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ABSTRACT

A study investigated factors affecting the development of positive attitudes toward environmental issues among college students, focusing on the direct and indirect effects of student background characteristics, institutional characteristics, and college experience and outcomes variables. Data were drawn from the Cooperative Institutional Research Programs's follow-up survey of the 1985 freshman class, using a subsample of the database representing 18,887 students. Analysis of these data suggests that being male or liberal increases the likelihood of positive environmental attitude development. In addition, the results suggested that the number of science courses and human ethical/social activist values play important roles in development of a positive attitude toward the environment. Also, student academic and social integration appear to indirectly influence environmental attitude development. Based on these findings, it is urged that colleges and universities find methods to support: (1) development of a science curriculum incorporating environmental issues for both science and non-science majors; (2) hiring of environmental science faculty or retraining of other science faculty; and (3) development of public forums for student and faculty discussion of social issues and human ethics. Appended materials include definitions of variables, data summaries, and analytical models. (Contains 81 references.) (MSE)

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Assessing an Environmental Attitude Development Model: Factors Influencing the Environmental Attitudes of College Students

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Introduction

Overview

Society's present attitude and behavior have a devastating impact on nature. In a world confronting ecological crises and diminishing resources, the possibility of environmental havoc increasingly threatens our very existence. One strategy to avoid an environmental demise is to shift human behavior toward a more nature-oriented dimension (Borden & Schettino, 1979; Gray, Border, & Weigel, 1985). However, such a change in behavior would require that people first develop a positive attitude toward the environment. Understanding environmental attitudes is thus an essential goal for educators and researchers to pursue since newly gained insights may help advance environmental behavioral research (Maloney, Ward, & Braucht 1975). Research with a focus on the identification of factors which influence an individual's attitude toward the natural environment will thus provide significant information into environmental behavior.

This study focused on the development of positive environmental attitudes of college students. It assumed that the leaders of our society make decisions about environmental issues based on values and attitudes attained previously in college. Therefore, it seemed necessary to look at the influence of higher education on environmental attitude development (Feldman & Newcomb, 1969; Pascarella, 1985; Pascarella, Ethington, & Smart, 1988; Pascarella, Smart, & Braxton, 1986; Pascarella & Terenzini, 1991).

Statement of Problem

There is a growing body of literature regarding environmental attitudes. Many authors have contributed to our understanding of influences upon environmental attitudes and provided the bases for further research by identifying potential variables. However, there are four areas of concern. The first concern is that many studies on student environmental attitudes have been conducted with precollege students. While precollege findings may be helpful in addressing some attitude development processes in college students, most studies do not address the unique circumstances present throughout the college experience. More studies focusing on postsecondary effects on students' environmental attitudes are needed.

The second concern is that most studies use a cross-sectional design or are descriptive

in nature. One drawback of these types of studies is that it may be difficult to discern the effects of college experiences on environmental attitude development. There are few, if any, longitudinal studies on environmental attitudes that follow the same individual throughout the college experience and allow one to say with more confidence that a certain development occurred during college. While not fully discerning the effects of outside variables, a longitudinal study focusing on factors influencing environmental attitude development in college would complement the existing literature.

A third concern is a need to advance a conceptual framework to determine the direct and indirect effects of factors influencing the development of environmental attitudes at the college level. Most studies within the college impact literature focus on direct effects only or submerge the environmental attitude indicator in a larger construct called humanitarian values. Regardless, these studies provide information about pertinent factors that may affect environmental attitude development. The next step is to describe the interaction of these factors by proposing and testing conceptual frameworks specifically for the development of environmental attitudes.

A fourth and final concern is insufficient research clarifying the direct, indirect, and combined effects that personal characteristics including gender, race, and socioeconomic status, and institutional characteristics, such as control and size, have on the development of environmental attitudes. Studies suggest that personal and institutional characteristics do influence environmental attitudes and, therefore, deserve closer examination than descriptive and correlational methods allow. A study that utilizes more sophisticated statistical analysis might illuminate the influence that these and other variables have on environmental attitudes.

Objectives

The purpose of this study was to gain a greater understanding of what factors affect the development of environmental attitudes among undergraduate students using data from a national longitudinal database. More specifically, this investigation focused on the direct and indirect effects of student background characteristics, institutional characteristics, and college experience variables on environmental attitudes.

Literature Review

Overview

This literature review begins with a presentation of the Pascarella, Ethington, and Smart (1988) model of the development of humanitarian/civic values. A review of the research acquainting the reader with findings regarding environmental attitudes follows. This section concludes with a presentation of a model addressing the development of environmental attitudes in undergraduates.

A Humanitarian and Civic Values Development Model

After reviewing the literature on student development, Pascarella, Ethington, and Smart (1988) concluded that although models proposed for college impact may differ (A. W. Astin, 1984; Parker & Schmidt, 1982; Pascarella, 1985; Pascarella, 1980; Pascarella, Smart, Ethington, & Nettles, 1987), there were four basic components: student precollege characteristics, structural and organizational characteristics of the institution, an academic integration component, and a social integration component. Based on their review of the literature, the authors then constructed a model addressing the development of humanitarian and civic values among college students.

Their model was composed of four constructs that affected the development of humanitarian and civic values: student precollege characteristics, institutional characteristics, the college experience which included both academic and social integration components, and postcollege experiences. The first three constructs represented the minimal core as postulated in the literature. The last component, postcollege experiences, was included since the study involved a nine-year follow-up, five years after college ended.

The construct of student precollege characteristics included measures of humanitarian and civic values before college, family socioeconomic status, age, high school academic achievement, and high school social leadership involvement. Institutional characteristics included selectivity, size, and racial diversity of the college. College experience included a student's major, college academic achievement, college social leadership involvement, and familiarity with faculty and staff. Postcollege experiences included the degree attained and occupation. Figure 1 depicts the model for the development of humanitarian/civic values

based on research by Pascarella, Ethington, and Smart (1988).

Support for using the Pascarella, Ethington, and Smart model in this study as a base model for the development of environmental attitudes was found throughout the literature. Although Pascarella, Ethington, and Smart's model focuses on humanitarian/civic values, it may also be used and adapted to study the development of environmental attitudes. The following sections clearly document the effects of variables/constructs, such as student precollege characteristics, institutional characteristics, and college experience on the development of environmental attitudes.

Student Background Characteristics

Three general precollege characteristics emerged as possibly influencing environmental attitudes after reviewing the literature: demographics, human ethic values, and leadership qualities. The following describes the rationale for using various indicators to operationalize the constructs in the Pascarella, Ethington, and Smart model for the investigation of the development of environmental attitudes.

Demographics. The literature search revealed six demographic variables that may affect environmental attitudes: age (Van Liere & Dunlap, 1980), socioeconomic status/income (Thompson and Gasteiger, 1985), residence (Buttel and Flinn, 1978b; Polinard, 1979; Thompson and Gasteiger, 1985), ethnicity (Polinard, 1979), gender (Borden and Francis, 1978; DiChiro, 1987; Gifford, Hay, and Boros,1982), and political awareness/ideology (Buttel & Flinn, 1978a; Dunlap, 1975; Greenall, 1987; Pascarella, Smart, and Braxton, 1986; Thompson and Gasteiger, 1985; Van Liere & Dunlap, 1980). Of these, only age, socioeconomic status, gender and political ideology were considered in this study. Age, socioeconomic status, and gender were included because they were originally present in the Pascarella, Ethington, and Smart model and closely associated with environmental attitudes. Political ideology was included in the model because there was much evidence of its close positive association with environmental concern. Residence and ethnicity may have also been important variables. However, they were not included in the model since the database had no information regarding a student's place of residence, and had a small percentage of responses from underrepresented minorities.

Human ethical/social activist values. Literature clearly supported the relationship between human ethic/social activist values and environmental attitudes. "An essential part of an environmental ethic is a human ethic based on social justice for all individuals and groups. Such justice requires humanistic values (i.e., anti-racist, anti-sexist, anti-poverty values)" (Gray, Borden, & Weigel, 1985, p. 197). These authors proposed that people who do not possess a human ethic based on social justice were unlikely to practice a land etnic. In addition, each ethic is very much interdependent upon the other and, a person must first develop a human ethic before developing a land ethic (Gray, Borden, & Weigel, 1985; Ray & Lovejoy, 1984; Roth, 1973).

