

The liberal arts and environmental awareness: Exploring endorsement of an environmental worldview in college students

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The purpose of this research was to explore student endorsement of an environmental worldview during the college years through a sampling of freshmen and seniors. Nine independent samples of freshman and senior class undergraduates (N=779) were surveyed over a five year period in a small, independent liberal arts college. The survey instrument included the New Ecological Paradigm (NEP) scale, demographic items, and other measures, such as knowledge of, and worry over, climate change, and perceived priority for environmental issues. In general, NEP endorsement was weakly pro-environmental and was higher among women. Endorsement was stable during the years of the study, except for a temporary, significantly lower level during the recession. Class status had no effect on either NEP endorsement or responses to two questions assessing knowledge of global warming. Knowledge of climate change was comparable to that shown in samples of the public taken by other researchers.

Keywords: new ecological paradigm (NEP), climate change, college curriculum, environmental attitudes, environmental knowledge

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While greenhouse gasses continue their relentless buildup in the atmosphere, policies that might mitigate climate change and all its risks to planetary ecosystems are, at best, inching forward. The public meanwhile shows limited support for mitigation, and a similarly limited awareness of the mechanisms and risks associated with this issue (Weber & Stern, 2011). The determinants of actual behavior change on the part of individuals, households, businesses and institutions, are extremely complex, and numerous structural and psychological barriers block the shift in energy consumption that is necessary to avoid potentially catastrophic effects of climate change (Stern, 2011). Although awareness of environmental issues is only one determinant of this behavioral change, a better public understanding of climate science should increase support for those mitigating policies, by at least increasing public acceptance of scientific consensus and the need for these policies. However, educating the electorate on the topic of climate change is made difficult in several ways: first, by the questions of what message and what media are best for

informing people; second, by the inherent complexity of the topic, particularly for those without a scientific orientation; and finally by the presence of significant political and economic interests that promote doubts in the public about the present and future effects of climate change (Stern, 2011). In the United States the result has been a public that is increasingly polarized on energy policies designed to mitigate climate change (Weber & Stern, 2011).

One strategy for reducing these educational difficulties in part of the public is to incorporate environmental issues into elementary and secondary education, which can provide a developmentally early, more systematic, and less confusing presentation of these societal problems. At that developmental stage, there may also be more openness to imagining a future under the influence of climate change and other environmental threats. An emerging electorate may then be more able to confront new environmental challenges. The focus of this paper, however, is on the environmental concerns shown by students at the college level, where a large portion of adolescents in western cultures have their final formative educational experience before entering the world of employment or post-graduate training. While this report does not survey what is generally happening in a sampling of colleges or universities, it does describe our efforts to track environmental awareness at a small, independent college, in terms of the knowledge and worldview that might be relevant in preparing students to enter a society where environmental issues must be confronted.

In a previous paper (Rideout, 2005), I reported on the outcomes of a brief environmental problems module in an undergraduate Psychology course on research design. In that case, I examined the effects of a 2-3 week exposure to readings, discussion, and a writing exercise covering various environmental problems (with an emphasis on global warming/climate change and mitigating technologies). The influence of the module was assessed by looking at changes in knowledge and also environmental worldview, as measured by the New Ecological Paradigm scale (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000). Several successive classes were tested, with different delays following the module, thus enabling examination of the module's influence over time. Despite the brevity of the program, significant changes were seen in worldview as well as knowledge. While an initial positive effect on knowledge was degraded over a period of three semesters, as students forgot specific factual information, the effect on worldview was more stable, and showed no significant decrease over the same three semester period. Thus, the immediate implication is that even a short, limited exposure to these issues can increase student awareness and bring current ecological realities into their perspective.

An earlier form of the NEP scale, the New *Environmental* Paradigm scale, was developed in the 1970s to assess the new cultural perspective that was allegedly emerging at that time from increased understanding of ecology and human limits (Dunlap & Van Liere, 1978). This new perspective was believed to be replacing the so-called Dominant Social Paradigm, which rested on belief in a laissez faire economy and limited governmental planning, as well as assumptions of anthropocentrism and unlimited resources, resilience of nature, and potential for growth. Revised and renamed in 2000, the current NEP scale was intended to measure basic beliefs about the relationship between humans and nature, and includes 15 Likert items, with three items devoted to each of five concepts or facets: antianthropocentrism, antiexemptionalism, limits to growth, the sensitivity of the balance of nature, and the likelihood of environmental catastrophe (Dunlap et al., 2000). Thus, the NEP attempted to assess endorsement of the new perspective that the authors deemed necessary for adaptation to a newly limited world.

In their original report (Dunlap and Van Liere, 1978), as well as in Dunlap et al. (2000), the developers of the NEP assessed and confirmed the validity, internal consistency, and unidimensionality of the scale. Others have also examined these issues, and the use of this scale has rapidly expanded to include many cross-cultural studies (Dunlap, 2008). Data from our lab have also shown very stable internal consistency over numerous samples. The NEP scale has typically been used as a unidimensional scale, although some have pointed to limitations in this use of the instrument. For example, a recent analysis by Amburgey and Thoman (2012) indicated

the NEP is best considered as a multifaceted rather than unidimensional measure. Their analysis found that the unidimensional model was at an intermediate level of acceptability of fit, while it was still considerably better than a model based on five uncorrelated factors. The analyses in the present study primarily refer to a unidimensional composite score of the fifteen NEP items, but also include attention to the five facets and the individual items of the scale where they might shed further light on patterns of response in the data. While there may be imperfections in the NEP scale and potential value in pursuing its refinement, based on our previous success at showing its sensitivity to educational inputs and sampling procedures (Rideout, Hushen, McGinty, Perkins & Tate, 2005), its usefulness as a unidimensional measure was accepted for the present context of examining changes during the college years.

