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Relationships among college-level science course enrollment, environmental perception, and pro-environmental attitude: Evidence from the US General Social Survey

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ABSTRACT

Understanding pro-environmental attitudes is critical to encouraging pollution-minimizing behaviors. Therefore, identifying associated factors is essential for understanding different types of pro-environmental attitudes. We aimed to investigate the associations among individuals' college-level science course enrollment and their perceptions of the level of spending to improve and protect the environment, as well as their pro-environmental attitudes. We used nationwide population-based cross-sectional survey data from 2,348 individuals obtained from the General Social Survey in the United States. An ordered logistic model was used to examine the associations among college-level science course enrollment, environmental perception, and pro-environmental attitude. We found that science course enrollment was positively associated (OR:1.80, 95% CI: 1.17–2.75) with individuals' pro-environmental attitudes. We also found that the perception that "too little" is spent on improving and protecting the environment was positively associated (OR:6.68, 95% CI: 2.46–18.12) with a pro-environmental attitude. Understanding how people's college-level science education and positive environmental perceptions are associated with their positive pro-environmental attitudes could facilitate national environmental policy and the allocation of necessary funds.

1. Introduction

Individuals' pro-environmental attitudes toward environmental concerns such as pollution are a critical component of their pro-environmental behavior and activities (Ajzen, 1991; Olli et al., 2001; Polonsky et al., 2012). Therefore, the factors that are associated with people's pro-environmental attitudes need to be studied in order to promote pro-environmental behavior and activities through reinforced attitudes, thereby enhancing efforts to address environmental concerns. There is a growing body of research on the role of socioeconomic and demographic factors associated with pro-environmental attitudes and related behaviors (Aoyagi-Usui et al., 2003). Evidence from recent studies suggests that the people more likely to show pro-environmental behaviors are educated, female, earn high incomes, exhibit place and community attachment, and have a positive attitude (Bissing-Olson et al., 2013; Briscoe et al., 2019; Jakučionytė-Skodienė et al., 2020; Kollmuss and Agyeman, 2010; Meyer, 2016; Subiza-Pérez et al., 2020; Takahashi and Selfa, 2015; Vicente-Molina et al., 2013). Such studies also provide insights into the potential impact of these factors on pro-environmental behaviors that enhance our understanding of pro-environmental attitudes and interests.

According to the General Social Survey (GSS), a significant percentage (68.3%) adults in the United States (US) reported that "too little" is spent on improving and protecting the environment; 80.11% of them were very interested in pollution-related environmental issues; and 73.71% of them took a college-level science course (Smith et al., 2018). Several studies have suggested that both attitudes and perceptions are associated with people's behaviors (Aoyagi-Usui et al., 2003; Polonsky et al., 2012; Weaver, 2002). However, identifying factors shaping pro-environmental behavior is practically complex (Kollmuss and Agyeman, 2010). From both environmental research and policy perspectives, it is important to understand people's perceptions and attitudes to develop strategies and tools that encourage pro-environmental behaviors.

There is little empirical evidence on the relationship between environmental perceptions regarding spending on improving and protecting the environment and pro-environmental attitudes regarding environmental pollution. Although the association between education and pro-environmental behavior is well recognized, little evidence exists that explains the relationships among college-level science enrollment or ed-

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ucation, environmental perceptions, and pro-environmental attitudes in the US context. Considering this literature gap, we conducted a study based on GSS data to investigate the relationships among US individuals' college-level science course enrollment, their perceptions regarding levels of spending on improving protecting the environment, and their pro-environmental attitudes.

2. Materials and methods

2.1. Data and study settings

The study used the most recent data from the nationally representative GSS in the US. GSS collects data annually through a survey administered by the National Opinion Research Center (NORC) at the University of Chicago in order to monitor societal change and study the growing complexity of American society. These data are based on multistage probability sampling that is representative of adults (aged 18 and older) living in US households.

In 2018, a total of 2348 US adults (≥ 18 years old) were surveyed by the NORC. Structured questionnaires and face-to-face interviews with one adult per family were used to gather demographic, social, economic, and political data. Informed consent was obtained from interview subjects before they were interviewed. Details of the study methodologies can be found at https://gssdataexplorer.norc.org. The study protocols were approved by the NORC Institutional Board of Review at the University of Chicago.