Other authors have studied the relationship between basic value systems and environmental attitude (Hoover & Schutz ,1963a; Hoover & Schutz, 1963b; Hoover & Schutz, 1964), the relationship between ethnic diversity, social activist issues and the concern for cleaning up the environment (A. W. Astin, 1993), as well as the relevance of humanistic values in an environmental chemistry course (Fazio & Dunlop, 1976)

The literature suggested that a construct representing human ethics or social activist values was essential in developing a model to understand environmental attitudes. While a construct representing a human ethic/social activist values was not present in the Pascarella, Ethington, and Smart model, evidence presented by prior research on the contribution of this construct on environmental attitude was strong. As a result, human ethical/social activist values was incorporated into the Pascarella, Ethington, and Smart model.

Leadership skills. Leadership capabilities also seemed to influence environmental attitudes. Borden and Francis (1978) speculated that women become involved in environmental issues in order to exercise their leadership skills. The authors concluded " . . . that high environmental-concern females are, in a word, leaders" (p.200). H. S. Astin and Kent (1983) also showed that there was a relationship between leadership activities and change in values during college. Female students who had assumed leadership roles as editors of campus publications tended to develop stronger sociopolitical and humanitarian values. These results were consistent with Pascarella, Ethington, and Smart's (1988) causal study regarding the development of humanitarian and civic values. The authors found that leadership experience had a significant, positive direct effect on humanitarian and civic values

of Caucasian students and African-American males.

One of the original features of the Pascarella, Ethington, and Smart model took into account the social leadership involvement acquired during high school and college. However, closer examination of the social leadership construct showed that it was defined by social activities in which a student assumed a leadership role. It did not exactly correspond to leadership skills. In this study, a leader typology score was used to capture a student's leadership skills. Social leadership involvement was reserved for the social integration construct. Nevertheless, Borden and Francis (1978) presented sufficient evidence for including a leadership typology in the environmental attitude version of the Pascarella, Ethington, and Smart model.

Institutional Characteristics

The literature review revealed that there were several college variables that influenced humanitarian, civic, and political values (Pascarella & Terenzini, 1991). Assuming that there was a relationship between college-influenced values and environmental-awareness values, the same group of variables should influence both types of values. Structural characteristics of institutions, such as size of the college, type of control, selectivity and racial diversity, have been found to influence outcomes. Most studies have noted that these variables influence student change in values, intellectual orientation, personal development, and self-concept indirectly, rather than directly. In each case, the indirect effect of college characteristics, mediated through the social and academic components of the academic system remained large (Lacy, 1978; Pascarella, 1985).

Institutional size, selectivity and racial diversity were prominent in the Pascarella, Ethington, and Smart model. However, for this study, only institutional size and selectivity was used given the scant information regarding the influence of ethnicity on environmental attitudes.

College Experience

Number of science classes. Past research supported a strong relationship between science knowledge and environmental attitude. In the literature two types of science

knowledge emerged. The first type of science knowledge referred to that gathered through traditional science content classes. In the discussion that follows this type of knowledge will be termed general science knowledge. The second type of science knowledge referred to that knowledge gathered through environmental science content courses. This type will be termed environmental science knowledge. Among the several studies (Brook & Smythe, 1980; Cohen, 1973; Gifford, Hay, & Boros, 1982; Jaus, 1982; Maloney & Braucht, 1975; Zeidler & Schafer, 1984) showing a strong relationship between environmental science knowledge and environmental attitudes, only three appeared reliable.

Brook and Smythe (1980) analyzed the Maloney and Braucht attitude scale and found a significant relationship ($r = .13$, $p < .001$) between knowledge and the affective component in a sample of Canadian and American adults. This occurred despite Maloney and Braucht's (1975) failure to detect a relationship between knowledge and affect in a previous study. Zeidler and Schafer (1984) looked at the mediating factors of moral reasoning of environmental science students and non-environmental science students. They concluded that an environmental science student applied higher levels of moral reasoning than a non-environmental science student given the same amount of scientific knowledge.

Jaus (1982) looked at the effect of environmental education instruction on fifth graders' attitudes toward the environment using a static group comparison. The experimental group and the control group took the same courses, used the same textbooks and materials during the same period and differed only in that the experimental group received ten hours of environmental instruction using specialized environmental education lesson plans. Results indicated that the experimental group reported significantly more positive attitudes than did the control group. This study concluded that ten hours of formal environmental instruction produced significant changes in attitudes among elementary school children.

Other studies touched upon the relationship between general science knowledge and environmental attitudes. After studying the attitudes of high school seniors toward environmental issues, Steiner (1973) commented that knowledge was relevant because he observed that non-science oriented students tended to choose a neutral response to the issues, while science oriented students "were either in agreement or disagreement, but not as many students took a neutral position" (p. 434). In another study, Thompson and Gasteiger (1985)

concluded that enrollment in a biology class, or a society and science course, had no effect on a student's environmental attitude. They suggested, however, that the general level of student awareness was perhaps already quite high, thereby preserving the possibility that scientific knowledge could affect environmental attitude. A. W. Astin (1993) also found that being a physical science major had a positive affect on environmental attitude, as well as, the number of science courses. This also supported the relationship between scientific knowledge and environmental concern since students who take more science classes would more likely become aware of environmental problems, and therefore, show more concern.

Academic major was cited as a foremost variable in the Pascarella, Ethington, and Smart model. However for this study, the substitution of major by the number of science classes was necessary given the measurement and definition problems surrounding the construct major. In this investigation, the construct of major was replaced by the number of science classes taken by a student in college. This decision was warranted because it refined the Pascarella, Ethington, and Smart model to explain the development of environmental attitudes. This substitution allowed the inclusion of a very influential variable affecting environmental attitudes. It also removed the problem of using a dichotomous or categorical variable in a traditional path analysis. While conclusions could have been made regarding major as represented through the number of science courses, they would have been tenuous. As a result, conclusions were limited to the influence of the number of science classes on environmental attitudes only, irrespective of major.

Academic and social integration. Tinto (1987) has proclaimed the importance of integration into the college community. Academic integration, that is, how well a student becomes a part of the informal and formal activities of the academic environment, and social integration, that is, how well a student becomes a part of the social system, has influenced various student outcomes (Lacy, 1978; Pascarella, 1985; Pascarella, Ethington, & Smart, 1988; Pascarella, Smart, Ethington, & Nettles, 1987; Pascarella & Terenzini, 1979; Pascarella & Terenzini, 1980; Spady, 1971; Terenzini & Wright, 1987a; Terenzini & Wright, 1987b).

Academic integration has been broken down into both formal and informal aspects. Common indicators of formal academic integration have included college grade point average and class rank. Common indicators for informal academic integration have included student-

faculty interactions which have been shown to perform a major role in influencing the values and goals of students (H. S. Astin & Kent, 1983; Pascarella, 1980; Pascarella, Ethington, & Smart, 1988; Pavel & Padilla, 1993).

Social integration theoretically had both a formal and informal component. However, it has manifested itself as a combined construct in many studies as a student/peer interaction construct (Cabrera, Nora, & Castañeda, 1993; Theophilides, Terenzini, & Lorang, 1984; Terenzini & Wright, 1987a; Terenzini & Wright, 1987b). Peer influences have also been found to influence values of students (A . W. Astin, 1993; Pascarella & Terenzini, 1991). The Pascarella, Ethington, and Smart model considered the academic and social integration in college to be key constructs in studying the development of values and attitudes. This aspect will be retained in developing a model to explain environmental attitudes.

A Model for the Development of Environmental Attitudes in Undergraduates

The literature generally supported the Pascarella, Ethington, and Smart model to examine changes in environmental attitudes. However, modifications were necessary to reflect specific theory supporting development of environmental attitudes. These modifications were guided by results of the literature review above. Comparing the original model with the newly refined Environmental Attitude Development model (EAD) in Figure 2, the absence of the postcollege experience construct predominated. This component was not necessary since the students were surveyed four years after college entry. Intermediate college outcomes relevant to environmental concern —leadership skills, political ideology, and human ethical/social activist values— replaced Pascarella, Ethington and Smart's postcollege experience construct. These were more accurately positioned temporally in explaining the development of other college outcomes upon environmental attitudes.