Thus, the goals of the study were to see whether students entering college in successive years would vary in their NEP endorsement, and whether the college experience would be associated with growth in knowledge of climate change and the development of a more pro-environmental worldview. In our tracking of environmental attitudes over a five-year period, it was expected that the study would extend through a time of changing public environmental awareness due to the rapid growth of findings on climate change, and pronouncements such as those from the Intergovernmental Panel on Climate Change (IPCC).

Methods

Participants

The participants for this study were resident students, ages 17-22, at Ursinus College, a private, 4-year liberal arts college in southeastern Pennsylvania (US), with a total enrollment of 1600-1800 students during each year of the study. This report focuses on freshmen and seniors. Most data were collected by systematically sampling from alphabetical lists of resident students from the respective classes over the five year period from academic year 2007-2008 (that is, September, 2007 to May, 2008) through academic year 2011-2012. Systematic sampling consisted of selecting every *n*th student from an alphabetical list, with the value of *n* chosen in order to generate a sample of 80-100 participants from each class (freshmen or seniors).

To further clarify the research design, it should be noted that this study did not employ longitudinal sampling. In the one case where a particular graduating class was sampled as freshmen and as seniors, previously tested students were excluded from the senior sample. Thus, the independent samples that were taken avoided a possible confound of familiarity with the instrument with senior class status. Comparison groups were formed on the basis of class status (freshman or senior), gender, and other demographic or ex post facto variables.

Procedure

Surveys were hand delivered and subsequently picked up by student researchers, who were registered for academic credit for research under the mentorship of the author. Two independent samples were taken each year, one from the current freshmen and one from seniors, except that no seniors were sampled during 2010-11. The resulting data set from nine samples included a total of 779 participants. In addition to the data from systematic samples, some data were also included from convenience samples taken from Introductory Psychology courses during the academic years 2010-11 and 2011-12. In those cases, students received some credit towards their grades for participating in the study. During the systematic sampling, gender balance was monitored and maintained by random selection of additional participants of the appropriate gender as needed. Selected students were eliminated if they did not wish to participate or did not complete the survey within 24 hours. With the surveys kept short (less than five minutes to complete), participant cooperation was also kept high, at above 90%. Incomplete surveys were not included in the data set. The samples are described in Table 1, including NEP means and standard deviations for the different groups.

Table 1. Descriptive statistics for the samples collected

Academic Year	Sampling Method	Class Status	N	Percent Males	NEP Mean	Std. Dev.
'07-'08	Systematic	Freshmen	83	52	52.6	8.733
		Seniors	78	54	53.7	8.273
'08-'09	Systematic	Freshmen	76	54	52.9	9.558
		Seniors	85	49	54.0	8.566
'09-'10	Systematic	Freshmen	90	51	50.7	9.446
		Seniors	77	46	51.9	7.931
'10-'11	Systematic/ Intro. Psych.	Freshmen	128	38	53.7	6.728
'11-'12	Systematic/ Intro. Psych.	Freshmen	78	37	53.7	8.425
		Seniors	84	48	54.8	7.682
Total			779	47.1	53.2	8.363

Survey instrument: NEP scale

Although parts of the survey instrument varied over the years of the study, it had several components that were constant. The NEP scale was consistently the first page of the instrument, thereby limiting any contextual influence on NEP responses from the other survey items. The survey never exceeded two pages, which facilitated cooperation from the many students sampled. The second page always included demographic questions on gender and class status, as well as one or two questions related to knowledge of global warming, along with assorted ancillary questions that varied from year to year.

Table 2 shows the NEP scale, with response percentages from the data set substituted for the response grid (SA to SD) that subjects saw on the survey. The instrument was labeled 'Environmental Attitudes Survey.' As in our previous reports (Rideout, 2005; Rideout and others, 2005), for computing purposes the 15 item scale was converted to a single composite measure by coding the Likert scale response (SA through SD) for each item as a value 1 through 5, and then recoding odd-numbered items with reversed values to allow for directionality of those items. Summing the 15 item values then generated the NEP score, with potential values 15-75, neutrality at 45, and higher values representing greater endorsement of an environmental worldview.

Survey instrument: Ancillary questions

In addition to the NEP scale, a variety of other questions were used across the different samples. Besides demographic questions on gender, class status, and academic major, two questions assessed knowledge of global warming. Other questions assessed attitudes about pollution, the college curriculum, and news exposure. The ancillary items were chosen based on a hypothetical relation to worldview, and on the interests of student researchers. Some of these items are shown in Table 3, for reference in the Results and Discussion sections below. For analysis, response values 1 through 5 on multiple-choice, knowledge-based questions were recoded as 1 or 0 (for correct or incorrect), while original responses were retained in the data base for any subsequent error analysis.

Table 2. NEP scale with title and instructions as shown in survey. Response percentages have been substituted for Likert response grid; due to rounding, percentages may not sum to 100%. Percentages have not been corrected for directionality.

Environmental Attitudes Survey					
Note: Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree with it.					
	SA	MA	U	MD	SD
1. We are approaching the limit of the number of people that the earth can support.	20	40	22	13	5
2. Humans have the right to modify the natural environment to suit their needs.	7	37	15	35	7
3. When humans interfere with nature it often produces disastrous consequences.	21	49	15	13	2
4. Human ingenuity will ensure that we do NOT make the earth unlivable.	9	23	35	25	8
5. Humans are severely abusing the environment.	43	40	7	8	2
6. The earth has plenty of natural resources if we just learn how to develop them.	29	38	15	14	4
7. Plants and animals have as much right as humans to exist.	53	28	7	9	4
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	2	12	25	39	22
9. Despite our special abilities, humans are still subject to the laws of nature.	49	40	7	3	1
10. The so-called ecological crisis facing humankind has been greatly exaggerated.	6	15	20	33	26
11. The earth is like a spaceship with very limited room and resources.	15	37	20	23	5
12. Humans were meant to rule over the rest of nature.	9	17	17	28	29
13. The balance of nature is very delicate and easily upset.	22	44	18	14	3
14. Humans will eventually learn enough about how nature works to be able to control it.	7	21	27	28	17
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	31	39	18	9	2

Results

In the presentation of our findings below, data on the NEP scale are presented first, along with results on the first two listed ancillary items, which shed light on the NEP data. Other ancillary items are then considered more fully, in the context of the NEP and research by others.

