ATTITUDE CHANGES OF UNDERGRADUATE UNIVERSITY STUDENTS IN GENERAL EDUCATION COURSES

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Most agree that education plays a primary role in altering student values (Etzioni, 1993; Ikenberry, 1997; Thomas, 1993) and that general education is a way of satisfying that role (Holloway, 2005). Indeed, educators have pointed out that affective development is at least as important as the development of skills (Aloi, Gardiner, & Lusher, 2003; Kadish, 1991; Lee, 1999; RiCharde, Olney, & Erwin, 1993) because student attitudes can determine how, and even if, learning occurs (Hidi, 1990; Marzano, 2001; Pintrich, Marx, & Boyle, 1993; RiCharde et al., 1993), which can have a long-run impact on how these students function later in life (Erwin, 1991; Howard, 1986).

Whether general education courses change students' values is unclear (Pascarella & Terenzini, 1991), as research on students' affective development is generally lacking (Lazerson, Wagener, & Shumanis, 2000; RiCharde et al., 1993). This is partially because faculty seem unable, or unwilling, to specify the affective objectives of these courses (Gerretson & Golson, 2005; Stone & Friedman, 2002) and the approaches used to meet these objectives (Kobella, 1989). Reasons for this include faculty having difficulty in justifying the values being targeted in the course (Peters, 1980) and their fear of indoctrinating students (Bloom, Hastings, & Madaus, 1971; Kobella, 1989; Lee, 1999). As a result, most attitudinal studies have focused on how the course affects attitudes related to the subject material (e.g., Berg, 2005; Kobella, 1989; Lucas, 1976), the learning approach used (e.g., Eck, 2002), the students' view of themselves

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as a learner (e.g., Barnes, Cerrito, & Levi, 2004; Eck, 2002), or the student's view of faculty expectations (e.g., Barnes et al., 2004). In fact, only recently have researchers looked at the effect of higher education in promoting values-related attitude change (e.g., see Chang, 2002; Holloway, 2005).

At the University of Maine, all students must complete a course designated as meeting the general education theme of "Population and the Environment."[1] This requirement was developed to meet a broader concern for environmental literacy in higher education. Although the University of Maine's justification for the "Population and the Environment" requirement does not specifically mention any affective objectives, a primary goal of environmental literacy is to alter or reinforce attitudes supporting sustainable development and environmental protection (International Union for Conservation of Nature, U.N. Environment Programme, & World Wildlife Fund, 1980; U.N. Conference on Environment and Development, 1992; U.N. Educational, Scientific and Cultural Organization–U.N. Environment Programme, 1978, 1988). Notably, the Tbilisi Declaration states that one objective of environmental education is to alter students' "values and feelings of concern for the environment." Several authors (e.g., Fien, 1988; Hines, Hungerford, & Tomera, 1987) repeat the theme that environmental education is not only about conveying knowledge but also concerned with altering environmental feelings and attitudes.

The ultimate goal of these attitudinal changes is to promote the development of environmentally preferred behaviors (Fien & Tilbury, 1996). Indeed, some evidence exists that exposure to even one environmental education course can alter student environmental attitudes (Benton, 1993; McMillan, 2004; Rowe, 2002) and behaviors (Benton, 1993; Rickinson, 2001). However, the evidence is limited because the analyses are based on relatively small sample sizes or based on samples of students or courses that are relatively restrictive. For example, previous studies use data collected from only one type of major (e.g., only MBA students), a course from one discipline (e.g., environmental studies), or a voluntary course that may be filled with students who are already environmentally minded. Here we assess changes in students' environmental attitudes and values in response to *different* courses designed to address this specific

general education requirement. Further, the courses are offered across a range of disciplinary perspectives (e.g., biology, nursing, women's studies, economics, etc.). Important assessment questions about these courses include whether they affect student attitudes on environmental issues and, if so, whether the effects are the same across the curriculum. Thus, the specific objectives of this project are

- to determine whether courses designated as meeting the "Population and the Environment" requirement effect changes in student attitudes and values on the environment and
- to determine whether courses have differential effects on attitudes and values on the environment.