This section provided a synthesis of the literature which supported the Pascarella, Ethington, and Smart model for humanitarian and civic values. This model was refined for application to the study of environmental attitudes. A new model called the Environmental Attitude Development (EAD) model was analyzed as described in the following sections.

Research Design

Overview

This section provides information on the theoretical framework and methods used. It also discusses the data source, sampling procedure and the variables. This segment concludes with the limitations of the study.

Theoretical Framework

A causal model was developed based on higher education literature and environmental attitude research to explain the development of environmental attitudes in college students. The model drew primarily upon Pascarella, Ethington, and Smart's (1988) model for the development of humanitarian and civic values, which in turn was modified by the inclusion of other variables suggested by environmental attitude research to affect environmental attitudes. Constructs and indicators used to operationalize the model included: student background characteristics (gender, socioeconomic status, high school achievement, 1985 leadership skills, 1985 human ethical/social activist values, and 1985 political ideology), institutional characteristics (size and selectivity), college experience (number of science classes, student-faculty interactions, college academic achievement, and student interactions), intermediate college outcomes (1989 leadership skills, 1989 human ethical/social activist values, and 1989 political ideology), and 1989 environmental attitudes (based on a student's response regarding the personal importance he/she attached to becoming involved in programs to clean up the environment).

Previous research provided a theoretical background supporting the newly developed, specified Environmental Attitude Development model. Interpretive attention was mostly given to those relationships having a direct or indirect effect on environmental attitudes, even though all other valid, theoretically sound relationships between and among the indicators were included in the analysis.

Methods

Path analysis was used to examine the hypothesized causal relationships among the variables identified as having an effect on environmental attitude. The development of causal

modeling, specifically path analysis, evolved to examine and test causal relationships in nonexperimental studies. This method enabled the observation of relationships among the variables instead of focusing on bivariate relationships only. It also allowed one to look at the hypothesized causal ordering of the variables which was established on the basis of previous environmental attitude studies and college impact theory (Bollen, 1989; Hackett, 1985; Oetting & Beauvais, 1987). Path analysis' strength in illustrating the relationships among a complex set of variables dictated its usage for this study.

Path analysis employing EQS, a structural equation modeling program, assessed how well the initial Environmental Attitude Development model fit with traditional first-year, full-time college student data. Assessing a causal model using path analysis, a special case of structural equation modeling, permitted the researcher to consider both direct and indirect effects on environmental attitude development. The investigation identified not only the variables associated with environmental attitudes but also allowed the investigator to speculate with more confidence about the process by which different student characteristics and collegiate experiences impact environmental attitudes.

The analysis was conducted in two steps. First, SPSS-X (SPSS-X™ User's Guide, 1988) provided computing ease for all preliminary analyses which resulted in four samples with similar demographic characteristics and descriptive statistics across the variables being studied; and for the preparation of all correlation matrices. Secondly, EQS (Bentler, 1992) was selected to carry out the actual path analysis after assuring that the model was identified. EQS provided a convenient means to estimate, test, and respecify the model in an exploratory manner. The final and most important step in the analysis cross-validated the final Environmental Attitude Model with three other traditional college student samples.

Data Source

The study used data drawn from the Cooperative Institutional Research Program's (CIRP) 1989 Follow-up Survey of the 1985 freshman class conducted by the Higher Education Research Institute (HERI). The base year survey was conducted in the fall of 1985 as described in The American Freshman: National Norms for 1985 (A. W. Astin, Green, Korn, & Schalit, 1985). The subsequent follow-up survey was administered in the summer

and fall of 1989 as described in The American college student, 1989: National norms for 1985 and 1987 college freshmen (Higher Education Research Institute, 1991).

It was not possible to analyze the entire database because of the numerous variables (over 1,100) and cases. As a result, an existing subset of the larger database was used. The subset used in this study contains a sample of records from the larger database in which any single institution is represented by no more than approximately 150 records. This smaller database harbors data for 18,887 college students who had responded to both the 1985 freshman survey and the 1989 follow-up survey (A.W. Astin, Green, Korn, & Schalit, 1985; Higher Education Research Institute, 1991).

Sampling Procedure

Each case in the smaller database was randomly assigned a number between one and four. These numbers were used to divide the data set into four randomized groups. Those cases flagged with the random number one were used in the initial model assessment. Those cases flagged with the random numbers two, three, and four formed three separate samples which were used for three cross-validations. Further, an SPSS-X program selected only first-time, first-year freshmen between the ages of 18 and 22 and performed a listwise deletion of missing data on the variables of interest. This process yielded four samples with similar demographic characteristics and descriptive statistics across the variables being studied.

Variables

Sets of variables relevant to the estimated model included: (1) student background characteristics, (2) institutional characteristics, (3) college experience measures, and (4) intermediate college outcomes influencing 1989 environmental attitude. The research design treated student background characteristics as exogenous variables since their "causes" existed outside of the model. The design addressed the remaining variables as endogenous variables since their causes lay within the model. While intermediate college outcomes are part of the college experience, separation of the two more accurately described the temporal relationship.

The literature review guided the selection of variables for the study. Various models and studies from higher education research influenced the selection of pertinent college impact

variables. Research in environmental education and attitudes supported the inclusion of relevant environmental attitude variables. Table 1 lists the variables germane to the estimated model. These indicators operationalized the Environmental Attitude Development model as presented in Figure 3.

Limitations

Limitations in this study must be acknowledged prior to the discussion of findings. First, the study included data from only college students even though information regarding environmental attitudes is important to all segments of society. As a result, findings may be generalized to traditional first-time, full-time college students only.

The second problem was one associated with all secondary data analysis; namely, that the data was collected for reasons other than addressing the development of environmental attitudes. Consequently, this situation limited the operational definitions and temporal positioning of constructs in the model. The problem of a limited operational definition was most relevant for environmental attitude which is based on one item. As a result, the discussion that follows is restricted to interpreting the possible influences of other variables on the importance a student places on becoming involved in cleaning up the environment. The phrase "environmental attitude" is used loosely and should not be attributed any further meaning.

Temporal positioning of college intermediate outcomes also posed a problem. The model implied that 1989 human ethical/social activist values and 1989 political ideology causally preceded the development of an environmental attitude. While it was hypothesized as such, the data for 1989 human ethical/social activist values and 1989 political ideology was not collected prior to data for environmental attitude. As a result, caution should be taken when making conclusions about the order of these variables.

Third, measuring an attitude has not always been indicative of subsequent behavior. While there is a strong substantive association between attitude and behavior, much debate continues on the exact relationship (Pascarella, Ethington, & Smart, 1988; Siegfried, Tedeschi, & Cann, 1982; Shirgley, 1990). Consequently, this study aimed to explain the development of a positive attitude toward the environment independent of predicting behavior.

Finally, the possibility remained that historical and/or generational influences may be affecting the development of environmental attitudes. As a result, it was difficult to say with certainty whether a change in attitude was due to the college environment or simply a reflection of changing views of society. These external influences are not accounted for in the model and any changes in environmental attitude could be accounted for, either wholly or partially, by these historical influences. (The 1985 freshman and 1989 follow-up surveys, however, were conducted before Earth Day in 1990 and the Rio Summit in 1992. As a result, it seems these events could not have influenced any change in students' attitudes between 1985 and 1989. It would be interesting to compare results with students who were surveyed prior to 1990 and after 1992.)

Results

Overview

This section presents findings based on the research design discussed in the preceding section. It describes the results of (a) the preliminary analysis providing support for multivariate normality of the data; (b) the assessment of the initial Environmental Attitude Development model (EAD) and the confirmation of the final model; as well as (c) the path analysis on the final model.

Preliminary Analysis

Descriptive statistics maintained that the data met the assumption of multivariate normality prior to path analysis. This was accomplished by examining the normality, linearity, and homoscedasticity of variables and residuals (Tabachnick & Fidell, 1989). Candidates for transformation due to skewed distributions included institutional size, institutional selectivity, and high school academic achievement. The first two variables were transformed by taking the logarithm of institutional size and standardizing selectivity. High school achievement indicated by g.p.a. was not that severely skewed and for purposes of interpretation and possible comparisons to college achievement g.p.a., it was not transformed. A univariate plot of the residuals showed that the errors were distributed normally and that a few outliers existed in each sample. However, a comparison of the descriptive statistics for each variable with and without the outliers showed relatively no change in the statistics. The

observations were retained since there was no direct evidence that any one represented an error in recording, a miscalculation, a malfunctioning of equipment, or a similar type of circumstance (Neter, Wasserman, & Kutner, 1989).