Table 3. Ancillary questions. All questions were not used in all samples, and order of questions varied in different samples.

Ancillary Items	
1.	During times of recession or slowed economic growth, environmental issues have to be placed on a lower priority. SA MA U MD SD
2.	Would you describe yourself as extremely worried, somewhat worried, only a little worried, or not worried at all about global warming/climate change? (a) extremely worried (b) somewhat worried (c) a little worried (d) not worried
3.	What do you understand to be the primary, generally recognized cause of global warming? (a) acid rain (b) increased carbon dioxide (c) loss of ozone (d) increased ozone (e) particulates, such as soot from smoke (f) other_____
4.	Do you believe that global warming is real? (a) Yes (b) No
5.	Which of the following best captures the meaning of the phrase "carbon footprint"? (a) the amount of atmospheric carbon that is deposited in the ground (b) the amount of carbon released into the air from plants and trees (c) the amount of energy consumed from all sources (d) the amount of carbon released from respiration (e) the amount of carbon from fossil fuels released into the air
6.	While in college, have you taken a course that had a focus on environmental problems/issues? (a) no (b) yes
7.	At what priority do you place environmental issues or global warming policy when deciding whom to vote for? (a) first priority (b) second priority (c) third priority (d) fourth or lower priority
8.	The absence of required course work on environmental problems/issues is an indication that the college believes these issues are not very important. SA MA U MD SD
9.	Do you agree or disagree that the presence of required course work on environmental issues would lead you to feel these issues are more important than they currently seem to you? SA MA U MD SD

NEP Endorsement

Descriptive statistics for the samples are shown in Table 1. Analyses of the internal structure and consistency of the NEP scale data indicated that the present results were quite consistent with our previous data sets, in this case yielding a coefficient alpha of .80 (.828 and .821 in earlier data). Principle components analysis indicated, as in our previous studies, a single prominent factor, with 14 of the 15 scale items loading heavily (.402 to .742) onto the first factor, which accounted for 27.6% of the variance in this data set. This was also consistent with results shown by Dunlap, et al (2000). Two additional, separate analyses for freshmen and seniors indicated some differences. Freshmen showed three principle components, the first with 29% of variance accounted for, and a total of 45.5% for the three components, while seniors showed 5 components, with the first at 26.1% and a total variance accounted for at 58.1%.

Subsequent analyses largely employed the NEP score, as used before and computed as the sum of the scale item scores, after correcting for directionality of the items. Mean NEP scores for different groups are presented graphically in Figure 1 for the five years included in the study. For technical reasons, seniors during the academic year 2010-2011 were not surveyed. For the

data set as a whole, the mean NEP score was 53.2 (SD = 8.363), which represents an endorsement level that is about midway between a neutral score (45) and “mild agreement” (60) with a pro-environmental position. Thus, in terms of the NEP scale, the students surveyed were rather weakly pro-environmental.

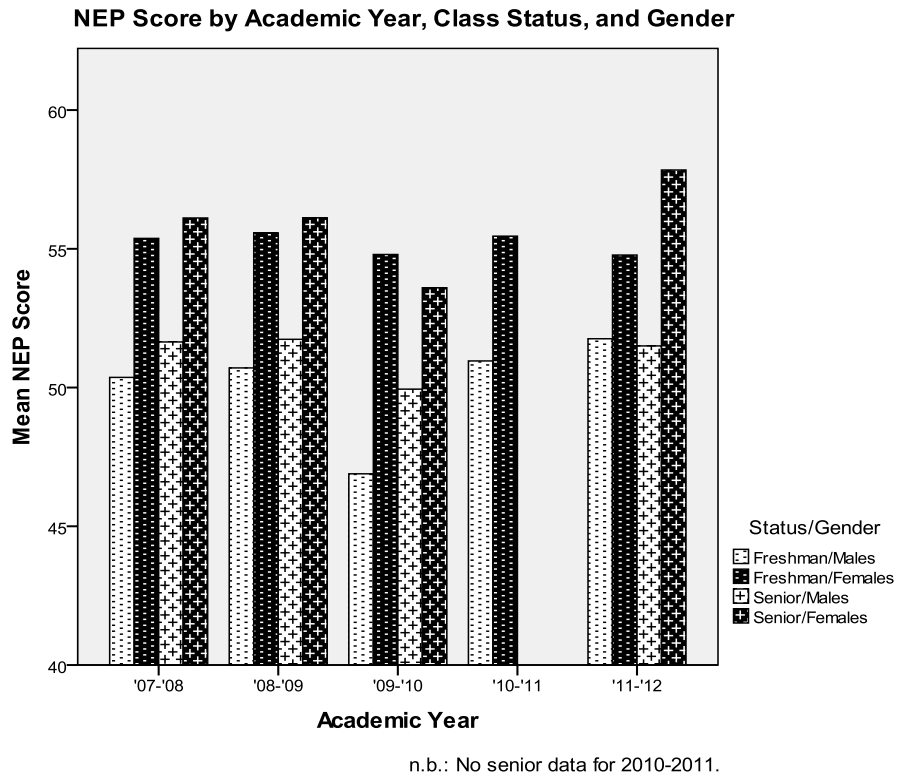


Figure 1. NEP Score as a function of academic year, class status and gender

Overall analysis

An overall analysis of the NEP data set for the effects of academic year, class status and gender showed significant effects for gender, $F(1,759) = 69.599, p < .001$, and academic year, $F(4,759) = 2.911, p < .021$, but not class status, with no significant interactions. The gender influence has been reported before by others (Johnson, Bowker, & Cordell, 2004; Casey & Scott, 2006) and virtually every sample taken in this study or our earlier work showed women with significantly higher NEP endorsement.