Methods

To meet the above objectives, a group of University of Maine faculty teaching courses fulfilling the "Population and the Environment" requirement administered an environmental attitude survey to students.

Survey Design

Two standardized instruments are available for attitudinal assessment around issues of the environment: the New Ecological Paradigm Scale (Dunlap, Van Liere, Mertig, & Jones, 2000) and the 2000 ISSP Module on Environment (Jarvis, Park, & Jowell, 1999). The New Ecological Paradigm (NEP) was chosen for this project because it and its predecessor instrument, the New Environmental Paradigm, have been extensively tested for validity and reliability (Dunlap et al., 2000). The NEP consists of 15 statements that respondents indicate their agreement with using a Likert scale.[2] There are eight statements that assert an attitude of environmental concern, such as, "We are approaching the limit of the number of people the earth can support." These are the odd-numbered questions on the instrument. There are seven questions that suggest an opposite environmental attitude, such as, "Humans have the right to modify the natural environment to suit their needs." These are the even-numbered questions. This allows the aggregation of an

individual's responses into a single additive scale by adding the Likert scale scores on the seven "not concerned" questions and subtracting the scores on the eight "concerned questions." For the purposes of reporting this study we will refer below to the odd-numbered questions as "green" and the even-numbered questions as "brown."[3] The NEP also allows more sophisticated analysis to get at the effects of general education courses on responses to specific questions.

Survey Administration

On the first and last day of classes, the NEP survey instrument was administered to students in 13 different University of Maine courses in the 2004–2005 academic year (Table 1). This before and after testing of student attitudes was conducted to identify and measure changes in attitudes while controlling for any preexisting attitudes (Astin & Lee, 2003). The surveys were administered to maintain student anonymity. Fewer completed surveys were collected at the end of the semester than at the beginning, reflecting several factors relating to registration processes and student attendance. Demographic data were collected allowing us to test whether the cohorts completing the surveys at the end of the semester were significantly different from the cohort at the beginning (Table 2). There were no significant differences between the distributions of the student characteristics collected from the pre- and posttest surveys.

Table 1. Course Characteristics

Course Designator	Semester Offered[a]	Number of Students	Percent of Total Surveyed Students
BIO342—Plants in Our World	F	35	2.67
BIO455—Biological Invasions	S	4	0.3
EES100—Human Population and the Global Environment	F, S	416	30.5
EES324—Environmental Protection Law and Policy	F	57	4.2
ERS102—Environmental Geology of Maine	S	118	8.7
INT105—Environmental Policy	F	206	15.1

Table 1. Course Characteristics (Continued)

Course Designator	Semester Offered[a]	Number of Students	Percent of Total Surveyed Students
NUR452—Community and Population Health	F, S	139	10.2
PSE105—Principles of Sustainable Agriculture	F	47	3.4
REP190—World Food Supply, Population, and the Environment	F, S	203	14.9
REP371—Introduction to Natural Resource Economics and Policy	F	48	3.5
REP381—Principles of Sustainable Development	S	30	2.2
WLE323—Introduction to Conservation Biology	F	33	2.4
WST230—Women, Health, and the Environment	F	27	2.0

[a] F indicates the course was taught in the fall 2004 semester; S indicates the course was taught in the spring 2005 semester.

Table 2. Demographic Characteristics of Pretest and Posttest Cohorts

Demographic Characteristic	Percent Stating		χ^2 Statistic[a]
	Pretest	Posttest	
Female student	53.5	52.9	0.048 (1)
School standing			
1st year	21.6	18.5	3.26 (4)
2nd year	27.5	25.9	
3rd year	19.0	20.5	
4th year	31.9	35.1	
College			
Business, Public Policy, and Health	22.1	21.8	7.27 (6)
Education and Human Development	13.4	12.8	
Engineering	6.1	7.4	
Liberal Arts and Sciences	25.1	26.9	

Table 2. Demographic Characteristics of Pretest and Posttest Cohorts (Continued)

Demographic Characteristic	Percent Stating		χ^2 Statistic[a]
	Pretest	Posttest	
Natural Sciences, Forestry, and Agriculture	21.5	23.8	
Unknown or undeclared	11.7	7.8	
Maine resident	78.8	78.7	0.008 (1)

[a] None of the χ^2 statistics is significantly different from 0; degrees of freedom in parentheses.