2.2. Model variables

The dependent variable "pro-environmental attitude" was assessed using a survey question related to the "individual's interest in environmental pollution issues." Generally, a pro-environmental attitude can be characterized as an individual's tendency to be concerned about the environment and related issues, such as pollution (Bamberg, 2003; Hawcroft and Milfont, 2010). Respondents' answers were categorized into three levels of attitudes: very interested, moderately interested, and not at all interested.

We included two independent variables in the statistical model. First, college-level science course enrollment information was collected through respondents' answers to the following question designed for the study population: "Have you ever taken any college-level science courses?" The response options were "yes," "no," "don't know," and "refuse to answer." We only considered the "yes" and "no" responses for the purposes of the analysis. The second independent variable represented environmental perceptions, which have "commonly been defined as awareness of, or feelings about, the environment" or the way of understanding or interpreting something related to environment (Zube, 1999). It was measured using the following question: "Improving and protecting the environment (… are we spending too much, too little, or about the right amount on improving and protecting the environment?)" The possible responses were "too much," "too little," and "about the right amount." We also considered a few control variables, such as age, sex, grown-up area (where the respondent grew up), and socioeconomic status (i.e., respondent's income).

2.3. Statistical analysis

We first conducted descriptive analyses of the predictor and control variables along with the outcome variable of the model using the recommended sample weight. We performed ordered logistic regression analyses including pro-environmental attitudes (interest in environmental pollution issues) as a dependent variable, college-level science course enrollment and perceptions (spending on improving and protecting environment) as independent variables, and demographic and socioeconomic control variables. First, we estimated crude odds ratios (cORs) from two univariate regression analyses to understand the univariate predictors (i.e., college-level science course enrollment and pollution-related environmental perceptions separately) of pro-environmental attitudes.

We then estimated a multivariate regression, including both science course enrollment and environmental perception variables. We estimated the odds ratios (ORs) for pro-environmental attitudes in relation to science course enrollment and environmental perceptions. Because of possible confounders, the multivariate regression model was adjusted for age (in years) and sex (men and women). To understand the extent to which the associations could be attributable to income and to where the individual grew up, we additionally adjusted for respondents' annual income (<US$1000–>US$25,000) and area of residence at age 16 (from among nine regions inside and outside the US), which may influence environmental attitudes. In the study, the statistical significance was set at $p < 0.05$. Stata (version 17) statistical software was used to perform the analyses (StataCorp, 2021).

Table 1
General characteristics of the sample (n = 2348).

Variable	n (%)
Age (years) (M ± SD)	47 ± 18
Sex	
Male	1,052 (45.5)
Female	1,296 (54.5)
Income (thousand US$) (M ± SD)	10.3 ± 3.1
College science course enrollment	
No	652 (56.5)
Yes	513 (43.5)
Environmental perception	
Too little	790 (68.3)
About right	284 (24.8)
Too high	83 (6.8)
Pro-environmental attitude	
Not at all	126 (11.0)
Moderately	516 (44.7)
Very	531 (44.4)

n = Unweighted number
% = Weighted percentage
US$ = US dollar
M = Mean
SD = Standard deviation

3. Results

The general sociodemographic characteristics of the respondents are presented in Table 1. The majority of the survey participants were female (54.5% or 1296 out of 2348), while 45.5% (1052 out of 2348) were male. The average age was 47 years, with a standard deviation of 18 years. Respondents' average annual income was US$ 10,300, with a standard deviation of US$ 3100. Only 44.4% (531 out of 1173) and 44.7% (516 out of 1173) of participants were "very interested" and "moderately interested" in pro-environmental issues respectively, while 11% (126 out of 1173) were "not at all" interested. Approximately 44% of the survey participants had been enrolled in college-level science courses. Moreover, more than half (68.3% or 790 out of 1157) of the surveyed population felt that "too little" is spent on improving and protecting the environment, while 24.8% (284 out of 1157) said that the amount spent is "about right." Only 6.8% (83 out of 1157) of respondents stated that the amount spent is "too high."

Enrollment in college-level science courses and environmental perceptions were both significantly associated with pro-environmental attitudes in the univariate models (Models 1 and 2). Science course enrollment was positively associated with pro-environmental attitudes; those who had been enrolled in a college-level science course were 1.37 times more likely to hold pro-environmental attitudes (95% CI: 1.08–1.75, $p < 0.05$) than those with no college-level science course experience (Model 1). Individuals who reported that environmental spending is insufficient had higher odds of expressing pro-environmental attitudes (cOR: 4.23,

Table 2
Relationships among science course enrolment, environmental perception, and pollution-related pro-environmental attitude.