The significant effect of academic year was due to a pronounced downward spike midway in the data set, during academic year 2009-2010. Post-hoc comparisons between that year and other years all showed significance, and there were no other significant comparisons. Similarly, repeat of the analysis after removal of the 2009-2010 data indicated no effect of academic year, so the NEP scores were essentially flat over the years of the study, aside from the 2009-2010 dip, which was reversed over the next 1-2 years. This general stability of NEP endorsement does not disprove a slow, upward trend, which can be seen over a longer time span. Comparison with an earlier systematic sample taken in 2002-2003 (Rideout et al., 2005) showed a significant increase over time, from 51.3 (SD = 8.70) to 53.2, $t(776) = 6.245, p < .001$. Scores of control subjects from Rideout (2005), sampled in 2001, were actually significantly higher, $M = 55.6$ (SD = 7.9) versus current 53.2, $t(776) = 8.106, p < .001$, but those subjects were

disproportionately women (78%), with the earlier control group data likely demonstrating the gender influence mentioned above.

Recession effect, and worry over climate change

The significant but temporary decline in NEP endorsement during 2009-2010 seems likely to be the result of attitude change in response to the economic recession. The prominence and persistence of news of the BP oil spill in the Gulf of Mexico during much of 2010 may have facilitated the fairly rapid return to more pro-environmental attitudes.

The decline in NEP endorsement is in some sense theoretically problematic. One would expect that as people become more aware of the realities that underlie the alleged paradigm shift to a more ecological perspective, NEP endorsement would increase with growth of that perspective and not be likely to decline at a time when ecological problems are typically worsening. However, while this irreversibility might apply to those with very strong levels of NEP endorsement, the population under study here is only weakly pro-environmental and likely to be more tentative in their endorsement. This interpretation is consistent with responses to a survey question that dealt directly with the recession. Item 1 from Table 3 asked whether environmental issues have to be placed on a lower priority during times of recession. For the whole data set, 44.9% agreed with this statement, and the Likert scores (Strongly agree to Strongly disagree) on that item correlated with NEP scores, $r = .299$, $p < .001$. During the academic years 2008-2009 and 2009-2010, when the decrease in NEP endorsement occurred, the respective values were: 44.7% agreement and $r = .434$, $p < .001$; and 46.1% agreement and $r = .364$, $p < .001$. Thus, higher NEP scores were associated with maintaining a relatively high priority for environmental issues despite the recession.

In order to determine the source of the changes in overall NEP endorsement seen during 2009-2010, further analyses were done on individual NEP item scores and the five facets of the scale. Pairwise comparisons of the item scores for the two years in question indicated that four items reached significance: items 3, 4, 11, and 15. While these items all contribute to different facets of the scale, two facets showed a significant change toward less environmental concern: sensitivity of the balance of nature, $t(326) = 2.604$, $p < .01$, and anti-exemptionalism, $t(326) = 2.120$, $p < .035$. A third facet, the likelihood of an ecological crisis, had borderline reliability, $t(326) = 1.886$, $p < .060$. Some differences were seen between freshmen, whose scores became less pro-environmental on the anti-exemptionalism facet, and seniors, whose scores during the recession changed on the other two of these three facets.

It is also noteworthy that the change in recession NEP scores was consistent with data assessing worry about global warming/climate change (Table 3, Item 2). Although it did not reach significance, a decrease in worry to its lowest level was seen during 2009-2010, consistent with research suggesting a limited pool of worry that has shifted from worry over the environment towards worry over the economy (Weber, 2006; Hansen, 2004).

The Influence of Class Status

One possible question arising from the comparison groups in this study is whether class status, and by implication the college's core curriculum as well as other experiential variables, was associated with a change in students' environmental awareness. Here, environmental awareness was operationalized with the NEP scale, which encompasses beliefs about the human-nature relationship in the context of the allegedly emerging new, more environmentally oriented cultural perspective. The effect of the core curriculum and other experiential variables was assessed through a comparison of freshmen and seniors.

In the overall analysis of NEP data described above, while gender and academic year had significant effects, class status showed no reliable influence on the measure of NEP endorsement, $F(1,759) = 2.681$, ns. Due to the lack of data from seniors during 2010-2011, the only group to be

sampled both as freshmen and as seniors was the class of 2012. In that class the difference in NEP scores was also nonsignificant, $t(158) = 1.373$. Thus, in the most general sense, and to the extent that the NEP is a valid and appropriate measure, as accepted for this study, there is no evidence supporting the idea that students complete their college experience with a worldview that is changed in terms of ecological perspective.

The Influence of Academic Major

It should be noted that academic major, or area of concentration, also had an effect on NEP scores, $F(28,445) = 2.338$, $p < .001$. In addition, major showed a reliable interaction with class status, $F(18,445) = 1.732$, $p < .031$. Along with a significant effect of major that is even seen when the analysis is restricted to freshmen (therefore, prior to any program impact), $F(25,260) = 1.785$, $p < .014$, these results suggest that much of the effect of major is due to initial differences among students who self-select for those areas of study, although there may be some area-specific influences on NEP scores (as implied by the Major x Class status interaction). In other words, while there may be some differential influence of major on NEP, student differences on NEP endorsement across majors are largely pre-existing when the major is selected in freshman year. For example, pre-existing differences in NEP scores were maintained for two majors where NEP would likely show a predictable pattern. NEP scores for seniors in Environmental Studies and seniors in Business and Economics had means of 60.33 and 50.07, respectively. For freshmen, the corresponding values were 59.47 and 47.20, and the effect of class status (and thus, program) within each major was nonsignificant.