Analysis

To test whether attendance in the general education courses had an impact on student environmental attitudes we performed two levels of analysis. First, we used descriptive approaches to test whether mean responses (using *t*-tests) or the distribution of responses (using chi-square tests of proportions) are significantly different between the pre- and posttests. Second, we ran three sets of regressions, also aimed at testing whether mean responses or the distribution of responses are significantly different between the pre- and posttests. The advantage to the regression approach is that it allows us to control for, and identify, any differences in responses that are related to differences in student cohort characteristics.[4]

Descriptive Analysis

Dunlap et al. (2000) argue that a single index of the New Ecological Paradigm can be constructed as a combination of the individual responses to the 15 attitudinal questions. Thus, to test differences in mean responses we first performed a *t*-test on this general environmental index; we then performed *t*-tests on responses to each of the individual questions. The general NEP is constructed as a sum of the students' responses to the even-numbered questions minus the sum of their responses to the odd-numbered questions. The possible range for NEP is –33 to +27. An NEP value of –33 indicates the most ecological response, most green in our nomenclature, and +27 indicates the least ecological response, most brown.

To test whether course attendance altered the *distribution* of students' responses we redefined the dependent variables to reflect whether the student answered the individual questions as green, brown, or unsure. A GREEN response (coded as 1) is if the student responded with a 1 or 2 to the odd-numbered questions or with a 4 or 5 to the even-numbered questions (0 otherwise). A BROWN response (coded 1) is if the student responded with a 1 or 2 to the even-numbered questions and with a 4 or 5 to the odd-numbered questions (0 otherwise). An UNSURE response (coded 1) is if the student responded with a 3 (0 otherwise).

Regression Analysis

Similar to the descriptive analysis, the first regression examines whether course attendance affected the NEP. Specifically,

$$(1)\quad NEP = \beta_1 INT_1 + \alpha_1 GEN + \alpha_2 2^{nd} + \alpha_3 3^{rd} + \alpha_4 4^{th} + \alpha_5 BUS + \alpha_6 EDU + \alpha_7 ENG + \alpha_8 LAS + \alpha_9 NSFA + \alpha_{10} ME + \alpha_{11} POST + e,$$

where NEP denotes the eco-index as the dependent variable. INT denotes the intercept. GEN denotes the gender of the student and is coded 1 for female and 0 for male; "2^{nd}," "3^{rd}," and "4^{th}" are dummy variables denoting whether the student was a second-, third-, or fourth-year student, respectively. BUS, EDU, ENG, LAS, and NSFA are dummy variables denoting whether the student's major was in the College of Business, Public Policy, and Health; Education and Human Development; Engineering; Liberal Arts and Sciences; or Natural Sciences, Forestry, and Agriculture, respectively. ME is a dummy variable denoting the residency of the student and is coded as 1 if the student was from Maine and 0 otherwise. POST is a dummy variable denoting whether the survey was filled out at the start of the semester (i.e., the pretest is coded as 0) or at the end of the semester (i.e., the pretest is coded as 1). Given the continuous nature of the dependent variable, the above equation was estimated using ordinary least squares regression (Kmenta, 1986).

The dependent variable in equation one (NEP) aggregates more detailed variables; because this causes a loss of information detail, analysis of NEP may hide changes in eco-attitudes that

could be revealed with a more detailed analysis. To develop a clearer understanding of whether exposure to the general education courses resulted in any attitudinal changes we estimated the following equation for each of the 15 questions:

$$(2)\quad V_X = \Sigma\beta_k \mathrm{INT}_k + \alpha_1 \mathrm{GEN} + \alpha_2 2^{\mathrm{nd}} + \alpha_3 3^{\mathrm{rd}} + \alpha_4 4^{\mathrm{th}} + \alpha_5 \mathrm{BUS} + \alpha_6 \mathrm{EDU} + \alpha_7 \mathrm{ENG} + \alpha_8 \mathrm{LAS} + \alpha_9 \mathrm{NSFA} + \alpha_{10} \mathrm{ME} + \alpha_{11} \mathrm{POST} + e,$$

