals of the project were to foster a deeper understanding of mercury levels in freshwater, increase student awareness of and involvement in local environmental issues, and prompt more effective responses to this particular issue.

Professor Pike’s students in Environmental Science researched S.C. freshwater mercury contamination and related fish consumption advisories, provided the information to Dr. Hanson’s writing students, and assisted in developing and reviewing drafts of the documents. They also learned about other water quality issues and practiced water quality analyses.

Under Dr. Hanson’s direction, the technical writing and business writing classes designed the layout for the PowerPoint presentation, developed an outline, and conducted audience analyses of the multiple groups who would view the PowerPoint presentation and photoessay. When the planning phase was complete, all three communication classes drafted the text and graphics of the presentation and conducted review cycles—in tandem with the Environmental Science students—to prepare for final publication. The business
writing students also wrote transmittal letters to SC DHEC officials, SC legislators and SC science teachers.

The students in Pike’s and Hanson’s classes communicated with each other, offering ideas and feedback about the PowerPoint presentation, through the university’s Blackboard software. The University Institutional Review Board (IRB) approved the use of human subjects in (a) the photographs and in (b) the pre-test and post-test of students. The pre-tests and post-tests of students provided an opportunity to measure (a) their environmental awareness and attitudes and (b) the effect of a project-based course module on environmental issues.

II. Materials and Methods

The project addressed the state-wide issue of mercury levels in South Carolina’s freshwaters. It required students to conduct secondary research, complete audience analyses of potential readers, conduct document review cycles with editorial recommendations, and design and produce multiple documents, including a Power Point presentation, formal business letters, and a photo essay. Class assignments and due dates are shown in Table 1.

The project also provided a research opportunity to measure the effects of such a project on students’ environmental knowledge and attitudes. Maloney and Ward (1973) and Maloney, Ward and Braucht (1975) developed an attitude scale with 4 subscales designed to measure knowledge, concern (affect), willingness to act (verbal commitment) and past behavior (actual commitment). Originally a 130 item questionnaire, it was modified and shortened (Fisher, Bell and Baum, 1984) for greater internal consistency and scale independence. Half the items are worded in a positive manner and half are worded in a negative manner. Higher scores represent greater pro-ecological behavior, knowledge, willingness to act, and concern.

Our hypothesis was that students working on the environmental project would raise their scores on each subscale after completing the project (or after completing an introductory course in environmental science). Lisa, let’s clarify this OR possibility.
Table 1. Class assignments and due dates for a collaborative, interdisciplinary, environmental science project

<table>
<thead>
<tr>
<th>Task</th>
<th>Due Date</th>
<th>Task</th>
<th>Due Date</th>
<th>Task</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft an outline of the mercury presentation</td>
<td>Sept 4</td>
<td>Analyze audiences who will receive the presentation</td>
<td>Sept 5</td>
<td>Research the mercury problem</td>
<td>Sept 5</td>
</tr>
<tr>
<td>Draft 1st Power Point presentation</td>
<td>Sept 16</td>
<td>Write a transmittal letter to SC teachers</td>
<td>Oct 3</td>
<td>Review the Power Point presentation</td>
<td>Sept 24</td>
</tr>
<tr>
<td>Review the Power Point presentation</td>
<td>Sept 25</td>
<td>Write a transmittal letter to DHEC staff</td>
<td>Oct 10</td>
<td>Draft 2nd Power Point presentation</td>
<td>Oct 2</td>
</tr>
<tr>
<td>Write a persuasive letter to SC senators &amp; representatives</td>
<td>Oct 15</td>
<td>Review &amp; critique the Powerpoint presentation</td>
<td>Oct 17</td>
<td>Review the critique of the Power Point presentation</td>
<td>Nov 6</td>
</tr>
<tr>
<td>Write an evaluation of the presentation for other student writers</td>
<td>Oct 22</td>
<td>Write a persuasive letter to managers of power companies</td>
<td>Nov 12</td>
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</tr>
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III. Results

