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A survey of the environmental
education of students in non-
environmental majors at four-
year institutions in the USA

Environmental
education of
students

301

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Abstract *Chief academic officers at four-year institutions in the USA were surveyed electronically to examine the extent to which these institutions provide for the environmental education of students in non-environmental majors, and to identify various approaches to increasing environmental literacy at the college level. Of the 496 responding institutions (representing a 42.3 percent response rate), 11.6 percent indicated that an "environmental literacy" course was required of all students, and 55.0 percent reported that such a course was available and countable toward the institution's general education requirements. At least one "environmental" minor (e.g. Environmental Science, Environmental Studies) was offered at 33.7 percent of the institutions; 39 percent reported the existence of an "environmental" academic program that offered a course appropriate for non-majors. Discusses various approaches to achieving environmental literacy at the college level and statistical differences in survey responses among Carnegie classifications, from Research to Baccalaureate; between public and private institutions; and among geographical regions.*

A 1998 survey conducted by Roper for the National Environmental Education and Training Foundation revealed persistent misconceptions in the USA with respect to the environment. For example, only 27 percent of Americans know that most electricity in the USA (70 percent of total production) is produced by burning coal and other flammable materials; rather, a majority believes that energy is produced in non-air-polluting ways, mostly by hydroelectric generation, which in fact provides only about 10 percent. Further, 47 percent think that the most common form of surface water pollution is waste dumped by factories, and another 15 percent of Americans think that garbage dumping by cities is the primary cause of water pollution. Only 22 percent know that run-off is the most common form of surface water pollution (National Environmental Education and Training Foundation/Roper Starch Worldwide, 1998).

In a 1994 essay, Orr suggested that the "ignorant and uneducated" are not primarily to blame for the environmental crisis. Rather, he said, it is the work of degree-holding individuals who have been indoctrinated with the notion that

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domination of nature is the rightful destiny of humans. He contended that solutions to ecological challenges would require reconsideration of the "substance, process, and purposes of education at all levels" (Orr, 1994, p. 44). Brough (1994, p. 37) warned that, without continued changes within higher education, most college students will graduate "with only a shallow knowledge of the planet that sustains them".

According to Gardiner *et al.* (1998), the liberally educated person is actively aware of his/her natural environment. This includes a knowledge of the structure and function of the planet's physical and biological systems as well as the impact of humans on the environment, and the ability to perceive possible solutions to environmental problems.

The 1998 edition of *Peterson's Guide to Four-Year Colleges* lists more than 983 programs in institutions offering majors in environmental science, environmental studies, or related subjects; this may represent more than a tenfold increase in the number of such programs in existence 25 years ago. However, the extent to which colleges and universities educate students in other majors about the environment is unknown. Coppola (1999, p. 39) points out that specialized environmental programs reach only a minority of undergraduates, and contends that "Students who do not major in environmental sciences or studies or who do not elect an environmental course will miss an opportunity for developing responsible behavior toward human and nature relationships."

Nickerson (1994, pp. 49-50) stated that universities had:

Come to realize that all students, not only those interested in science-based environmental studies, must become environmentally literate, in the same way that all students must understand math and science, even if they don't major in, or even enjoy, these subjects . . . all have a need to be sufficiently acquainted with science to discharge their obligations as citizens by making rational, environmentally sound decisions.

This research was conducted to examine the environmental education available to undergraduates in the USA who are not majoring in an environmental field such as environmental science, environmental studies, or environmental engineering.

Methods

The survey was addressed to the Chief Academic Officers (CAOs) at 1,172 (representing 84 percent) of the approximately 1,400 institutions in the Carnegie categories defined in Table I. Contact information for the CAOs was obtained from a mailing list purchased from Higher Education Publications, Falls Church, Virginia. The questionnaire was sent by electronic mail, if the CAO's e-mail address was available; a small number of questionnaires were sent via surface mail. In many cases the questionnaire was forwarded by the CAO to another person for completion. "Environmental literacy" (EL) was defined as "a basic understanding of the concepts and knowledge of the issues and information relevant to the health and sustainability of the environment, as well as environmental issues related to human health".

Table I.Definitions of Carnegie
classifications

Classification	Definition
Research	Award at least 50 doctoral degrees annually; receive at least \$15.5 million annually in federal support.
Doctoral	Award at least ten doctoral degrees annually in three or more disciplines, or 20 or more in one or more disciplines.
Master's	Award 20 or more Master's degrees annually in one or more disciplines.
Baccalaureate	Award fewer than 20 Master's degrees annually.