Variable	Model 1 cOR (95% CI)	Model 2 cOR (95% CI)	Model 3 aOR (95% CI)
Science course enrollment			
No (Ref)			
Yes	1.37 (1.08–1.75)*		1.80 (1.17–2.75)*
Environmental perception			
Too high (Ref)			
Too little		4.23 (2.42–7.41)*	6.68 (2.46–18.12)*
About right		1.34 (0.68–2.62)	2.36 (0.76–7.33)
/cut1	-1.99 (-2.24– -1.74)*	-1.29 (-1.89– -0.69)*	-1.17 (-3.02–0.68)
/cut2	0.36 (0.17–0.56)*	1.37 (0.80–1.93)*	1.86 (0.07–3.66)*

$*p \leq 0.05$; cOR = Crude odds ratio; CI = Confidence interval; aOR = Adjusted odds ratio
Notes: Models 1 and 2 are univariate ordered logistic regression models with the variable for college-level science course enrollment and environmental perception, respectively. Model 3 is a multivariate model with college-level science course enrollment and environmental perception variables and adjusted for age, sex, grown-up area, and respondent's income.

95% CI: 2.42–7.41, $p < 0.05$) than those who thought that the amount spent is "too high" (Model 2).

In the multivariate analysis, we adjusted for age, sex, grown-up area, and respondent's income to estimate Model 3 (Table 2). The adjusted odds ratios (aORs) for two variables of interest were marginally higher than the cORS presented in Models 1 and 2. Science course enrollment was strongly associated with pro-environmental attitudes, as those with a college-level science education were 1.80 times more likely to have these attitudes (95% CI: 1.17–2.75, $p < 0.05$) than those who did not take science courses. The odds of pro-environmental attitudes were higher for individuals who perceived that "too little" I spent on protecting the environment (aOR: 6.68, 95% CI: 2.46–18.12, $p < 0.05$) than for those who perceived the expenditures to be "too high."

4. Discussion

This study investigated the relationships among science education, environmental perceptions, and pro-environmental attitudes of US adults. Using nationally representative US General Social Survey (GSS) data, we found that individuals with college-level science course backgrounds were more likely to express positive pro-environmental attitudes toward environmental pollution. Previous evidence shows that education is strongly associated with an individual's pro-environmental behaviors. Scott and Willits showed that educated people are more likely to engage in pro-environmental behavior (Scott and Willits, 1994). A higher level of education exposes people to more environmental pollution-related information, which likely affects their knowledge, attitude, and behavior (Tamar et al., 2020).

The results also revealed that individuals who perceived that "too little" is spent on environmental issues were more likely to exhibit pro-environmental attitudes toward environmental pollution. This finding suggests that individuals with higher levels of pro-environmental attitudes are more concerned about a lack of spending on environmental issues than those with lower levels of pro-environmental attitudes. Several studies have examined the relationship between attitude and pro-environmental behavior (Soares et al., 2021; Yoon et al., 2021); however, no research has included perception and attitude using GSS data in the US context.

The use of nationally representative US GSS data is one of the strengths of the analysis, which includes pro-environmental attitudes and perceptions of adult respondents from a nationwide survey. A few issues should be noted in interpreting the findings of this study. This research is based on cross-sectional data, which is relevant for examining the relationships between multiple predictors and outcome variables; nevertheless, drawing inferences about causal links between the model variables would be inappropriate. To determine the causality, a future research based on longitudinal or experimental data is required. Furthermore, inherent biases may exist regarding attitudes and perceptions due to subjective understandings of the survey questions and self-reported responses. Selection bias is expected to be minimal, as the survey involved residents of multiple US states. The study sample is representative of the US population; however, a region or state-specific study would require a different sample and survey approach. Basic socioeconomic and demographic characteristics, such as age, sex, and income, were controlled for in statistical analyses. Additional control factors such as religion or political party affiliation may change the magnitudes of the estimates to some extent based on our sensitivity analysis, but the estimated relationships are expected to be the same in most cases.

5. Conclusions

We found that college-level science course enrollment and perception of the level of environmental expenditure are strongly associated with an individual's pro-environmental attitude toward environmental pollution concerns. These findings have implications for US national policy for improving pro-environmental attitudes and behaviors; nevertheless, more studies are needed to provide specific insights on different states, races, ethnicities, and socioeconomic groups.

CRediT authorship contribution statement

Mazbahul G. Ahamad: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Fahian Tanin:** Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Mazbahul G. Ahamad: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Fahian Tanin:** Writing – review & editing.

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