The results of this project were fourfold: (1) Information on mercury contamination was disseminated as a teaching resource in the form of a PowerPoint presentation downloadable from http://alpha1.fmarion.edu/~mercury/mercury.html. (2) The photoessay was exhibited for the community at the Florence Museum (August – September 2003) and will be exhibited at the Francis Marion University Smith University Center Gallery (May – August 2004). (3) The project resulted in a student-sponsored community action initiative, designed to stimulate state discussion regarding fish consumption advisories and methods for preventing mercury increases in our waterways. This was accomplished when a CD-Rom copy of the PowerPoint presentation was sent to South Carolina legislators and DHEC officials with accompanying letters of transmittal. (4) Data was obtained from an environmental knowledge and attitude survey, revealing significantly higher scores on the post-test for both environmental classes (those who participated in the project, and those in the control group) as well as for the English classes that participated in the project. The control English class showed no difference from pre-test to post-test. Only the control environmental science class showed a significant difference on the post-test in an area other than knowledge, with a greater percent answering positively to verbal commitment (Figures 1-5; Table 2). Of the 66 students who participated in the project, 53% were majoring in business. LH – note, that 13 + 44 does not add to 66. there were 66 on the class rolls, but for whatever reason not all took the post test (we have 57 kids who did the project taking the post test -
Figure 1. Mean Scores on Environmental Knowledge and Attitude Scale.
Figure 5. Mean scores on the Environmental Attitude Survey for the Technical Communication and Business Writing classes (CONTROL). The classes had no significant change in pre-test versus post-test scores. (n=39)
Table 2: Statistical Data from the pre-test and post-test surveys given to the English and Biology classes.

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>Verbal Commitment (Questions 1-10)</th>
<th>Actual Commitment (Questions 11-20)</th>
<th>Affect (Questions 21-30)</th>
<th>Knowledge (Questions 31-45)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD</td>
<td>5.70 1.73</td>
<td>2.8 1.92</td>
<td>5.9 2.20</td>
<td>4.44 1.81</td>
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<tr>
<td>Environmental Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Honors Pre -test (n=9)</td>
<td>Mean SD</td>
<td>6.3 2.46 0.303</td>
<td>2.9 1.77 0.466</td>
<td>6.6 2.66 0.447</td>
<td>7.46 1.61 0.00026 *</td>
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<tr>
<td>Environmental Science</td>
<td>Mean</td>
<td>5.3 2.18</td>
<td>2.3 1.90</td>
<td>5.3 2.74</td>
<td>4.67 2.09</td>
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<tr>
<td>Honors Post -test (13)</td>
<td>SD</td>
<td></td>
<td></td>
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<tr>
<td>Environmental Science</td>
<td>Mean SD</td>
<td>6.7 2.31 0.035 *</td>
<td>3.4 2.49 0.088</td>
<td>6.8 2.39 0.123</td>
<td>5.85 2.46 0.0048 *</td>
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<tr>
<td>Control Pre- test (52)</td>
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<td></td>
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<tr>
<td>Environmental Science</td>
<td>Mean SD</td>
<td>5.1 2.20</td>
<td>2.5 2.08</td>
<td>5.2 2.70</td>
<td>5.878 2.29</td>
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<tr>
<td>Control Post- test (53)</td>
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<tr>
<td>English 305 / 318 Pre-</td>
<td>Mean SD</td>
<td>5.20 2.55 0.439</td>
<td>2.7 2.21 0.15</td>
<td>5.1 2.66 0.333</td>
<td>7.09 1.74 0.0027 *</td>
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<tr>
<td>49)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English 305 / 318 Post-</td>
<td>Mean SD</td>
<td>5.1 2.26</td>
<td>2.4 2.21</td>
<td>5.7 2.40</td>
<td>4.95 2.31</td>
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<td>(n=44)</td>
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<td></td>
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<tr>
<td>English 305 / 318 –</td>
<td>Mean SD</td>
<td>4.9 2.35 0.118</td>
<td>3.0 2.37 0.255</td>
<td>5.0 2.87 0.483</td>
<td>5.51 2.47 0.153</td>
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<td>Control Pre -test (n=37)</td>
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<tr>
<td>English 305 / 318 –</td>
<td>Mean SD</td>
<td>5.1 2.26</td>
<td>2.4 2.21</td>
<td>5.7 2.40</td>
<td>4.95 2.31</td>
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<tr>
<td>Control Post -test (n=39)</td>
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</table>
IV. Discussions and Conclusions