Note: In this study no differentiation was made between level I and level II of each Carnegie classification; for more detailed definitions of these classifications the reader is referred to www.carnegiefoundation.org

Nominal-level questions asked whether the institution's general education curriculum included an EL course as a requirement or an option, and whether an "environmental" minor were offered. Respondents were also asked whether an "environmental" academic program (e.g. environmental science, environmental studies, etc.) existed, and if so whether it offered a course appropriate, or designed for, non-majors. All such questions were phrased positively.

Responses to nominal-level questions were analyzed for statistically significant differences at the $\alpha = 0.05$ level between public and private institutions; among Carnegie classifications; and among geographical regions. Geographical regions are shown in Figure 1. The statistical methods used were those outlined in Mendenhall and Sincich (1995) for determining a confidence

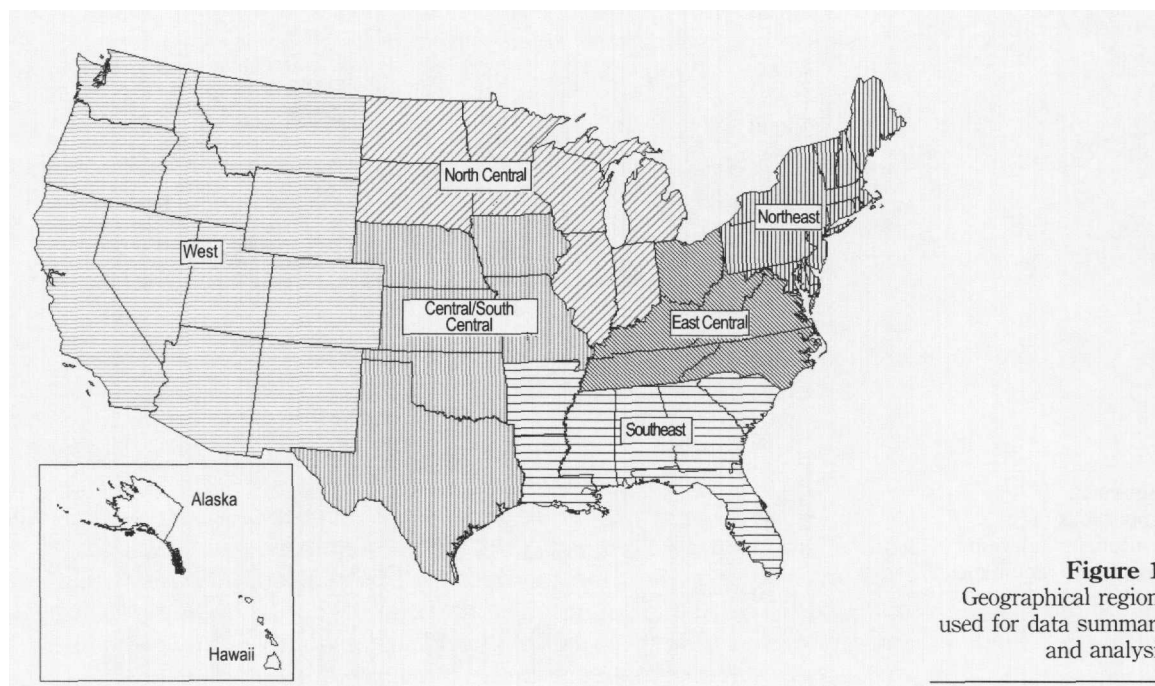


Figure 1.
Geographical regions
used for data summary
and analysis

interval for a binomial proportion, and for testing the difference between two binomial proportions. The methods are shown in detail in the Appendix.

Results and discussion

A total of 496 institutions responded, representing a response rate of 42.3 percent.

Core requirement

Survey respondents were asked to indicate whether or not the following statement applied to their institutions: "As part of this institution's core curriculum, all students are required to take one or more courses specifically intended to increase their environmental literacy." Figure 2 shows proportions of positive responses between public and private institutions, among Carnegie classifications, and among geographical regions. In all graphs, error bars represent two standard errors.