where V_X denotes the student's response to each of the 15 attitudinal questions ($X = 1, 2, \ldots, 15$). INT_k denotes a set of four intercepts ($k = 1, 2, 3, 4$), which accommodates the ordered nature of the dependent variable. All other variables are as defined previously. Given that the dependent variable is ordered and discrete (1, 2, 3, 4, 5), the above equations were estimated as ordered-logit regressions (Greene, 2002).

Regression results based on equation 2 give information about whether participation in the general education courses shifted students' responses *on average*. However, shifts in means may not tell the entire story because it is possible that course attendance could shift the distribution of student responses without any shift in the mean. For example, assume students do not hold strongly formed attitudes at the pretest for question 1 (i.e., the students all answer the question with a 3—"Unsure"). If, at the posttest, half of the students hold strong green attitudes (answer the question with a 1) while the other half hold strong brown attitudes (answer the question with a 5), then the course participation would have shifted the distribution of the responses but not shifted the response mean.

To test whether course attendance altered the *distribution* of students' responses we reestimated the above equations but with the dependent variables redefined to reflect whether the individual answered the question as green, brown, or unsure. That is, for each question we estimated three regressions; one regression measured if responses were more likely to be GREEN, one measured if responses were more likely to be BROWN, and one measured if responses were more likely to be UNSURE. Specifically, we estimated

$$(3)\quad PR_x = \beta_1 \mathrm{INT} + \alpha_1 \mathrm{GEN} + \alpha_2 2^{\mathrm{nd}} + \alpha_3 3^{\mathrm{rd}} + \alpha_4 4^{\mathrm{th}} + \alpha_5 \mathrm{BUS} + \alpha_6 \mathrm{EDU} + \alpha_7 \mathrm{ENG} + \alpha_8 \mathrm{LAS} + \alpha_9 \mathrm{NSFA} + \alpha_{10} \mathrm{ME} + \alpha_{11} \mathrm{POST} + e,$$

where the coding for *PR* depends on whether it was a GREEN, BROWN, or UNSURE equation. In the GREEN distribution question, *PR* was equal to 1 if the student response was mildly or strongly green (i.e., students responded with a 1 or 2 to the odd-numbered questions and with a 4 or 5 to the even-numbered questions) and was 0 otherwise. In the BROWN distribution question, *PR* was equal to 1 if the student response was mildly or strongly brown (i.e., students responded with a 1 or 2 to the even-numbered questions and with a 4 or 5 to the odd-numbered questions) and was 0 otherwise. In the UNSURE distribution question, *PR* was equal to 1 if the student response was unsure (students responded with a 3) and was 0 otherwise. All other variables are as defined previously. Given that the dependent variables are binary, the above equations were estimated as logit regressions (Greene, 2002).

Given the manner in which the independent variables are coded, the estimated parameters provide information of how responses differed across students and across the pre- and posttests. The sign and significance of α_1 indicates whether males and females differed in their responses to the questions; we hypothesized that α_1 will indicate females are more likely to provide greener answers, possibly because females are more socialized to help others (Eagly, 1987; Wilkson & Kitzinger, 1996). The signs on α_2 through α_4 indicate whether upper-class students differed from their first-year counterparts; α_5 through α_9 indicates whether students from the different colleges differed in their eco-attitudes relative to undeclared students, and α_{10} indicates whether students from Maine differed from their non-Maine counterparts. We did not hold strong a priori hypotheses on the signs and significance levels of these latter parameters. The sign and significance of α_{11} is the main item of interest here as it indicates whether responses differed across the pre- and posttest surveys.

The estimated parameters only test whether the group denoted by the variable is different than the excluded group (e.g., second- versus first-year students). We tested whether students' eco-attitudes were similar across the included groups (e.g., second- versus third-year students) by testing the equivalence of individual pairs of parameters sharing the same variable construct (e.g., $\alpha_2 = \alpha_3$ tests whether second-year students are similar to third-year students; $\alpha_5 = \alpha_6$ tests whether students in business are similar to students in engineering).