Ancillary questions

Knowledge of the cause of global warming, and climate change denial

Two of the ancillary questions were limited assessments of knowledge of environmental issues. Because global warming is such a prominent issue, the two questions were designed to tap knowledge of this topic. The first of these (in multiple choice format) asked the student to identify the primary, generally recognized cause of global warming (see Table 3, Item 3). This question had been used before (Rideout, 2005) and answering correctly had shown reliable correlations with NEP scores in some samples. In the data as a whole, 49% answered correctly ('increased carbon dioxide'). This level of understanding is comparable to earlier public survey data showing 45% aware of this causal connection (Leiserowitz, Smith, & Marlon, 2010).

After recoding responses for this knowledge item as correct or incorrect (1 or 0), this item showed a small but reliable correlation with NEP ($r = .088$, $p < .015$). Analysis of the effects of gender, academic year and class status showed only gender was significant, $F(1,759) = 12.797$, $p < .001$, indicating no effect of curriculum. In most of the samples (total $N = 529$) this item was accompanied by a question measuring belief in the reality of global warming (Table 3, Item 4). Analyses showed that for three of the four years sampled, global warming denial was at 12.4-14.0% of students. These values are consistent with the 14% reported by Leiserowitz, Maibach, Roser-Renouf, & Hmielowski (2012) in a recent sample of the public. The remaining year (2010-2011, without data from seniors) showed denial in 21.3% of [freshmen] respondents.

Identifying the primary cause of global warming proved difficult for many students, partly due to the presence of a choice that referred to loss of ozone. A considerable proportion (39.7%) of respondents were confused about ozone destruction and believed it to be the source of atmospheric warming. Leiserowitz and others (2010) also reported this confusion, finding that 34% of the public thought that the ozone hole contributed "a lot" to global warming, and another 23% said it contributed "some."

Paradoxical gender effect, and knowledge decline

The complicated role of knowledge in leading to endorsement of the NEP is underscored by these results, particularly regarding an apparent interaction with gender. While women in these samples consistently showed more pro-environmental views, they also had consistently lower performance on this measure of knowledge of the cause of global warming, $F(1,759) = 12.797$, $p < .001$. As mentioned above regarding our earlier research, a noteworthy finding in that earlier report was that exposure to information about environmental issues lead to an increased NEP endorsement, which then appeared more stable than recall of specific knowledge from the brief educational module (Rideout, 2005). Clearly, factors other than knowledge are involved in the determination of NEP endorsement.

Besides the somewhat paradoxical role of knowledge while looking across gender, another curiosity of the current data set was the apparent decline in scores on the global warming knowledge question (see Figure 2). Although the overall effect of academic year was nonsignificant using an F ratio, the slow downward trend in scores over the period of the study was seen in small but significant correlations between academic year and knowledge scores in both genders, and in the combined data, $r = -.094$, $p < .009$. From examination of the errors, the decline was due to fewer respondents selecting the correct answer (55.7% correct dropping to 42.3% correct), rather than change in confusion over the role of ozone, which remained stable at 38.9% (versus 38.6%) in the final year of the study; that is, more students were apparently making other incorrect choices. The reason for systematically less knowledge in later years among these independent samples of students is unclear.

Knowledge of the definition of carbon footprint

The second knowledge-based question asked respondents to recognize a correct definition of the term “carbon footprint” (Table 3, Item 5). This item was used in the last four years of freshmen samples and only two years of senior samples (2009-2010 and 2011-2012). In general, this question proved less difficult, with 57% of respondents answering correctly with choice (e). The most common error was choice (c), “the amount of energy consumed from all sources” (26.2%). While the “cause” question was the more discriminating question of the two, and was significantly correlated with NEP score, the footprint item showed no relation to NEP. In the overall analysis of recoded scores on the footprint question, academic year and gender showed significant effects, $F(3,522) = 4.524$, $p < .004$ and $F(1,522) = 6.112$, $p < .014$, but class status was nonsignificant, again suggesting no impact of the core curriculum. The effect of year was due to relatively lower scores for the first year of freshmen, with significant pairwise comparisons between those data and the other samples. Women again had lower scores over all, and there was also a significant Gender x Class status interaction, $F(1,522) = 4.771$, $p < .029$, generated by lower scores for freshman women, but not for senior women. Over the four years of freshman data, scores on this item improved, $r = .143$, $p < .006$; the two years of senior samples (spanning two years) showed no change, $r = -.041$, ns.

Effect of environmental coursework

Another survey question asked whether respondents had had a course dealing with environmental problems/issues (Table 3, Item 6), and was only analyzed for seniors. This enabled assessment of the impact of specific environmental coursework on NEP scores and knowledge. This item was used in two samples of seniors, from 2009-2010 and 2011-2012 (spanning two years). The effect of the unspecified courses on NEP was tested along with the effects of academic year and gender. All three factors showed significant influence, with no interactions: coursework, $F(1,153) = 9.505$, $p < .002$; academic year, $F(1,153) = 4.280$, $p < .040$; and gender, $F(1,153) = 17.742$, $p < .001$. Higher NEP scores were found in those with relevant coursework, those sampled more recently (2011-2012), and in women.