A total of 11.6 percent of responding institutions indicated that this statement was true of their institutions. The small proportion of respondents reporting such a requirement is not surprising, in light of a 1989 study of graduation requirements' which concluded that over 90 percent of the nation's

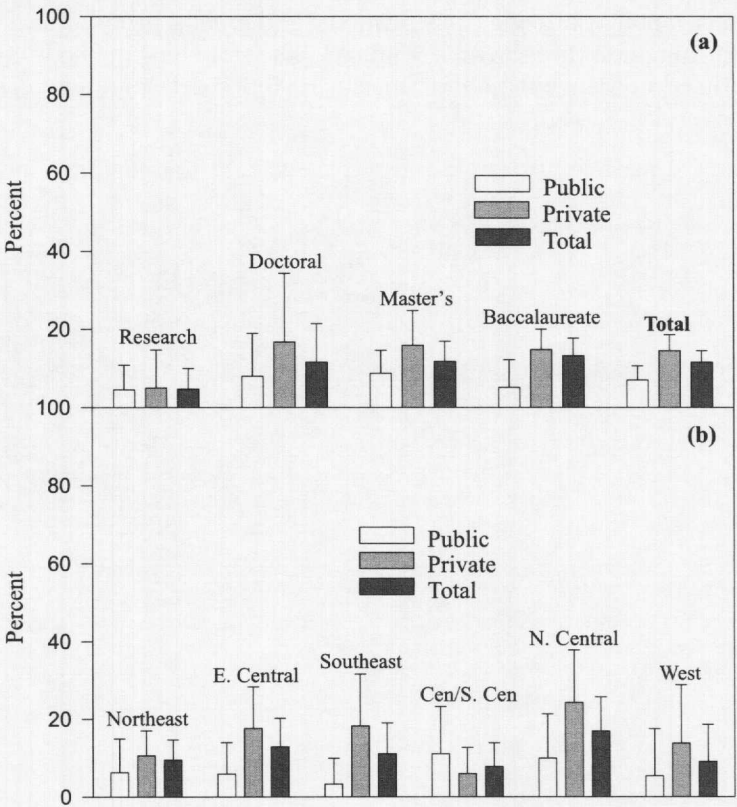


Figure 2. Proportions of institutions indicating an EL core requirement, by Carnegie classification (a) and region (b)

colleges and universities require students to select from lists of courses rather than to take prescribed courses (Toombs *et al.*, 1989). Overall, the proportion of private institutions responding positively (14.5 percent) was more than double the proportion of public institutions (7.0 percent); the difference between public and private institutions was statistically significant, as was the difference between private institutions in the Northeast and North Central regions.

Coppola (1999) opines that EL can be achieved for all graduates only by a general education requirement; and Collett and Karakashian (1996a, p. 3) write, "It is our conviction that within the next decade a graduation requirement in environmental literacy, championed by student activists, will be common in higher education, along with full majors in environmental studies." In another essay (Collett and Karakashian, 1996b, pp. B1-B2), the same authors contend that a "general-education requirement in environmental literacy . . . is the best way to make sure that all students become educated about the biosphere".

Two respondents whose institutions' general education requirements do include an EL course indicated that this approach has been successful; the first was a public doctoral institution, the second a private Master's institution:

Under a grant from the Environmental Protection Agency, we developed the course "Society, Technology, and Environment" as part of our core required curriculum. A textbook – *Environmental Protection* – has been published and is widely available, and our experiences with the curriculum have been published in peer-reviewed journals. I believe that our approach has been very, very successful for our students (Elliot, 1999).

When our evening program was developed in 1991 the science requirement was limited to the Ecology and Environment course. This course is described in the catalog as follows:

"Ecology and the Environment: Crises and Conflicts (3 units). Investigation of ecological principles involved in human relations to and interaction with the environment. Emphasis is given to political and economic aspects involved in the solution of environmental problems. A number of laboratory/field problems are studied."

This has been a very popular course and students have indicated that their lifestyles have been positively impacted by this environmental study (Lucy, 1999).

Two other respondents expressed the opposite opinion of this approach, however:

We feel that the best way to promote env. literacy is to offer compelling courses oriented toward environmental issues. Students are drawn to these because of interest and reputation, *not* because the courses are required! Requiring students to take courses results in a disinterested student audience and lowered quality of interactions in the classroom (Ellmore, 1999).

We feel that requiring environmental literacy courses is a heavy-handed strategy likely to backfire. Instead, we offer a rich program that students can sample and sponsor many on-campus events to raise the general level of environmental understanding (Everbach, 1999).

Finally, one respondent from a research university in the south central USA raised the issue of resource availability in such curricular decisions:

We have a course but to expand it into the realm of being required would require new resources to have enough faculty to teach this course to all of the new students that matriculate yearly (Vitek, 1999).