Bivariate plots of all variables with 1989 environmental attitude revealed linear relationships between the specified variables. These plots also suggested that the condition of homoscedasticity was met (Tabachnick & Fidell, 1989). In addition, multicollinearity was not present. No correlation between two variables was greater than .70. The correlation matrix for sample one is shown in Table 2. Furthermore, the largest variable inflation factor was 1.76 much below the recommended value of ten (Neter, Wasserman, & Kutner, 1989). The preliminary analysis suggested that the assumption of multivariate normality was justified.

Model Assessment and Confirmation

Initial fit and modifications. An initial assessment of the Environmental Attitude Development model provided evidence that a relatively weak fit existed between the model and the first sample of traditional college students. The assessment resulted in χ^2 /df ratio of 14.3. Other indices were used since chi-square fit measures tend to report trivial differences as significant with large samples (see Table 3 for indices for all models). The Bentler-Bonett Normed and Nonnormed Fit Indices (NFI and NNFI), as well as the Comparative Fit Index (CFI), described the fit as adequate with room for improvement. The Parsimonious Normed Fit Index (PNFI) indicated the model was approaching high parsimony. These measures suggested to the analyst to improve the model since in its present state it was not well-representative of the sample data. Consequently, an exploratory procedure was chosen to see if theoretically consistent and reasonable modifications could better fit the model to the college student sample data. In other words, the goal was to determine how the model could better represent the data, by adding then deleting paths.

First, the model was modified by adding paths one at a time using the Lagrange Multiplier test as a modification guide. The multivariate Lagrange Multiplier chi-square statistic evaluated the statistical necessity of restrictions in the model. In other words, it tested if a path set to zero needed to be estimated. If not necessary then the test suggested that this path may be a nonzero parameter in the sample, and hence should be treated as a

free parameter (added to the model) to improve the model fit significantly. In addition, the Lagrange Multiplier procedure in EQS produced a parameter change statistic to estimate the chi-square univariate decrease in fit if the path were added. This means that paths were added when: (1) the chi-square increment estimate was greater than 12.12, df =1, $p<.0005$, and (2) the paths were theoretically consistent. The addition of the paths resulted in an expanded model. A comparison of the nested initial and expanded models showed that the additions made to the model were significant (see Table 4). Furthermore, goodness-of-fit measures presented in Table 3 also suggested that the additions dramatically improved the model at the expense of parsimony.

The model was further modified by deleting paths one at a time as suggested by the Wald test procedure in EQS for purposes of parsimony. This test was designed to determine whether an existing estimated path could be set to zero, and thus deleted from the model without substantial loss in fit. This means that paths were deleted when: (1) the z-test statistic was less than 3.291 ($p<.001$), and (2) the Wald test included the particular path in the set of free parameters that could be dropped from the model without significant loss of fit. The removal of paths resulted in the final model.

Figure 4 shows the final Environmental Attitude Development model in path diagram form with standardized and unstandardized coefficients. Table 5 displays the direct effects for the final EAD model. A comparison of the nested expanded and final models shows that the removal of paths made to the model were not significant (see Table 4). The CFI and NFI indices presented in Table 3 suggested that the removal of paths did not affect the fit; if anything, the NNFI index implied an improvement in fit. In addition, the final model was highly parsimonious. The final Environmental Attitude Development model was assessed to be a good representation of the data.

Some researchers are skeptical of theory trimming and respecifications due to dramatic changes that may occur in parameter estimates if unscrupulous additions and deletions are made. This was avoided in this study by using theory and previous research to guide modifications. Nevertheless, for those who remain skeptical, a comparison of the estimates from the initial and final model was made. This comparison produced a very high Pearson's correlation ($r = .992$, $p<.0005$) indicating that the coefficients common to both sets of

parameters had barely changed despite model modifications.

Confirming the final model. The next step in the analysis was to cross validate the final Environmental Attitude Development model with other traditional college student samples. No modifications of the model took place during this phase. Rather, this procedure aimed to confirm that the modifications made on the bases of the initial sample data were sound. Three cross-validations using three separate samples reproduced fit indices that supported the assertion that the final model estimated was a good one and thus acceptable.

Path Analysis

Table 5 presents the structural equation coefficients for the final Environmental Attitude Model. The coefficients displayed are similar to regression weights when regression analysis is used to do path analysis. These coefficients may be interpreted as direct effects of the individual independent variables upon the dependent variable while holding constant the influence of all other independent variables in the equation. A few coefficients may appear small to some researchers. However, they are comparable in size to coefficients explaining college influences on humanitarian/civic values (Pascarella, Ethington, & Smart, 1988).

Each column in Table 5 represents a specific structural equation depicting the influences of the independent variables on the specified dependent variable. The structural equation for the 1989 environmental attitude variable presents the direct effects of the specified independent variables on that environmental attitude.

Variables in the final model explained 30% of the variance in 1989 environmental attitude. In the cross-validations the variables explained between 30% to 32% of the variance in the final dependent variable. The explained variance in 1989 environmental attitude is higher than the 12.6% to 18.8% range reported for various ethnic/gender groups of college alumni using humanitarian/civic values as the dependent variable (Pascarella, Ethington, & Smart, 1988).

Table 6 presents direct, indirect, and total effects of all variables on environmental attitude. Direct and indirect effects are reported in standardized form for comparisons made across different variables for the same sample. The unstandardized or metric form of the coefficient enables comparisons of effects across different samples (Loehlin, 1992; Pedhazur,

1982). The indirect effect describes the influence of a predictor variable on environmental attitude mediated through intervening variables in the model (see Table 7). The total effect is the sum of the direct and indirect effects. The rank of the total effect is provided instead of the unstandardized effect. These tables should assist the reader in the ensuing section which presents significant effects.

Discussion

Overview

In any complex path analysis, the number of hypothesized relationships assumed by the specified model is large. Given this fact this discussion highlights direct and indirect effects on the final environmental attitude indicator which were significant at the $p<.0005$ level for the final model assessment and all three cross-validations. The following discussion focuses on the effects that gender, the number of science courses, academic and social integration, and humanitarian/social activist values have on environmental attitude.

Gender

The most surprising finding among these variables involved gender. It was found that being male was positively associated with environmental attitude. This supported Borden and Francis' (1978) finding that males were more likely to become involved with environmental concerns for the issues themselves. However, these authors had further interpreted their findings to suggest that women became involved with environmental concerns in order to exercise leadership skills, thus implying an ulterior motive for women's concerns for the environment. This study provided no evidence to support their latter finding. Results showed that gender had no indirect effect on environmental attitude as mediated through 1989 college leadership skills. Indeed college leadership skills had no direct effect on either environmental attitude or human ethical/social activist values which conflicts with findings of other studies (Borden & Francis, 1978; H. S. Astin & Kent, 1983; Pascarella, Ethington, & Smart, 1988). However, being female appeared to have a positive indirect effect on attitude mediated primarily by human ethical/social activist values and political ideology; however, the number of science courses taken may also be involved.

The finding that being female directly influences environmental attitude in a negative

manner simply adds to a collection of inconsistent findings in the literature. If anything, it seems that more evidence supported that being female had a positive effect on environmental concern (Borden & Francis, 1978; Van Liere & Dunlap, 1980). However, a more recent literature review uncovered studies which supported that being female was negatively associated with environmental attitudes (Arcury, 1990; Gutteling & Wiegman, 1993; Solomon, Tomaskovic-Devey, & Risman, 1989). Interestingly, these studies deal with specific, or "local," environmental issues implying that the manner in which people respond to these local issues may differ depending on the specific environmental problem. Furthermore, Stern, Dietz, and Kalof (1993) most recently presented results showing that women, more than men, saw environmental quality as having consequences for personal well-being, social welfare, and the health of the biosphere. Moreover, when these gender-differentiated belief systems were taken into account, there was no remaining direct effect of gender on political action for the environment.