Results

Descriptive Analysis

The *t*-test on the NEP index indicates no significant difference between the pre- and posttest scores (Table 3); however, when we examine differences in means and distributions of responses to the individual questions we find some significant effects. First, as the analyses become more detailed we find more evidence that course attendance alters students' eco-attitudes. Tests of means indicate that course attendance made students greener, on average, for three of the individual questions. When we look at the distributions of the responses we find significant movement in eight of the 15 questions. Note that the analyses of the distributions indicate that course attendance does not always make students greener. Further, the distributions indicate that much of the movement in students' eco-attitudes is away from unsure to either browner or greener.

Regression Analysis

Similar to findings by Tikka, Kuitunen, and Tynys (2000), females are more likely to provide greener answers than males (Table 4). Further, the parameter estimates indicate that second- and third-year students are similar to first-year students, although fourth-year students are significantly greener than first-year students. Pair-wise tests indicate that second- and third-year ($F_{[1, 1280]} = 2.47$; $p = .1161$) students and third- and fourth-year ($F_{[1, 1280]} = 1.59$; $p = .2073$) students are similar, whereas fourth-year students are greener than ($F_{[1, 1280]} = 9.53$; $p = .0021$) second years. There are two possible explanations for this effect. First, individual student attitudes could become greener as they experience more college education and not necessarily from general education classes. Alternatively, this could be the result of a selection-mortality effect; that is, the composition of the student body changes as it moves through college—maybe browner students are relatively more likely to drop out of college.

For the parameter estimates related to choice of academic major (represented by college in which the major is housed) we find that engineering students are less green than undecided students and

Table 3. Descriptive Statistics of the Dependent Variables

Survey Question	Mean[a]		Percent GREEN[b]		Percent UNSURE[b]		Percent BROWN[b]	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
New Ecological Paradigm (Question index)	6.78	7.38						
Q1	2.33	2.14**	64.1	74.6***	17	8.9***	18.2	16.2
Q2	3.18	3.18	48.8	48.6	13.6	12.4	36.6	38.6
Q3	2.32	2.32	67.9	69.3	13.6	10.2	18.3	20.4
Q4	3.17	3.15	38.3	41.3	34.1	27.1**	26.3	31.3*
Q5	1.82	1.79	83.9	85.8	5.8	5.3	9.7	8.7
Q6	2.37	2.50*	20.7	26.6**	16.4	12.9	62.4	60.4
Q7	1.53	1.55	87.6	88.2	4.2	4.4	7.5	7.3
Q8	3.81	3.87	65.4	70.7*	22	16.2**	11.9	12.7
Q9	1.59	1.58	87.4	86.9	9	9.1	2.6	3.82
Q10	3.47	3.57	49.1	58.4***	32.1	20.7***	17.7	19.8

Table 3. Descriptive Statistics of the Dependent Variables (Continued)

Q11	2.47	2.30**	60.2	68.2**	14.9	10.2**	24.4	21.3
Q12	3.73	3.72	64.7	62.6	13.6	14.2	21.3	22.6
Q13	2.28	2.31	66.2	67.8	17.1	10.0***	15.7	21.8*
Q14	3.58	3.59	56.7	56.2	22.4	21.3	20.3	22.2
Q15	2.20	2.24	64	64.7	25.7	20.9*	9.5	14.0**

Note: GREEN is defined as a student responding with a 1 or 2 to the odd-numbered questions or with a 4 or 5 to the even-numbered questions; BROWN is defined as a student responding with a 1 or 2 to the even-numbered questions or with a 4 or 5 to the odd-numbered questions; UNSURE is defined as a student responding with a 3.

[a] *T*-test indicates a significant difference between the pre- and posttest values: * is significant at the 0.05 level; ** is significant at the 0.01 level; *** is significant at the 0.001 level.