General education option

Figure 3 depicts proportions of responding institutions, indicating that the statement, "All students are *not* required to take an 'environmental literacy' course as part of this institution's core requirements; however, such a course is available and may be counted toward the fulfillment of general education requirements", was true of their institutions. In this case, statistically significant differences were seen between public (75.0 percent) and private (50.0 percent) research institutions. In addition, there was a statistically significant difference between the proportion of public research institutions responding positively and the proportion of either public master's (57.6 percent) or public baccalaureate (41.0 percent) institutions. Regionally, a statistically significant difference was seen between the total proportion of positive responses in the Central/South Central region (42.9 percent) and that in both the Northeast (61.1 percent) and North Central (61.0 percent) regions. The proportion of positive responses among public institutions in the Western region (70.3 percent) was greater than that in the Central/South Central region (44.4 percent). Finally, a statistically significant difference was seen between the proportion of positive responses in public v. private (44.8 percent) institutions in the Western region.

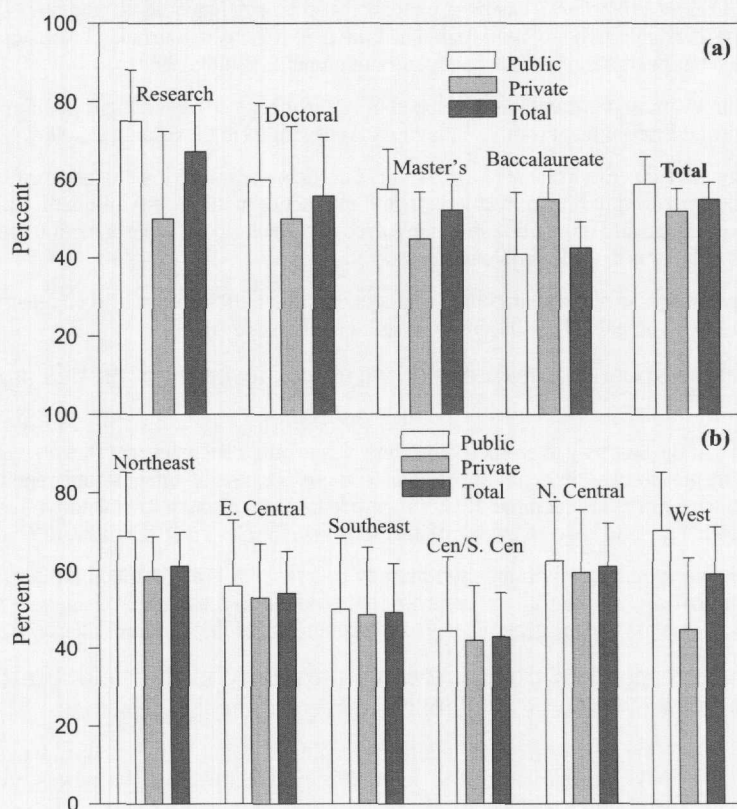


Figure 3.
Proportions of
institutions reporting an
EL core option, by
Carnegie classification
(a) and region (b)

Course appropriate for increasing EL

The proportions of institutions, that indicated the existence of an academic program that offered a "course appropriate for increasing the environmental literacy of non-environmental majors, although not designed for that purpose", are shown in Figure 4. Statistically significant differences were seen between the total proportion of research institutions (54.7 percent) and the total proportion of master's institutions (36.0 percent) responding positively, as well as the proportions of public research (56.8 percent) and public baccalaureate institutions (25.6 percent). Regionally, among public institutions, the proportion of institutions responding positively in the Southeast was less than that in each of the five other regions by a statistically significant margin. Among private institutions, the proportion responding positively was greater in the Northeast (44.7 percent), North Central (51.4 percent) and Western (48.3 percent) regions than in the Central/South Central region (22 percent). In addition, the proportion of positive responses among private institutions in the Northeast and North Central regions was greater than that in the East Central region (27.5 percent).

Course designed for increasing EL

Proportions of institutions indicating the existence of an academic program that offered a "course designed to increase the environmental literacy of non-environmental majors" are shown in Figure 5.