Lisa: Let’s see if we can combine and condense the next 2 paragraphs: I agree

The post-test results indicate an increase in knowledge for the students who participated in the project, although there was not a significant increase in attitude. Although business students were targeted, the post-test confirms that their attitudinal change after the project was improved, but not significantly, as we had hoped. One explanation might be that, by necessity, the post-test was administered at the end of the semester-long course, but not at the end of the project when the products were complete and distributed state-wide. In fact, the Power Point presentation was not available for viewing on the internet until 2 months later in the summer and the photo essay was not available for public display until 3 months later. Consequently, surveyed students had not had an opportunity to see the fruits of their labors, or to fully understand the impact of the project, at the time of the post-test. One year after the course began, students are finally able to see the results and get an idea of the scope and magnitude of their efforts, thus increasing their sense of empowerment and attitude toward environmental activism.

Environmental science must be taught interdisciplinarily, but strictly teaching content is not enough. In a summary of research pertaining to science education, Louis Iozzi (1989) notes that focusing on the affective domain is crucial to teaching positive environmental attitudes and values. Knowing why we need to improve environmental quality is important, but possessing such knowledge does not ensure that one will be motivated to take action or use knowledge to select environmentally sound choices. Although the relationship between knowledge and action is unclear, recent studies indicate that knowledge alone will not ensure responsible environmental behavior (Tomsen and Disinger, 1998).

Positive environmental attitudes, once acquired, appear to be long lasting (Edwards and Iozzi, 1983). A study in which teachers attended a summer institute showed that both knowledge and attitude had increased by the end of the two week institute, however, when tested two years later, it was seen that there was a large decline in knowledge, to the point that it was not significantly different from knowledge prior to the institute, but environmental affect and actual commitment stayed high (Hungerford and Volk, 1990). This is important especially with respect to the increasing need for students with environmental training.

Our project involving English classes and Environmental Science classes worked in a variety of ways. Most importantly, we believe that it laid the basis for a feeling of empowerment and ownership of the project. Though attitude scores were not significantly different on the post-test, student comments such as “The real-life situation made the assignments more enjoyable because there was a point in doing them” show
that perhaps, given more time and a chance for the students to see the end products of the project, attitude scores would increase as the knowledge scores did.

Integrating service and learning by solving problems as part of the curriculum can improve education as well as make the education more relevant and more interdisciplinary (Orr, 1994). Courses with these components result in a high level of student engagement as students learn to put their ideas about sustainability into action, as well as promoting interdisciplinary learning and teaching critical thinking skills and the skills necessary to deal with real-life problems (Ahern-Rindell, 1998; Balsas, 2001; Cortese, 1992; Chaplin et al., 1998; Filho, 2000; Flint, 2000; Leroy et al., 2001).

Working with the intent that the products of the course would actually be used and viewed by state politicians and teachers gave the students a sense of political efficacy and the belief that their voices mattered and that they actually made a difference (Breyman, 1999).

Two, business majors were made more aware of environmental problems and they learned the skills necessary to take action. Of the 66 students who participated in the project, 53% (35) were majoring in business, and these are the students who are traditionally less inclined to participate in environmentally beneficial actions. A study of MBA students before and after a course on the environment emphasized that attitudinal as well as behavioral changes can result from a single course (Benton, 1993).

The business world has begin to acknowledge that the environment is playing an increasingly prominent role in all aspects of American society yet only 37% of CEOs and board members surveyed feel they have successfully integrated environment into everyday actions. Many corporate leaders recognize the need to become more environmentally sustainable, yet most MBA students are not trained to consider the natural environment as a key factor in business decisions. In fact it is difficult to find business school programs that teach environment and sustainability issues even though most companies report increasing consumer requests for environmental information on their products and processes (Benton, 1993; Bunch and Finlay, 1999; Eagan and Streckewald, 1997; Inman, 1973; Jubeir, 1995).