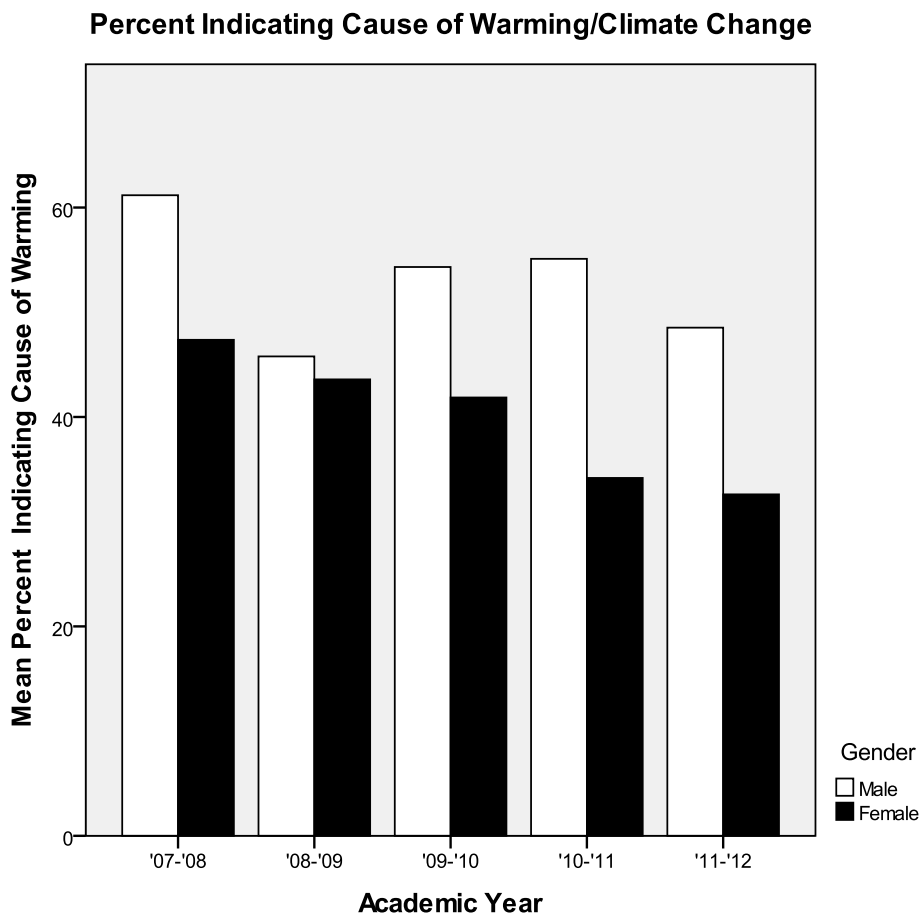


Figure 2. Knowledge of global warming as a function of academic year and gender

While these effects on NEP endorsement are of interest, and are consistent with expectation, students naturally select their own courses, usually on the basis of interest, so concluding a causal influence of the courses on NEP is premature. Repeating the analysis with performance on the two knowledge variables as dependent measures instead of NEP showed no effect of coursework (or of either academic year or gender) on the two knowledge variables in these samples of seniors. Since one would expect relevant coursework to increase knowledge and therefore performance on these two rather basic questions, these results are somewhat puzzling. However, they are reasonably consistent with our previous results when testing the effects of the brief educational module on NEP and knowledge (Rideout, 2005). As mentioned above, an influence of the module on NEP was fairly stable over three semesters, while specific knowledge of the information covered was forgotten. In that earlier study, after a three semester delay following the module, only 60% of students correctly identified the cause of global warming. In the present study, a comparable 54.5% of students reporting previous coursework answered the question correctly.

Another factor that may increase the error rate on the knowledge question in the present analysis is that in responding to the coursework question, students may have used varied criteria for what course has a "focus on environmental problems/issues," as mentioned in the question. For example, a course on environmental literature in the English department or on environmental ethics in the Philosophy department may carry an Environmental Studies label and may seem to

fit the question's criterion for some students, and yet have no information on global warming that might relate to the two quite narrowly defined knowledge questions in this study. The significant association between environmental coursework and NEP scores is likely to have been influenced by high NEP students' self-selecting for those courses. This interpretation would also be supported by our previous findings from email surveys (Rideout and others, 2005). Students who elected to respond to an environmentally labeled email survey showed apparent self-selection that was seen in terms of NEP scores that were higher than the norm from systematic samples.

Comparison with general public on concern over climate change

In the final year of the study (academic year 2011-2012), four questions were taken from earlier public opinion polls in order to compare the current students with the general public on concern over climate change (Gallup (US), 2010, National Statistics Opinion Surveys (UK), 2009, as cited in Weber & Stern, 2011). Table 4 shows the items and the results of the comparison in terms of percent of subjects agreeing with the item statements in the public as compared with our students. Class status had no effect on these data, so freshman and senior data were combined. All the differences were statistically reliable, with the students showing more concern than the public (in order, from Table 4: $t(87) = 7.430$, $t = 3.641$, $t = 4.003$, and $t = 3.612$, $p < .001$).

These results may seem inconsistent with the weakly pro-environmental findings already described, but they need to be considered within the broader context of public opinion. Leiserowitz, and others (2012) describe recently increased public concern over climate change, and growing acceptance of its real influence on weather extremes in the United States. Findings indicated that the public, at least as of spring, 2012, had found the weather events of 2011, such as heat waves, droughts, and floods to be persuasive personal experiences, either directly or indirectly through the news media. This is in a sense ironic, since scientific conclusions such as those of the Intergovernmental Panel on Climate Change (IPCC) have met with some public resistance, but now belief in climate change is increasing on the basis of associations with specific weather patterns or yearly fluctuations that climate scientists are more reluctant to blame on climate change. This increased public concern, however, is against the background of a diminishing concern that has been characteristic of public opinion over the past five years, and even punctuated during the economic crisis beginning in 2008, as already mentioned. So the specific contrasts described in Table 4 are between current (2012) student opinion and the earlier public data from 2009 and 2010 opinion polls, which may represent a historically lower level of acceptance in the fluctuating public opinions on climate change. This lends further credence to the view that the student data reported here are primarily reflective of views of the general public, with the academic environment having minimal impact. It should also be noted that only 43% of our student samples considered climate change among the top three issues facing the U.S.