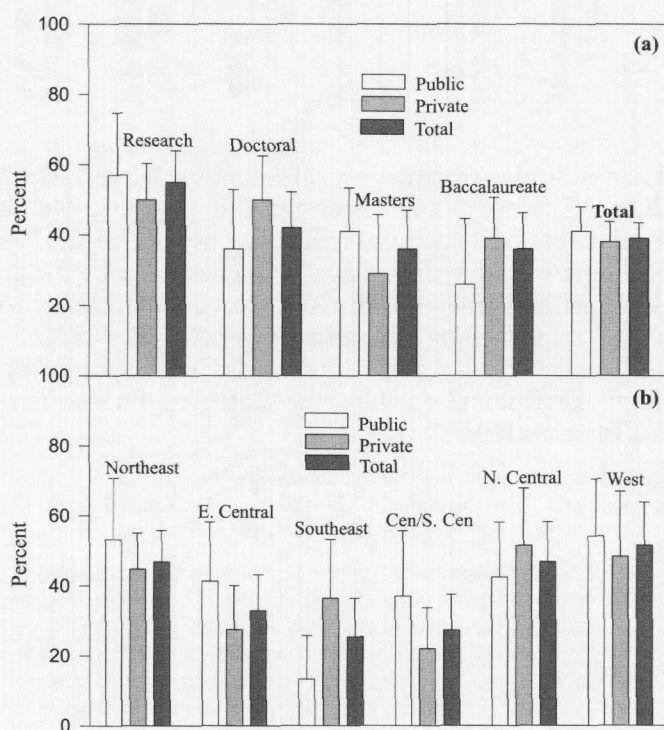
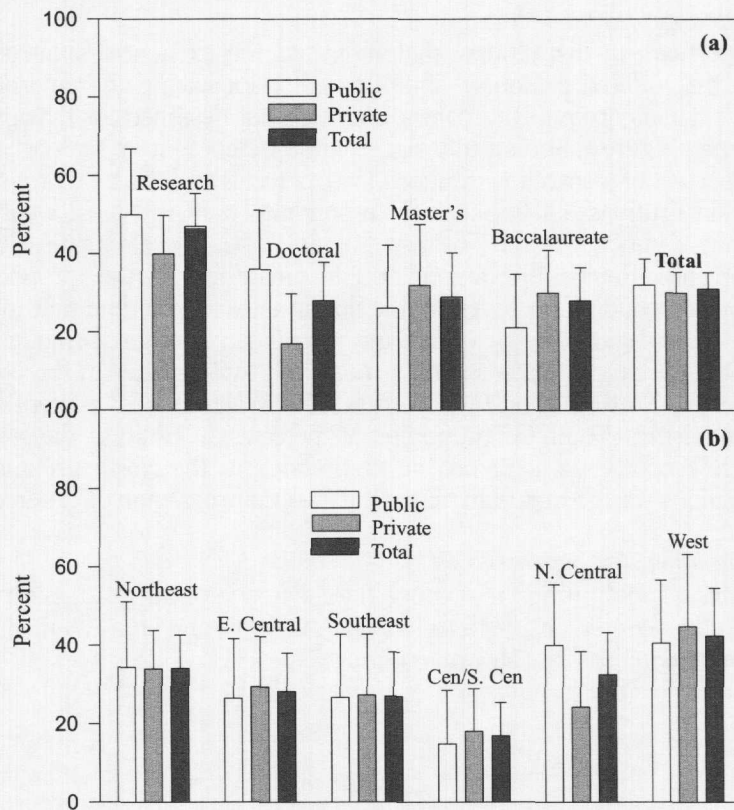


Figure 4. Proportions of institutions indicating the existence of an environmental program offering a course "appropriate" for non-majors, by Carnegie classification (a) and region (b)

Figure 5. Proportions of institutions indicating the existence of an environmental program offering a course "designed" for non-majors, by Carnegie classification (a) and region (b)



Two assumptions led to this question's inclusion in the survey. The first was that an "introductory" course or courses designed to provide a foundation for students majoring in that particular discipline may not be the ideal vehicle for providing some "literacy" in that discipline to students majoring in other fields. For example, Chinnici and Hiley (1998) report recognition of this reality by science faculty at Virginia Commonwealth University; the solution was the development of a selection of science courses designed specifically for the general education curriculum. Further, the Carnegie Foundation for the Advancement of Teaching (1977) writes:

Breadth or distribution requirements are too often ... met by the introductory course intended for persons who plan to major in the field ... We suggest special courses for non-majors ... (Carnegie Foundation for the Advancement of Teaching, 1977, p. 12).