It appears that other factors in connection with gender influence environmental attitude. It also appears that the direction of this effect may be dependent on the specific environmental issue. Surely, the interplay between gender and environmental concern needs much more investigation.

Science Courses

The number of science courses in which an undergraduate enrolls had a positive direct effect on environmental attitude. This finding implied that the more science courses a student takes, the more likely he or she is to place importance on cleaning up the environment. Apparently science courses convey more knowledge about environmental issues thereby heightening students' awareness. This finding supported previous research suggesting that scientific knowledge influences environmental concern (Steiner, 1973; Thompson & Gasteiger, 1985).

This research further supports that taking science courses actually helps a student develop a concern for the environment. Perhaps science courses transmit more knowledge allowing students to become concerned about cleaning up the environment. However, the relationship is not very strong. This weak relationship may reflect the various types of

science classes that may teach students about environmental issues. Some courses may introduce general information about the environment, while others may solely discuss a particular issue. More information is needed regarding the type of environmental knowledge students receive in the various classes as well as how much they learn. Researchers must take into account the fine features of the science curriculum in order to clarify the relationship between science courses and environmental attitude.

Academic and Social Integration

It was also found that high socioeconomic status and small institutions increased student-faculty and student interactions and thus exhibited indirect effects on environmental attitude mediated by human ethical/social activist values developed in college. Review of the literature supported that students from high socioeconomic backgrounds are likely to spend more time on campus (having no need to work), and thus interact more with social and academic systems. Also, past research corroborated that small institutions allow students to interact with faculty and students better than larger ones. In turn, increased interaction positively influences the development of attitudes and values. This finding coincided with results of other studies stating that student-faculty, student interactions, and peer influences positively affect value and attitude development in college students (A.W. Astin, 1993; H. S. Astin & Kent, 1983; Pascarella, 1980; Pascarella, Ethington, & Smart, 1988; Pascarella & Terenzini, 1991; Pavel & Padilla, 1993).

The finding that interactions, whether with faculty or students, influence human ethical/social activist values, and thereby environmental attitude, repeats itself throughout this study. Interactions provide an opportunity for discussion to occur and the sharing of ideas and values. Transmittance of values from faculty to students and from student to student is thus possible. A. W. Astin's theory of involvement, as well as his theory of peer groups seems relevant to this finding. Pascarella's plea for further research on the influence of student-faculty interactions on student outcomes is also supported.

Human Ethical/Social Activist Values

Finally, the research findings support the assertions by other researchers (Busch, 1990;

Doob, 1991; Gray, Borden, & Weigel, 1985; Seligman, 1989; Ray & Lovejoy, 1984; Vining & Ebreo, 1992) that prior to having a land ethic, a person must develop a human ethic. It is essential to note that 1989 human ethical/social activist values ranked number one among the total effects. This indicator ranked above the dependent variable's own premeasure contrary to what one might expect. The direct effect of 1989 human ethical/social activist values on 1989 environmental attitude remains strong, even after taking into account gender, environmental attitude in 1985, human ethical/social activist values in 1985, number of science classes, college academic achievement, and political ideology in 1989.

Also, strong support exists that a liberal person will tend to have a more positive environmental attitude than a conservative one (Buttel & Flinn, 1978a). These findings are consistent with the literature.

Overall, the findings indicate that being male or liberal facilitate the development of a positive attitude. Being female likewise influences environmental attitudes positively, although its effect is mediated by a woman's human ethical/social activist values and political ideology. In addition, the number of science courses and human ethical/social activist values play important roles in this development. Finally, academic and social integrations indirectly influence the development mediated by human ethical/social activist values.

Conclusion

Summary

The purpose of this investigation was to study the direct and indirect effects of student background characteristics, institutional characteristics, and college experience variables on environmental attitudes. A causal model was developed based on higher education literature and environmental attitude research to explain the development of environmental attitudes in college students. Path analysis employing EQS, a structural equation modeling program, assessed how well the initial Environmental Attitude Development model fit with traditional first-year, full-time college student data. After some theoretically consistent modifications, the final model fit the college student data well. The respecified Environmental Attitude Development model was supported by cross-validations with three separate samples of college students.

Originally, the initial model gave at most an adequate explanation of the development of an environmental attitude. After modifications, the final model was more representative of the data in explaining environmental attitude. Notably, the only college variable that surfaced as having a direct effect on environmental attitude was the number of science classes. It appears that social and academic integration have indirect effects on attitude through human ethical/social activist values. It is interesting to see that these interactions affect human ethical/social activist values only, and that the latter values influence environmental attitude. Surprisingly, leadership skills did not surface as an important variable either directly or indirectly. Also, political ideology influenced environmental attitude directly.

Some relevant factors may be missing from the final Environmental Attitude Development model. These may include place of residence (Freudenberg, 1991; Williams & McCrorie, 1990), ethnicity (Dolin, 1988; Graham, 1991; Noe & Snow, 1989; Taylor, 1989), and personality traits (Pettus & Giles, 1987). The moral norms of society, which are related to human ethical/social activist values, may also play an important role (Stern, Dietz, & Black, 1986). Incorporation of these constructs may help refine the final Environmental Attitude Model in order to better explain how undergraduates develop positive feelings toward the environment.

Practical Significance

The objective of this study was to understand what factors help college students develop a positive attitude toward the environment. This study has provided valuable insights describing and underscoring the important role that institutions can play as they transform into active proponents of environmental education at the college level. Primarily, institutions' role should be to eventually design a curriculum which offers and requires enrollment in science classes that incorporate environmental issues. It seems that institutions that support a general science requirement for all students may impact students' attitudes more so than those institutions that do not. While this study does not particularly address to what extent environmental education occurs in science courses, it is reasonable to suggest that the incorporation of such themes into science classes will further the cause. In addition, it might be necessary to design science classes that address environmental issues in a non-technical,

less intimidating manner since most non-science students find science classes difficult. In this manner, institutions and science departments would be affecting both science and non-science students.

Another role that institutions should play is to provide forums and settings which allow and foster informal learning interactions among students and faculty about social issues, human ethics, and ultimately environmental issues. This study soundly supports the importance of social and academic integration via student and student-faculty interactions for the development of human ethical/social activist values. In turn, these values play a significant and powerful role in influencing students' attitudes about the environment. Institutions that provide opportunities for students to interact with each other and with faculty will help undergraduates develop positive environmental attitudes. It seems reasonable that activities, such as special public forums which congregate students and faculty to discuss human ethics and social issues will serve to help undergraduates develop proenvironmental attitudes.

In order for institutions to play these roles, institutions must first make a commitment to environmental education. Examples of such commitment exist (Cortese, 1992; Deavor, 1992; Dodge, 1990a, 1990b; Eagan & Orr, 1992; Keniry, 1993). Institutions that place the development of proenvironmental attitudes as a priority must provide person-power and monetary funds to (1) develop new curricula that integrate science and environmental issues, (2) hire faculty with environmental science/studies background or retrain faculty, and (3) plan campus-wide social issue forums. The influence of an institution on the development of environmental attitudes of its students may not occur unless these institutions first make a commitment to support environmental education on all levels.

Recommendations for Future Research

At least three issues should be addressed to improve research on the development of environmental attitudes in college students. The first issue involves the operationalization of environmental attitudes. An environmental attitude measure such as the New Environmental Paradigm (Albrecht, , Bultena, Hoiberg, & Nowak, 1982; Vining & Ebreo, 1992) should be used to measure attitudes before and after the college experience. This data should be

collected in addition to other background and college variables and used to more fully operationalize the environmental attitudes construct. Furthermore, this study looked at the general environmental issue of "cleaning-up the environment." Research suggests concentrating on specific, "local" environmental issues since people respond differently to different causes. A local issue that affects college students is campus-wide recycling (Williams, 1991). Using the Environmental Attitude Development model to study environmental concern regarding recycling may provide insightful findings on college students. In addition, comparing environmental attitudes toward local issues with those attitudes toward general issues may help clarify the unique role which gender plays.

Secondly, more curricular information is needed on the specific classes students take in order to understand the impact of science classes on environmental attitudes. Distinctions should be made among a science major class, a non-science major class, and an environmental science/studies class. A method of measuring the number of references to environmental issues in a science class should be devised. In addition, the importance of environmental knowledge versus general science knowledge and how it affects attitudes should also be investigated.