Another recent survey (Institute of Politics, Harvard University, 2012) indicated that respondents ages 18-29 ranked 'Combating the impacts of climate change' less important than ten out of a list of eleven domestic affairs issues. Similarly, students in the present study, sampled in academic years 2007-2008 and 2008-2009, when asked at what priority they placed environmental issues or global warming policy when voting (Table 3, Item 7), rated these issues at just slightly higher than third priority ($M = 2.8$, $SD = .923$).

Table 4. Percentage agreement with public survey items. Items 1-3 from Gallup (US, 2010); item 4 from National Statistics Opinions Surveys (UK, 2009).

Questions for comparison with public samples	Public 2009-10	Students 2011-12	P<
1. The effects of global warming have already begun or will begin within a few years.	53%	83%	.001
2. The increases in the Earth's temperature over the last century are due more to human activities than natural	50%	68%	.001
3. Global warming will pose a serious threat to you or your way of life in your lifetime.	32%	53%	.001
4. Climate change is among the top three most important issues facing the United States.	24%	43%	.001

Student attitude regarding lack of environmental curriculum

Two final questions for consideration in this report assessed student feelings regarding the college curriculum (Table 3, Items 8 and 9). For samples from academic years 2009-2010, 2010-2011, and 2011-2012 (N = 456), the first item found only 23.5% agreeing that the lack of environmental requirements indicated that the college believed these issues were not very important. Another 25.7% were unsure on this matter. For the second item, whether an environmental issues requirement would lead the respondent to attribute greater importance to these matters, data showed 56.4% agreement (23% unsure). Both these measures were significantly correlated with NEP scores, $r = -.163, p < .001$, and $r = -.244, p < .001$, respectively. On the second question only, gender and class status showed significant effects, with females and seniors indicating more agreement with the statement, $F(1,446) = 10.316, p < .001$, and $F(1,446) = 6.552, p < .011$.

Summary of Results

NEP data showed patterns consistent with prior research and demonstrated a weakly pro-environmental level of endorsement among the sampled undergraduates. Women showed higher NEP scores, and the year of sampling had a significant effect that was restricted to one year and appeared to represent a negative effect of the recession on environmental concern. This effect was correlated with the belief that during recessions environmental issues should be placed on a lower priority, and was also parallel to a decrease in worry about climate change. NEP was not influenced by class status, indicating no significant impact of the core curriculum. NEP scores varied with academic major, but this effect appeared to result from self-selection of respondents for particular majors, rather than a causal influence on NEP endorsement from course experience within a major.

Knowledge of the cause of global warming was at a relatively low level, partly due to confusion over the role of ozone loss in the atmosphere, and both of these patterns in the data were consistent with research by others using public opinion polls. This measure of knowledge was correlated with NEP scores, but a second measure, dealing with the definition of carbon footprint, showed higher levels of understanding (or was an easier question to guess correctly) and was not related to NEP endorsement. Despite higher levels of NEP scores, women showed paradoxically lower levels of performance on these two knowledge questions. Knowledge of the

cause of global warming also appeared to decrease over the years of the study, with no influence of class status on this puzzling decline.

Prior coursework dealing with environmental issues also had no significant impact on the two knowledge variables used here. Taking an environmental course was, however, statistically related to NEP scores. As was seen with the effect of academic major, this influence of coursework on NEP may be due to self-selection of students with high NEP scores for those courses. Comparison of the present data with data from public opinion polls gave some evidence of higher concern over climate change among the students in more recent samples, but otherwise yielded apparently comparable patterns on knowledge and climate change denial. In the absence of influence from the curriculum, changes in attitudes of students are likely reflective of the same forces affecting the public at large.

Two other items considered here assessed student attitudes on the lack of an environmental component in the [required] core curriculum. Students in general felt that the lack of an environmental component did not indicate that the college thought these issues were unimportant, but more than half felt that if there were such a component, it would increase their belief in the importance of these issues. Both these measures showed reliable correlations with NEP endorsement.

Discussion

In the Results section, various analyses have been described, along with interpretations supported by other published reports. Some of the findings here are clear-cut, while others raise more questions regarding environmental awareness in undergraduates. NEP endorsement was influenced by gender, consistent with reports by Johnson, Bowker, & Cordell (2004) and Casey & Scott (2006). NEP also varied in association with the recession. Inferring a recession effect was reinforced by observation of lower levels of worry over climate change during that period, and by a correlation between NEP and perceived priorities for environmental issues. Differences in NEP means across academic majors were largely equivalent in freshmen and seniors, and were thus likely due to self-selection by students, rather than differential experiences in different majors.

Interpretation of the absence of an effect of class status on both NEP and knowledge is, however, more ambiguous. One cannot prove the null hypothesis, and it also could be argued that for the NEP data the influence of curriculum is actually positive, serving to mask a more negative drift in baseline attitudes. However, while we do not have NEP data from the public for direct comparison, we do see general parallels between the knowledge and concerns measured here and those of the public regarding climate change. These suggest the more straightforward interpretation that the college experience simply had no impact on the environmental knowledge and perspective as measured with the present variables.

A second null finding, the absence of a lasting influence of environmentally oriented coursework on knowledge, is not inconsistent with the findings described in Rideout (2005), in which a measure of knowledge was initially increased, but declined soon after exposure to the course information. In contrast, the influence of the environmental issues module used in that study was more enduring in its effect on endorsement of the NEP. That effect is not consistent with the current finding of no coursework influence on NEP, which might be due to respondents defining their environmental coursework too loosely, as mentioned above. Testing the effect of an environmental module similar to that used in Rideout (2005) in the context of a core curriculum might be a fruitful next step in finding a path to enhancing environmental awareness in undergraduates.