One way to improve that part of general education that is drawn from the subject fields is to develop for each one an introductory course for non-majors ... In making this suggestion, we are aware that there is widespread criticism of what are often called "survey courses." It is true that, when they are badly handled, introductory courses deteriorate into superficial "appreciation" courses. We do not believe, on the other hand, that the flaw is in the concept. The flaw is in execution, which, in turn, is subject to college control (Carnegie Foundation for the Advancement of Teaching, 1977, p. 170).

The second premise that led to inclusion of this question in the survey was that academic units (i.e. departments, schools, etc.) should take seriously the need to impart, at a minimum, "conversational" knowledge of their disciplines to students in other majors who enroll in their courses either as electives or to satisfy general education requirements; indeed, that the education of such students should be a primary goal of academic units and that outreach to the student body at large should be a part of the unit's agenda. One respondent indicated that educating the larger campus community is a goal of his institution's Environmental Studies department:

By creating a department of Environmental Studies in 1998, Emory College and Emory University made a statement that environmental literacy should be a component of undergraduate education. Developing that literacy of the Emory community is a programmatic goal of the Department of Environmental Studies (Gunderson, 1999).

A statistically significant difference was seen between the proportion of total research institutions responding positively to this question (46.9 percent) and that of total doctoral institutions that responded positively (27.9 percent). Among public institutions, the proportion of research institutions responding positively (50.0 percent) was greater than the proportion of both Master's (26.1 percent) and baccalaureate (20.5 percent) institutions by a statistically significant margin. Regionally, the proportion of private institutions reporting the existence of such a course in the Central/South Central region (18.0 percent) was less than that in the Northeast (34.0 percent) and Western (44.8 percent) regions. Among public institutions, the proportion of positive responses in the Central/South Central region (14.8 percent) was less than that in the North Central (40.0 percent) and Western (40.5 percent) regions by a statistically significant margin.

Does a single course make a difference?

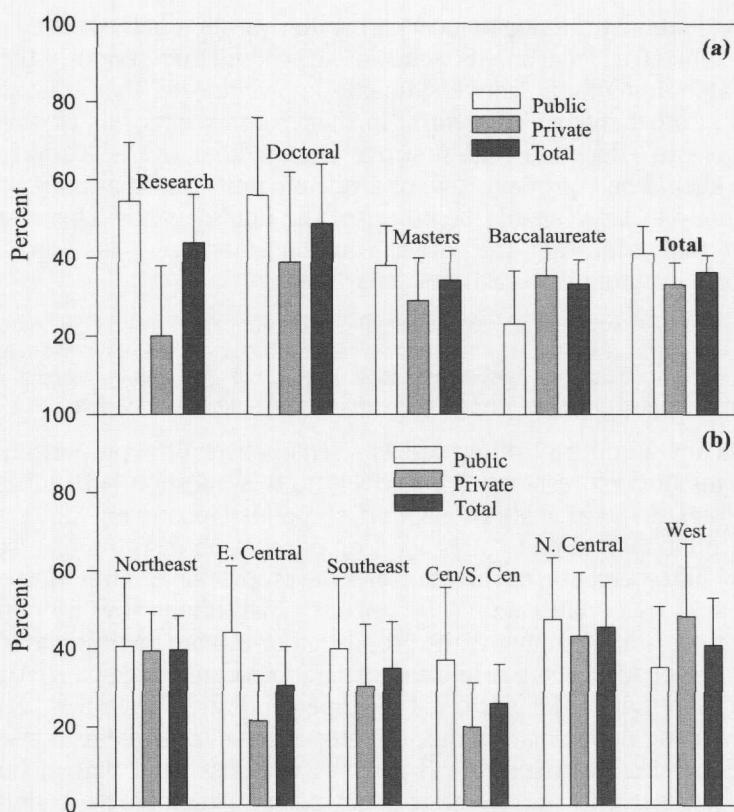
This question is appropriate, since the discussion thus far has focused on individual courses; research indicates that the answer is "yes". Smith-Sebasto (1995) reported a statistically significant difference in measures of environmentally responsible behavior among students who completed an environmental studies course, in comparison with a control group of students who completed a history course. Benton (1993) found that MBA students who had completed a ten-week environmental management course were more environmentally knowledgeable, expressed greater concern about the environment, and were more action-oriented than was true before the course.

"Environmental" minor

Since a minor typically consists of 15 credit hours, it represents the most in-depth EL option short of a major; its primary disadvantage is the relatively small number of students who choose to pursue such a minor.