Finally, the question remains whether leadership plays a role in developing the environmental attitudes of college women. Separate analysis on men and women may reveal the unique role played by leadership. In addition, there may be a difference between women becoming involved in social leadership activities and women possessing leadership skills. A distinction between these two operational definitions may answer lingering questions about the function of leadership.

Conclusion

The findings suggest that being male or liberal enable the development of a positive environmental attitude. In addition, the results recognize that the number of science courses and human ethical/social activist values play important roles in the development of a positive attitude toward the environment. Furthermore, academic and social integrations indirectly influence the development of environmental attitudes mediated by human ethical/social activist values. Based on these findings it was stressed that institutions find methods to

support: (1) the development of a science curricula that incorporate environmental issues for both science and non-science students, and (2) the hiring of environmental science/study faculty or retraining of other science faculty, and (3) the development of public forums where students and faculty gather to discuss social issues and human ethics. In this manner, institutions would be enhancing the development of positive attitudes among students. With the help of environmental research behavior, these attitudes can eventually turn into environment-friendly actions.

Table 1
Variable Definitions

Variable	Definition
Student Background Characteristics	
1. Gender	A dummy variable indicating the gender of the student coded as 1 = male and 2 = female.
2. Family socioeconomic status	Sum of parents' combined level of education (eight categories, from 1 = "grammar school or less" to 8 = "graduate degree") and combined parental income (fourteen categories, from 1 = "less than $6000" to 14 = "$150,000 or more") ranging from 3 to 30 (alpha, internal consistency reliability = .67).
3. High school academic achievement	One item based on the student's self-reported average high school grades coded as eight categories, from 1 = "D" to 8 = "A or A+."
4. 1985 Leader typology	Sum of three self-ratings concerning leadership ability, popularity, and social self-confidence in 1985 (five categories, from 1 = "lowest 10%" to 5 = "highest 10%") ranging from 3 to 15 (alpha = .73).
5. 1985 Environmental attitude	One item based on the personal importance of becoming involved in programs to clean up the environment coded as 1 = "not important," 2 = "somewhat important," 3 = "important,"and 4 = "essential."
6. 1985 Political ideology	One item based on the student's self-reported political orientation in 1985 coded as 5 categories, from 1 = "far right" to 5 = "far left."
7. 1985 Human ethical/social activist values	Sum of five items concerning the importance placed on human ethical/social activist values in 1985 such as influencing the political structure, influencing social values, helping others in difficulty, participating in community action programs, promoting racial understanding (four categories, from 1 = "not important" to 2 = "essential") ranging from 5 to 20 (alpha = .72).

Table 1 (Continued)
Variable Definitions

Variable	Definition
Institutional Characteristics	
8. Institutional selectivity[a]	Average academic ability of the entering class by institution expressed as a combined SAT verbal and mathematical score ranging from 621 to 1430.
9. Institutional size[b]	Total institutional enrollment ranging from 63 to 50372
College Experience Variables	
10. Number of science classes	One item indicating the number of undergraduate courses emphasizing science/scientific inquiry taken by a student coded as 1 = "none" to 5 = "9 or more."
11. Informal academic integration: student-faculty interactions	Sum of nine items concerning amount of contact between student and faculty such as, being a guest in professor's home, working on professor's research project, assisting faculty in teaching class, ease of seeing faculty outside office hours, description of college on whether there is little contact between student and faculty[c], amount of time talking with faculty outside of class, satisfaction with opportunity to talk with professors, satisfaction with contact with faculty/administration, student opinion of whether there were many opportunities for faculty and students to socialize, ranging from 6 to 30 (alpha = .76).
12. Formal academic integration: college academic achievement	One item based on the student's self-reported average undergraduate grades coded as six categories, from 1 = "C- or less" to 6 = "A."
13. Informal and formal social integration: student interactions	Sum of 12 items concerning amount of contact between students such as, discussing course content with students, working on a group project for a class, tutoring another student, participating in intramural sports, being a member of fraternity or sorority, participating in campus demonstrations, being elected to student office, description of college as to whether there is little student contact outside of

Table 1 (Continued)
Variable Definitions

Variable	Definition
	class[c], and whether students don't socialize regularly[c], amount of time spent with clubs/ groups, satisfaction with opportunity for extracurricular activities, satisfaction with campus social life, ranging from 4 to 34 (alpha = .63).
Intermediate Outcomes	
14. 1989 Leader typology	Sum of three self-ratings concerning leadership ability, popularity, and social self-confidence in 1989 (five categories, from 1 = "lowest 10%" to 5 = "highest 10%") ranging from 3 to 15 (alpha = .74).
15. 1989 Human ethical/social activist values	Sum of five items concerning the importance placed on human ethical/social activist values in 1989 such as influencing the political structure, influencing social values, helping others in difficulty, participating in community action programs, promoting racial understanding (four categories, from 1 = "not important" to 2 = "essential") ranging from 5 to 20 (alpha = .79).
16. 1989 Political ideology	One item based on the student's self-reported political orientation in 1989 coded as 5 categories, from 1 = "far right" to 5 = "far left."
17. 1989 Environmental attitude	One item based on the personal importance of becoming involved in programs to clean up the environment coded as 1 = "not important," 2 = "somewhat important," 3 = "important,"and 4 = "essential."

Notes. [a]Selectivity was transformed to a standardized z-score to avoid iteration failure caused by its relatively large variance. [b]Total enrollment was transformed to the log of its enrollment to avoid iteration failure caused by its high skewness [c]Subtracted from the sum.

Table 2
Pearson's Correlations, r^a, Among Variables in the Final Model Estimation

Variable	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17
1. Gender	1.000																
2. Socioeconomic status	-.083	1.000															
3. High school academic achievement	.076	.025	1.000														
4. 1985 Leader typology	-.077	.161	.050	1.000													
5. 1985 Environmental attitude	-.037	.000	-.007	.073	1.000												
6. 1985 Political ideology	.079	-.000	-.009	-.013	.105	1.000											
7. 1985 Human ethical/ social activist values	.085	.038	.015	.240	.454	.095	1.000										
8. Institutional selectivity[b]	-.115	.361	.319	.094	.027	.081	.021	1.000									
9. Institutional enrollment[c]	-.059	.066	.065	.061	-.015	.005	-.076	.103	1.000								
10. Number of science classes	-.163	.025	.211	-.015	.059	-.036	-.062	.141	.112	1.000							
11. Student-faculty interactions	.037	.085	.104	.125	.044	-.020	.127	.051	-.415	.032	1.000						
12. College academic achievement	.089	.090	.475	-.002	-.012	-.008	.044	.147	-.038	.066	.206	1.000					
13. Student interactions	-.063	.163	.118	.214	.058	-.017	.148	.125	-.121	.053	.451	.108	1.000				
14. 1989 Leader typology	-.107	.143	-.026	.593	.057	-.016	.192	.065	-.004	-.006	.211	-.044	.362	1.000			
15. 1989 Human ethical/ social activist values	.099	.047	-.031	.205	.241	.113	.490	.038	-.094	-.063	.198	.043	.218	.241	1.000		
16. 1989 Political ideology	.116	.054	-.001	-.025	.095	.402	.132	.124	-.006	-.058	.013	.051	-.016	-.043	.220	1.000	
17. 1989 Environmental	-.051	.056	-.034	.106	.323	.079	.230	.037	-.027	.085	.095	-.014	.097	.115	.480	.167	1.000

[a] significant if $r > .044$ at $p < .01$
[b] standardized z-score
[c] log of enrollment

Table 3
Goodness-of-Fit Measures for the Initial, the Expanded, the Final Environmental Attitude Development (EAD) Models and the Cross-Validations

	Goodness-of-fit information						
Model	χ^2	df	p	CFI	NFI	NNFI	PNFI
1. Initial EAD	901	63	<.001	.928	.924	.845	.380
2. Expanded EAD	397	47	<.001	.970	.966	.913	.300
3. Final EAD	426	63	<.001	.969	.964	.933	.400
4. Cross-validation 1	590	63	<.001	.955	.950	.902	.391
5. Cross-validation 2	512	63	<.001	.960	.955	.914	.393
6. Cross-validation 3	520	63	<.001	.959	.953	.911	.392

Notes. CFI = Comparative Fit Index , NFI = Bentler-Bonett Normed Fit Index, NNFI = Bentler-Bonett Nonnormed Fit Index, PNFI = Parsimonious Normed Fit Index .