Besides the ambiguity of null findings, the present study has other limitations. Although it was argued above that the student concerns and knowledge measured here roughly parallel those in the general public, directly comparable samples of NEP or knowledge data are not

available from students at other academic institutions, or from non-academic cohorts. So these samples may be constrained by specific self-selection for this college, and, as well, may not be representative of the general peer group.

In addition, as with any sampling over an extended time period, historical factors may be confounded with developmental and other experiential factors (such as exposure to the college curriculum). It could be asked: What would be the source(s) of an effect of class status, even if one were observed? If one cannot discern a close tie between a specific course experience and a change in NEP endorsement, perhaps mediated by specific knowledge, then the source of any such worldview change remains ambiguous at best.

Sometimes the influence of historical factors can be clarified, as shown above in Results. The examination of participants' worry over climate change, and their perceived priorities during times of recession, appeared to support attribution of the dip in NEP to student reaction to current economic conditions. The complexity of factors affecting environmental worldview, also discussed above, makes the determination of simple causal relationships difficult. Future research may lead to better understanding, especially if the effects of specific curricula can be tested more broadly.

Implications for the College Core Curriculum

In the current case of a program with no required environmental component, one might ask whether it is reasonable to expect any changes in NEP over the college years. Here the answer is affirmative, since the determination of NEP endorsement is complex and could be influenced by maturity, other non-curricular experiences, or by an accumulation of many subtle, course-based experiences across the curriculum that implicitly relate to environmental issues. The latter might occur if environmental issues had permeated the academic culture in the way, for example, that diversity issues have affected academic policies, course content and requirements. So measuring perspective with the NEP scale informs our judgment regarding adolescent transformation through the college years.

Regarding the development of an environmental component in a common core curriculum, one might also ask whether making broader environmental awareness a requisite for a college degree is consistent with the traditional goals of liberal arts education. A full discussion of these goals is certainly beyond the scope of this report. A thorough historical account is offered by Delbanco (2012). Perennial arguments about goals focus on college as a source of self-discovery, as opposed to vocational training, and as preparation for life and as the foundation for an informed electorate. Awareness of the serious, impending global environmental crises facing humankind (Barnosky and others, 2012; Cardinale and others, 2012) is arguably an essential part of any of these educational goals. If one is to accept the validity of a new, ecologically oriented paradigm, then lack of attention to this emerging worldview is a default endorsement of the *laissez faire* Dominant Social Paradigm. Furthermore, absence of exposure to sustainability issues does not have a politically neutral impact; a majority of students in the present study attributed less importance to the issues than might otherwise be the case if a core component were present. Lowered perceived importance in the public can lead to delay of the climate change mitigation referred to in the Introduction.

On the question of an environmental core requirement, there is a further distinction to be drawn regarding science education, scientific methods versus results, and the NEP. As Delbanco points out, the rise of science in the nineteenth century led to curricular science requirements with an emphasis on students understanding the scientific method. This was reasonable, given the need for greater public understanding of the special character of scientific reasoning. However, an essential point of the New Ecological Paradigm is that it is the specific results of science, in terms of scientific understanding of ecological relationships, in conjunction with scientifically acquired information on the deteriorating status of ecosystems, that have now enabled us to recognize our situation as one that is qualitatively different from that which is assumed under the

Dominant Social Paradigm. A fundamentally changed worldview is now required as a platform from which new constraints and new opportunities can be perceived. In other words, the relationship between humankind and nature is not what we thought it was, and the newly understood relationship now dictates changes in our behaviors. The typical liberal arts science requirement, with its emphasis on scientific reasoning and usually involving choice among a variety of narrowly defined courses, is at best an unreliable source for a new perspective on the human ecological situation.

It should not be concluded, however, that the present college is either uniquely or intentionally anti-environmental. In fact, the institution studied was recognized by the Princeton Review's Guide to Green Colleges for various "sustainability-related endeavors." Indeed, many colleges promote 'green' public images based on energy conservation and other efforts to decrease their carbon footprints. Nonetheless, there is a common and puzzling disconnect between the green public images and the primary business of education in these institutions, where the core curriculum remains silent on the daunting sustainability challenges of the near future. While a brief search of the internet does not represent an exhaustive survey of institutional environmentalism, examination of web sites for a convenience sample of 13 regional (northeast United States) liberal arts programs revealed that four of the web sites had very impressive "sustainability mission statements," but none of the 13 programs had integrated any environmental issues into degree requirements. Thus, although environmental issues have reached the level of a topic for possible student interest, projections of the various ecological crises that are clearly ahead on the current path of global human development are not considered essential knowledge in the preparation of future citizens.

Conclusion

In summary, if the NEP scale is taken as a valid measure of endorsement of a perspective that is correct and, indeed, needed in the education of an informed public (as assumed in the present study), the data reported here suggest that a typical college curriculum may have little impact on the development of that perspective. More research is needed to clarify the best educational methods for enhancing the readiness of college students for future ecological challenges. In his account of the current status of college education, Delbanco quotes Derek Bok, former Harvard president, who wrote, "faculties currently display scant interest in preparing undergraduates to be democratic citizens, a task once regarded as the principle purpose of a liberal education and one urgently needed at this moment in the United States" (Delbanco, 2012, p. 149). Neither Delbanco nor Bok expresses specific concern for approaching environmental crises, which serves as a tribute to the depth of the Dominant Social Paradigm in contemporary academic dialogue. Within the context of societal sustainability challenges, academic institutions should perhaps reassess their responsibilities in the preparation of students to be enlightened consumers and voters in a democratic society.

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