Proportions of institutions reporting the existence of an "environmental" minor are shown in Figure 6. The proportion of public baccalaureate institutions reporting the existence of such a minor (23.1 percent) was less than

Figure 6.
Proportions of
institutions reporting
the existence of at least
one "environmental"
minor, by Carnegie
classification (a) and
region (b)



the proportion of research (54.5 percent) or doctoral (56.0 percent) institutions that did so by a statistically significant margin. Among private institutions the proportion reporting such a minor in the Northeast (39.4 percent), North Central (43.2 percent) and Western (48.3 percent) regions was significantly greater than the proportion in the Central/South Central (20 percent) and the East Central (21.6 percent) regions.

A number of respondents mentioned the existence of some type of interdisciplinary environmental program, e.g. an interdisciplinary minor. One respondent from a public Master's level university makes a persuasive case for a team-taught introductory course for an interdisciplinary program:

Salisbury State University currently has an interdisciplinary environmental minor program. As a steering committee member, I have been involved in planning the new curriculum for the minor. A new interdisciplinary course in environmental studies that involves faculty from ecology, philosophy and economics has recently been developed in order to provide unity to the minor. This course is currently being taught in the fall 1999 semester and has been very successful thus far.

I think that providing the students with this interdisciplinary approach to the environment can greatly improve the program in many ways. First, the course introduces students to the different ways of approaching environmental issues. This knowledge could increase

students' interest in environmental courses that they never would have taken prior to the interdisciplinary course. Second, the course provides the students with a framework for the interdisciplinary minor. Because the minor has courses from many departments, the students may feel that the minor is disjointed. A course such as this – that is required of the minor – could help to avoid this feeling. And lastly, the course mimics the real world. Environmental studies are interdisciplinary by nature – and should be addressed in this way in the classroom (Caviglia, 1999).

Other approaches to EL

"Infusing" sustainability and environmental issues across the curriculum.

Responses to some open-ended survey questions revealed an approach to EL on college campuses that was not addressed by a direct survey question: that of integrating environmental themes into courses across the curriculum. For example:

Another route that has proven successful in enhancing env. literacy at Tufts has been to invest in faculty development programs, offering workshops to help faculty design and incorporate environmental units or perspectives in their already-established courses. These workshops have gone a long way in "seeding" dozens of courses with environmental perspectives across the curriculum ranging from engineering to drama (Ellmore, 1999).

Reaching non-environmental majors through non-environmental classes:

- affirms that environmental concerns are not marginal;
- reaches more students; and
- does not depend upon a small number of faculty (Strauss, 1996).

This approach might be compared with the "Writing across the curriculum" movement of the 1970s and 1980s. In summarizing the curriculum reform movement of the 1980s, Gaff (1991) opined that students benefit most from particular kinds of general education curricula, including mandated study across the curriculum of such subjects as writing, critical thinking, and ethics or values.

EL as an educational "outcome". A current trend in higher education is that of focusing on learning outcomes rather than content inputs in designing curricula. For example, students at Alverno College in Milwaukee, Wisconsin must demonstrate competence in eight "abilities" in order to graduate; one of the abilities is "taking responsibility for the global environment" (Levine and Nidiffer, 1997). The trend toward educational outcomes is reflected also in Iowa State University's response to the survey:

Through our curriculum process, we are looking at re-defining our core set of expected outcomes for students. Among those being considered is environmental literacy.

We have seven undergraduate colleges, and few general education requirements for all students at Iowa State. Our focus on core student outcomes is the way in which we achieve common curricular goals without requiring all curricula to accomplish those outcomes in the same way (namely, with the same course requirements). We believe that this approach is consistent with current trends in higher education focusing on student learning outcomes rather than curricular inputs (Shapiro, 1999).

Conclusions

In view of the dismal facts and opinions reported in the first paragraphs of this paper, the author generally finds the survey results encouraging, e.g. that more than half (55 percent) of the responding institutions indicated that at least one EL course was included in the institution's general education curriculum; that 39 percent report the existence of an environmental program offering a course "appropriate" for non-majors; that 30 percent have environmental programs that offer a course "designed" for non-majors; and that one third of the institutions offer an "environmental" minor. Obviously, however, there is still much more that could be done with regard to these approaches as well as others. For example, a few survey respondents mentioned institutional environmental educational activities involving K-12 students, prompting the author to further explore involvement of higher educational institutions in K-12 environmental education; findings will be reported in a forthcoming paper.

Three general "trends" were observed among responses to nominal-level survey questions.