Table 4
Difference in Chi-Square Tests for the Initial, the Expanded, and the Final Environmental Attitude Development (EAD) Models

	Difference in chi-square tests		
Comparison	χ^2	df	p
1. Initial and Expanded EAD Models	504	16	<.0005
2. Expanded and Final EAD Models	29	16	ns

Table 5
Direct Effects for All Structural Equations for the Final EAD Model

	Dependent variable									
Independent variable	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17
1. Gender	-.119* (-0.240)	-.060* (-0.056)	-.166* (-0.412)		.045 (0.096)	-.071* (-0.610)	-.047* (-0.193)	.071* (0.466)	.083* (0.137)	-.071* (-0.125)
2. Socioeconomic status	.343* (0.061)	.059* (0.005)		.088* (0.061)	.079* (0.014)	.094* (0.071)			.057* (0.008)	
3 High school academic achievement	.321* (0.214)	.068* (0.021)	.204* (0.167)	.110* (0.287)	.463* (0.321)	.067* (0.190)	-.081* (-0.110)			
4 1985 Leader typology				.117* (0.232)	-.054* (-0.029)	.116* (0.251)	.537* (0.553)	.072* (0.119)		
5 1985 Environmental attitude			.054* (0.089)							.245* (0.286)
6. 1985 Political ideology	.093* (0.125)								.388* (0.424)	
7. 1985 Human ethical/ socia' activist values				.065* (0.092)		.069* (0.107)		.442* (0.523)	.085* (0.025)	-.110* (-0.035)
8. Institutional selectivity			.047 (0.058)							
9. Institutional size			.085* (0.225)	-.437* (-3.681)		.042 (0.383)				

Table 5 (continued)
Direct Effects for All Structural Equations for the Final EAD Model

	Dependent variable									
Independent variable	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17
10. Number of science classes				.061* (0.195)	-.033 (-0.028)					089* (0 063)
11. Student-faculty interactions					.157* (0.042)	.432* (0.473)	.049* (0.026)	.083* (0.069)		
12. College academic achievement										-.030 (-0.025)
13. Student interactions							.231* (0.110)	.105* (0.080)		
14. 1989 Leader typology										
15. 1989 Human ethical/ social activist values										.476* (0.127)
16. 1989 Political ideology										.069* (0 073)
17. 1989 Environmental attitude										
R^2	.247	.012	.089	.227	.261	.254	.422	.275	.180	.295

Note. The top number is the standardized effect; the number in parentheses is the metric (unstandardized) effect
*p<.0005.

Table 6
Direct (D), Indirect (I), and Total (T) Effects of All Variables on 1989 Environmental Attitude

	Final Model			Cross-validation 1			Cross-validation 2			Cross-validation 3		
Variable	D	I	T	D	I	T	D	I	T	D	I	T
1. Gender	-.071*	.019	-.052	-.049*	.040*	-.009	-.053*	.036*	-0.017	-.048*	.028*	-.020
	(-0.125)	(0.034)	(7)	(-0.086)	(0.071)	(14)	(-0.096)	(0.065)	(12)	(-0.086)	(0.050)	(11)
2. Socioeconomic status		.012*	.012		.014*	.014		.010*	.010		.012*	.012
		(0.002)	(14)		(0.002)	(13)		(0.002)	(13)		(0.002)	(14)
3. High school academic achievement		.015	.015		.015	.015		.009	.009		.016	.016
		(0.009)	(12)		(0.009)	(12)		(0.005)	(14)		(0.009)	(13)
4 1985 Leader typology		.048*	.048		.021	.021		.025	.025		.028*	.028
		(0.021)	(9)		(0.009)	(11)		(0.011)	(10)		(0.013)	(8)
5 1985 Environmental attitude	.245*	.005	.250	.291*	.007*	.298	.256*	.004	.260	.263*	.007*	.269
	(0.286)	(0.006)	(2)	(0.343)	(0.008)	(2)	(0.305)	(0.004)	(2)	(0.305)	(0.008)	(2)
6 1985 Political ideology		.027*	.0270		.025*	.025		.026*	.026		.023*	.029
		(0.032)	(11)		(0.030)	(8)		(0.031)	(9)		(0.026)	(10)
7. 1985 Human ethical/ social activist values	-.110*	.223*	.113	-.137*	.221*	.084	-.124*	.227*	.103	-.145*	.221*	.076
	(-0.035)	(0.071)	(3)	(-0.044)	(0.071)	(3)	(-0.040)	(0.073)	(3)	(-0.046)	(0.071)	(5)
8. Institutional selectivity		.004	.004		.003	.003		.002	.002		.003	.003
		(0.004)	(15)		(0.003)	(15)		(0.001)	(15)		(0.003)	(15)
9 Institutional size		-.015*	-.015		-.022*	-.022		-.021*	-.021		-.025*	-.025
		(-0.027)	(13)		(-0.041)	(10)		(-0.039)	(11)		(-0.046)	(9)

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Table 6 (continued)
Direct (D), Indirect (I), and Total (T) Effects of All Variables on 1989 Environmental Attitude

Variable	Final Model			Cross-validation 1			Cross-validation 2			Cross-validation 3		
	D	I	T	D	I	T	D	I	T	D	I	T
10 Number of science classes	.089* (0 063)	.004* (0 003)	.093 (4)	.072* (0.052)	.005* (0.004)	.078 (4)	.047* (0.034)	.004 (0.003)	.051 (7)	.0743* (0.053)	.0071* (0 005)	.081 (3)
11 Student-faculty interactions		056* (0.013)	.056 (6)		.063* (0.014)	.063 (6)		.066* (0.015)	.066 (5)		.077* (0.0171)	.079 (4)
12 College academic achievement	-.030 (-0.025)		-.030 (10)	-.025 (-0.021)		-025 (9)	-.028 (-0.025)		-.028 (8)	-019 (-0.016)		-.019 (12)
13 Student interactions		.050* (0.010)	.050 (8)		.062* (0.013)	.062 (7)		.058* (0.012)	.058 (6)		.038* (0.008)	.038 (7)
14 1989 Leader typology												
15 1989 Human ethical/ social activist values	.476* (0 127)		.476 (1)	.489* (0.132)		.489 (1)	.489* (0.134)		489 (1)	.492* (0.134)		492 (1)
16 1989 Political ideology	.069* (0.073)		.069 (5)	.063* (0.066)		.063 (5)	.067* (0.071)		.067 (4)	.057* (0 059)		057 (6)

Note Top number is the standardized effect; number in parentheses for direct and indirect effects is the metric (unstandardized) effect, number in parentheses for the total effect is the rank of the total effect.
*p < 0005

Table 7
Primary Paths of Significant Indirect Effects on Environmental Attitude Across All Four Estimations

Predictor variable	Primary intervening variables
1. Socioeconomic status	-student-faculty interactions; student interactions -1989 human ethical/social activist values
2. 1985 Political ideology	-1989 political ideology
3. 1985 Human ethical/ social activist values	- 1989 human ethical/social activist values
4. Institutional size	-student-faculty interactions; student interactions -1989 human ethical/social activist values
5. Student-faculty interactions	-student interactions -1989 human ethical/social activist values
6. Student interactions	-1989 human ethical/social activist values