[b] Chi-square test of proportions indicates a significant difference between the pre- and posttest values: * is significant at the 0.05 level; ** is significant at the 0.01 level; *** is significant at the 0.001 level.

Table 4. Regression Results: Dependent Variable Is New Ecological Paradigm

Independent Variable	Parameter	Standard Error
Intercept	2.87**	1.01
GEN (Student is female)	3.71***	0.47
2nd (Second-year student)	0.02	0.68
3rd (Third-year student)	1.09	0.74
4th (Fourth-year student)	1.91**	0.70
BUS (Student in College of Business, Public Policy, and Health)	-0.86	0.99
EDU (Student in College of Education and Human Development)	-0.82	1.03
ENG (Student in College of Engineering)	-3.85**	1.25
LAS (Student in College of Liberal Arts and Sciences)	0.52	0.95
NSFA (Student in College of Natural Sciences, Forestry, and Agriculture)	3.99***	0.99
ME (Student is a Maine resident)	0.82	0.57
POST (Posttest score)	0.60	0.46

Note: * indicates the parameter is significant at the 0.05 level; ** indicates the parameter is significant at the 0.01 level; *** indicates the parameter is significant at the 0.001 level.

natural science students are greener than undecided students. Pairwise testing indicates that business students are similar to education students ($F_{[1, 1280]} = 0.00$; $p = .96$), whereas they are significantly greener than engineering students ($F_{[1, 1280]} = 8.49$; $p = .0036$) but browner than liberal arts ($F_{[1, 1280]} = 4.36$; $p = .0370$) and natural science ($F_{[1, 1280]} = 51.09$; $p \leq .0001$) students. Education students are significantly greener than engineering students ($F_{[1, 1280]} = 7.16$; $p = .0075$) but browner than liberal arts ($F_{[1, 1280]} = 2.95$; $p = .0863$) and natural science ($F_{[1, 1280]} = 34.45$; $p \leq .0001$) students. Engineers are significantly browner than liberal arts ($F_{[1, 1280]} = 18.90$; $p \leq .0001$) and natural science ($F_{[1, 1280]} = 61.68$; $p \leq .0001$) students. Liberal arts students are significantly browner than natural science ($F_{[1, 1280]} = 28.47$; $p \leq .0001$) students. In summary, if we ordered students by the college of their academic major from most to least green, we would find the following:

natural science > liberal arts > business = undecided = education > engineering

These results indicate that students' eco-attitudes and college/career choice seem to be directly related to each other. Obviously a cross-sectional study such as this cannot determine the direction of causality on this point. However, other research parallels our results; Tikka, Kuitunen, and Tynys (2000) found that biology students had more positive environmental attitudes, whereas those majoring in technology-related programs and economics were more negative. Similar findings are found by Hodgkinson and Innes (2001); biology, sociology, and environmental studies students had more positive attitudes toward the environment relative to students of law, business, and computer science.

The parameter estimate on ME indicates that Maine students are similar to non-Maine students. We also find that, at least in the aggregate equation, there is no impact of participation in a general education course on students' eco-attitudes, a central question in this study.

However, when we examine the more detailed regressions we find two interesting results (Table 5). First, as the analyses become more detailed we find more evidence that course attendance alters students' eco-attitudes. Above, when we used the eco-index as the dependent variable we found no evidence of a course effect. If we disaggregate to the individual-question level (Table 5, column 2), we find two attitudinal questions indicating that course attendance made students greener, on average. Further, when we disaggregate to look at the distributions of the responses (Table 5, columns 3–5) we find significant movement in eight of the 15 questions. Again, similar to the descriptive analysis, the more detailed analyses of the distributions indicate that course attendance does not always make students greener. Furthermore, the analyses of the distributions indicate that much of the movement in students' eco-attitudes is away from unsure to either browner or greener.