Business students were not less environmentally knowledgeable but did demonstrate less concern for the environment, less willingness to act in environmentally friendly ways, when compared to students majoring in other fields using an environmental knowledge / attitude survey (Benton, 1994). Results of a study to determine the relationship of educational programs to people’s tendency to participate in a collective action aimed at environmental protection or improvement confirmed that education affects environmental attitudes: knowledge of science, psychology, humanities, social science and education was associated with willingness to support environmental action, but students who majored in business or economics were less likely to support environmental action (Smith, 1995).

Three, the communication skills of students in both classes were increased and the science knowledge of students enrolled in a non-science course also increased. A
National Commission on Writing in America’s schools and Colleges report says student success hinges upon increasing writing proficiency in the nation’s schools. Using extended writing exercises in every subject is important (Manzo, 2003). Additionally, students enrolled in an English class which wrote on biology topics gained a greater awareness of biology’s importance, and more respect for biology (Kokkala, 2002). Many students are not used to thinking consciously and deliberately about whom they are addressing when they write – they often view the task narrowly, as course-based assignments whose sole audience is the instructor and whose purpose is to obtain a satisfactory grade. Because they perceive such assignments as detached from the ‘real world’ they tend to write in a vacuum, struggling with issues of purpose, form, diction and voice. Assignments paralleling real-life science writing situations and addressing clearly defined audiences can transform student writing. Students can make more informed decisions about all aspects of their writing once they understand the needs and expectations of their readers (McMillan and Huerta, 2003).

V. Recommendations for Subsequent Efforts

It was quickly discovered that a project of this magnitude cannot be completed in a single semester. Recommendations for similar projects in the future include developing a method for long-term communication with the class members to ensure that all participants have the opportunity to see the final products and have access to feedback. For example, it was 6 months after the semester ended before the photoessay was on display at the museum, and several months before the PowerPoint presentation was in final form and ready to be mailed. After mailing, several thank you letters were received, including one from the S.C. governor. With a project like this, it could conceivably be two years before it is complete and feedback received. Empowerment of the students would have been much more complete had they had access to the positive feedback and if we had a way of letting them know when the photoessay would be displayed and the web site of the final PowerPoint presentation.

It was also noted that there are several advantages and disadvantages to trying a project like this at the university level. In a high school setting, it would have been much easier and more effective to have the students be enrolled in both the technical communication classes and the environmental classes, which would have reinforced concepts and would have been more typical of interdisciplinary learning. At the university level however, the students were all of voting age and so were in a better position to write to their legislators.

There were also certain risks associated with an interdisciplinary project of this nature. One, focusing on a single topic over a variety of assignments may lead to an increased attitude of student boredom. Second, there were often times in the English courses that science questions were asked, and vice versa, leading to some frustration with the inability to answer question outside our field of study. Third, there was some confusion because of communicating through technology, primarily the Blackboard system. There were also some incompatibility issues with software programs that the
students used. Lastly, there was the problem of providing too much guidance for true inquiry learning, base on the need to stick to the project schedule. The Biology class had to have their feedback handed in by a certain time so that the English class could continue. Future courses developed in this manner need to …

VI. Literature Cited


Jubeir, J. 1995. Educating Environmental Managers for Tomorrow: The environment must be part of the bottom line. EPA Journal 31-33.


Schlosberg, D. and Sisk, T. 2000. The environmental science / policy menace: crossing disciplinary boundaries with a team-teaching approach. PS 75- 79. PS Online


This requires effective communication skills and a solid grasp of persuasive strategies.

{important if programs in environmental education were to be effective in teaching}

Traditional thinking in the field of environmental education is that making humans more knowledgeable about the environment and its associated issues will lead to favorable attitudes which will lead to action promoting better environmental quality; unfortunately research into environmental education does not bear out the validity of this linear model.

Empower Students and Address Environmental Issues

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1 One such program utilizing comprehensive programs with environmental themes is the EIC program (Using the Environment as an Integrated Context for Learning), now modeled in some Pennsylvania, Wisconsin, Maryland, and Minnesota schools (Ruskey, 1995). South Carolina, with the lowest high school graduation rate of all 50 states, will start the EIC program this year. Programs such as EIC are not only designed to improve test scores in all disciplines, reduce discipline problems in schools, motivate and interest students in their own learning but also to make people more knowledgeable about the environment and its associated issues (Lieberman and Hoody, 1998).