The first was that proportions of positive responses to most survey questions were greater among research institutions than among the other Carnegie classifications. Perhaps this is simply a reflection of more diverse curricula among these largest institutions. Comments of the Carnegie Foundation for the Advancement of Teaching (1977) may be relevant:

Private liberal arts colleges are often disadvantaged in . . . competition, because they lack financial and other resources needed to expand their curricula (Carnegie Foundation for the Advancement of Teaching, 1977, pp. 60-1).

In terms of comprehensiveness, the community colleges and liberal arts colleges have the fewest offerings, and the research universities have the largest number. This characteristic is influenced by size and also by function and history. Institutions that were established with responsibilities for teacher education or with the responsibilities for agricultural and technical education under terms of the Land-Grant College Act tend to be more comprehensive than liberal arts colleges (Carnegie Foundation for the Advancement of Teaching, 1977, pp. 140, 149).

According to Ratcliff (1997, p. 144), however, there may be reason to hope that smaller institutions will follow suit:

The research university leads the academic procession . . . The other forms of higher education – the community colleges, liberal arts colleges, comprehensive institutions, and doctoral granting universities – have drifted toward the ideals of the research university or followed innovations produced by them like the tail of a snake following its head.

The second general trend was that of greater proportions of positive responses among public than among private institutions. One notable exception to this trend was that more than twice as many private as public institutions reported requiring an EL course in their core curricula (Figure 2(a)). However, since this was the only exception to the trend, perhaps it merely indicates a greater preference among private institutions for core curricula over distribution requirements.

The third general trend was that, in regional comparisons, proportions of positive responses were significantly lower in the Central/South Central region than in the Northeast, North Central and Western regions.

Environmental
education of
students

Recommendations

So is there a "best" approach to incorporating EL into the curriculum and culture of a college or university? In part, the answer depends upon the institution's particular culture. Institutions whose general education curricula comprises core requirements should include an environmental course in those requirements. On the other hand, those who allow students to select general education courses from a "menu" (i.e. distribution requirements) should include an interesting selection of environment-related courses and require students to choose one or more. Such courses could include sufficient science to satisfy general education science requirements for non-science majors. Institutions moving toward basing their general education curricula on "learning outcomes" rather than "content inputs" should include environmental literacy among their expected learning outcomes.

Whether or not an institution's core or distribution requirements include courses offered by an "environmental" department or program, such programs can reach out to the broader campus community in a variety of ways, such as designing courses specifically for non-majors, and publicizing environmental courses appropriate for non-majors. Other avenues for outreach include a weekly column in the campus newspaper, and special lectures and seminars appropriate for general audiences. For example, the University of Oklahoma's Interdisciplinary Perspectives on the Environment minor received a grant from the College of Arts and Sciences to fund a series of lectures which included Interior Secretary Bruce Babbitt, historian Carolyn Merchant, philosopher Mark Sagoff, and ecologist George Cox (Heiser *et al.*, 1996).

Other approaches that can be employed alone or in combination with any of the above include incorporation of environmental and sustainability issues across the curriculum. To maximize the effectiveness of such efforts, faculty can avail themselves of such resources as Second Nature, Inc. <<http://www.secondnature.org>> or Collett and Karakashian's (1996a) *Greening the College Curriculum*. In addition, institutions might consider publication of a catalog of environmental courses; two survey respondents reported annual publication of such a catalog at their institutions.

Finally, the importance of "green" campus operations cannot be overemphasized. The reader is referred to Bloom's (1982) discussion of the "latent curriculum" – i.e. the lessons educators and institutions teach via their day-to-day practices and operations. Bloom contends that the latent curriculum may actually be more effective than the manifest curriculum; that learning is most powerful when the manifest and latent curricula reinforce each other; and that, when the two curricula are in conflict, the latent curriculum is likely to dominate. Keniry's (1995) *Ecodemia* is an excellent guide for greening campus operations from purchasing to groundskeeping, from energy conservation to printing services.

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Appendix

Statistical method:

- Standard error = $\sqrt{pq/n}$,
where
 p = proportion of positive responses and $q = 1 - p$.
 - $z = (p_1 - p_2) / \sigma_{(p_1 - p_2)}$,
where
 p_1 and p_2 = proportions of positive responses,
 $\sigma_{(p_1 - p_2)} \approx \sqrt{pq[(1/n_1) + (1/n_2)]}$,
 $p = (y_1 + y_2) / (n_1 + n_2)$,
 y_1 and y_2 = numbers of positive responses,
 $q = 1 - p$.
- Rejection region: $|z| > Z_{\alpha/2}$