Conclusions

It is generally accepted that education changes attitudes and values. The research reported here sheds light on the ways in which one

Table 5. Summary of Regression Results: Dependant Variable Is *V* (Mean Response) or *PR* (Distribution of Response)

Question Number	Movement in *V*[a]	Movement in *PR*[b]		
		More Likely to Be Green	*Less* Likely to Be Unsure	*More* Likely to Be Brown
1	Greener**	S***	S***	
2				
3				
4			S*	
5				
6		S**		
7				
8		S*	S**	
9				
10		S***	S***	
11	Greener**	S***	S**	
12				
13			S***	S**
14				
15				S*

Note: * indicates the parameter is significant at the 0.05 level; ** indicates the parameter is significant at the 0.01 level; *** indicates the parameter is significant at the 0.001 level

[a] "Greener" denotes a significant green movement in the mean dependent variable; blank cells denote no significant effect.

[b] "S" indicates a significant effect; blank cells denote no significant effect.

general education program may be affecting the environmental values of undergraduate students. The research also leads to several important questions about the role of general education in changing student values.

Attitudinal change may or may not be a goal in general education, and when it is a goal, it may or may not be explicitly stated. If value change is a goal of general education but not explicitly stated, then this may lead to several problems. For example, it is likely that faculty at the University of Maine, in the process of generating the

"Population and the Environment" general education requirements, shared specific value-related goals but did not explicitly discuss the implications of these goals. This leads to both a failure to recognize the need to assess attitudinal changes and a failure to discuss the implications of, or plan for, such changes.

Whether or not attitude change is a goal of general education, measuring such change is important, if for no other reason than faculty members need to know the effects of their classes beyond student acquisition of subject knowledge or skills. The curriculum can have unintended effects on students; by measuring attitudinal change instructors gain insight into whether the curriculum is creating changes in values that are not intended.

In this research, we discovered that general education courses aimed at environmental literacy do not make students more "green" or more "brown" on average. What this general education program does is move students toward less ambiguous attitudes as measured by several individual elements of the New Ecological Paradigm. Though clarification of environmental values was not an explicit goal of the general education program, it is conceivable that this could have been a reasonable learning outcomes objective. Giving students the tools to evaluate information leading to a clarification of attitudes would be a valuable outcome of such a program.

We also discovered that, although the program across the curriculum does not have a consistent effect, some individual courses and faculty members may make students on average more "green" or more "brown." Investigating this possibility is a subject of ongoing research. Certainly individual course or instructor effects are important, particularly in a general education program structured as the University of Maine program is. In this case, students satisfy their general education requirements by completing one or more courses from an approved list. Differential effects by course or instructor may or may not support the overall goals of the general education curriculum. This leads to a series of important questions that are stimulated but unanswered by this research.

Should general education have explicit attitudinal outcome goals? This is little discussed in the literature or, in our experience, in faculty conversations around the development of the general education curriculum. Are some types of values change more desirable

or more acceptable than others? For example, would improving students' appreciation of the importance of math and science be an acceptable attitudinal goal, whereas making students more pro-environmental would not be acceptable?

If desired attitudinal change from general education is explicit, then should assessments be used to confirm that this attitudinal change has occurred? The answer here is obviously yes. However, this raises more interesting and perhaps more difficult questions. If attitudinal assessment is necessary, should not then faculty members be evaluated on whether their course affected the desired change? Conversely, might there not be an expectation in some contexts that courses in this area not affect a consistent attitudinal change? Here again, well-designed assessments would be necessary.

Addressing any of these issues requires consistent application of attitudinal assessment. The NEP appears to be a valid and reliable instrument for such assessments when the goal is to measure change in environmental attitudes. Other instruments may serve equally well, but the reliability and validity of the NEP suggest that it would be a first choice for many faculty members teaching in this area. Assessment programs in other value-laden areas should seek similarly constructed tools for attitudinal assessment in the general education context.

Notes

1. Two studies indicate that eight (McIntosh, Cacciola, Clermont, & Keniry, 2001) to 12 (Wolfe, 2001) percent of higher education institutions have a general environmental literacy requirement.
2. Survey questions are available from the first author; they are also presented in table 4 of Dunlap et al., 2000.
3. This is not nomenclature employed by Dunlap and colleagues.
4. The presence of cohort effects in environmental education classes is indicated by Tikka, Kuitunen, and Tynys (2000) and Hodgkinson and Innes (2001).

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