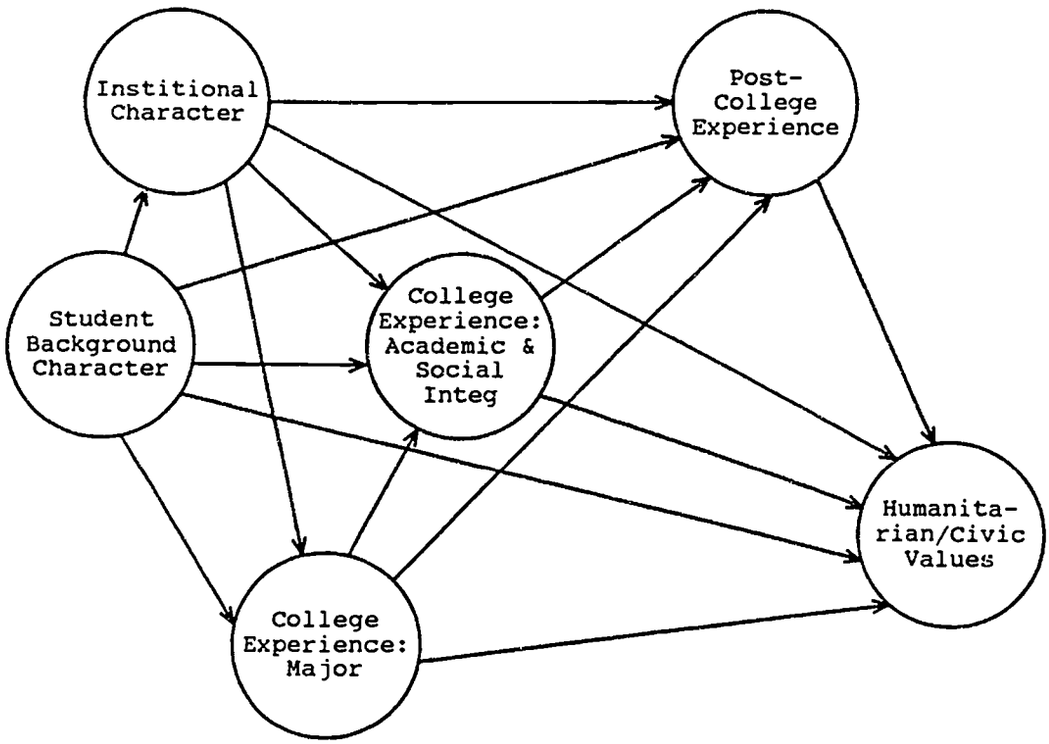


Figure 1. The Pascarella, Ethington, and Smart model for the development of humanitarian and civic values in college students.

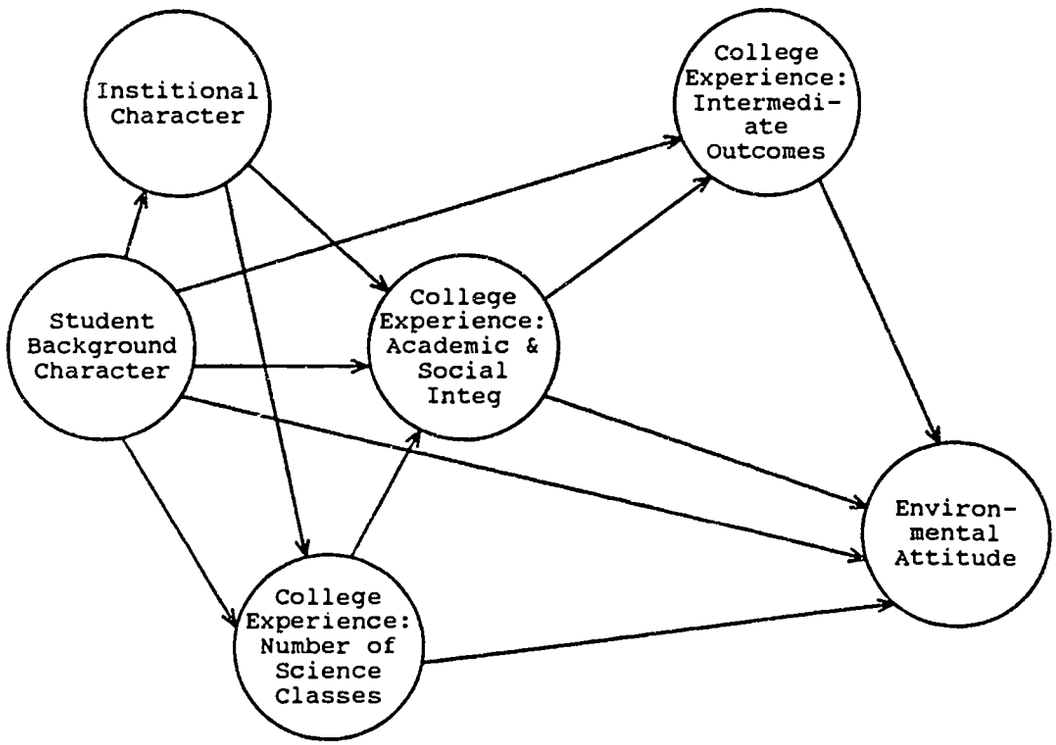


Figure 2. The Environmental Attitude Development (EAD) model for college students.

Figure 3. Initial Environmental Attitude Development model and hypothesized paths.

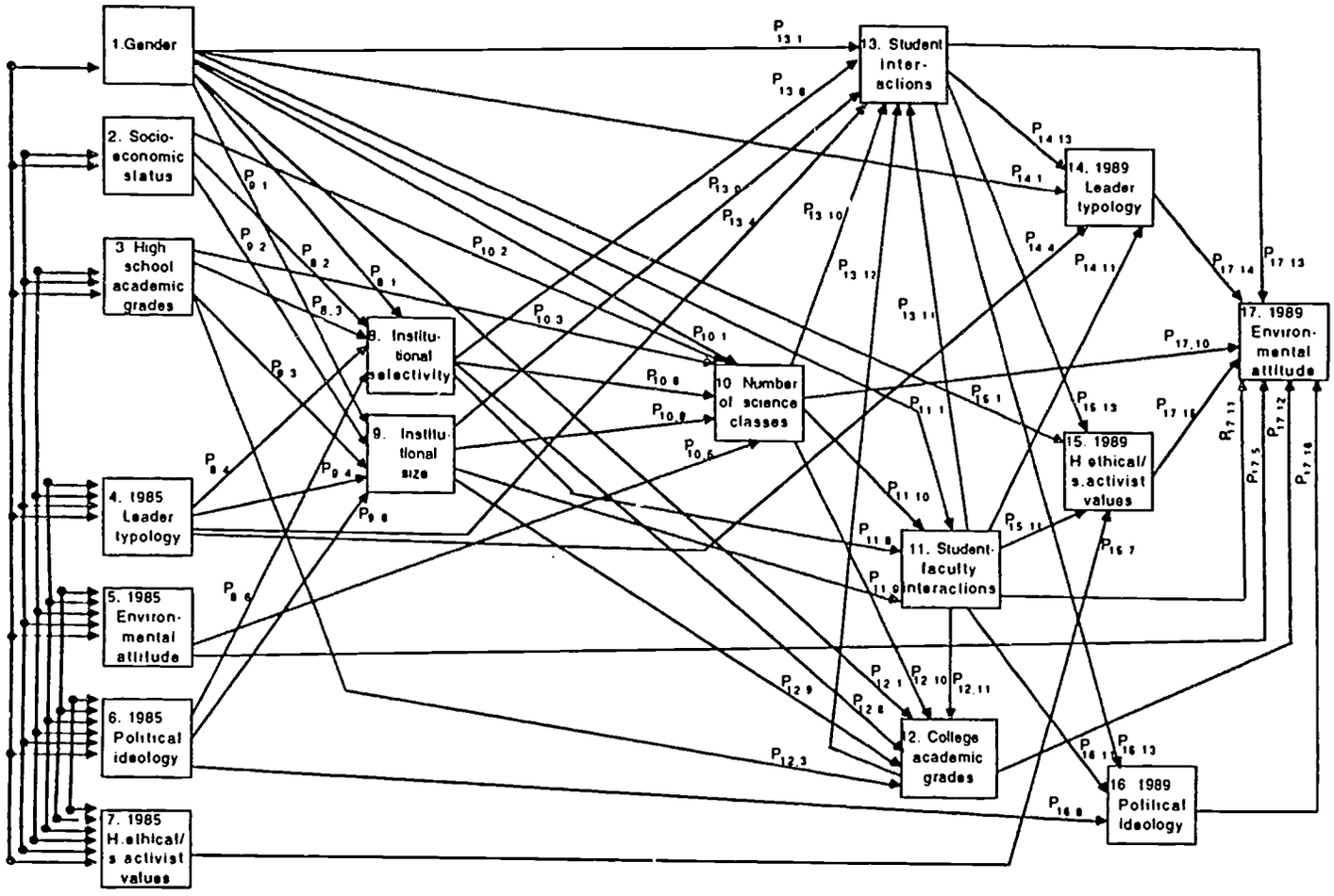
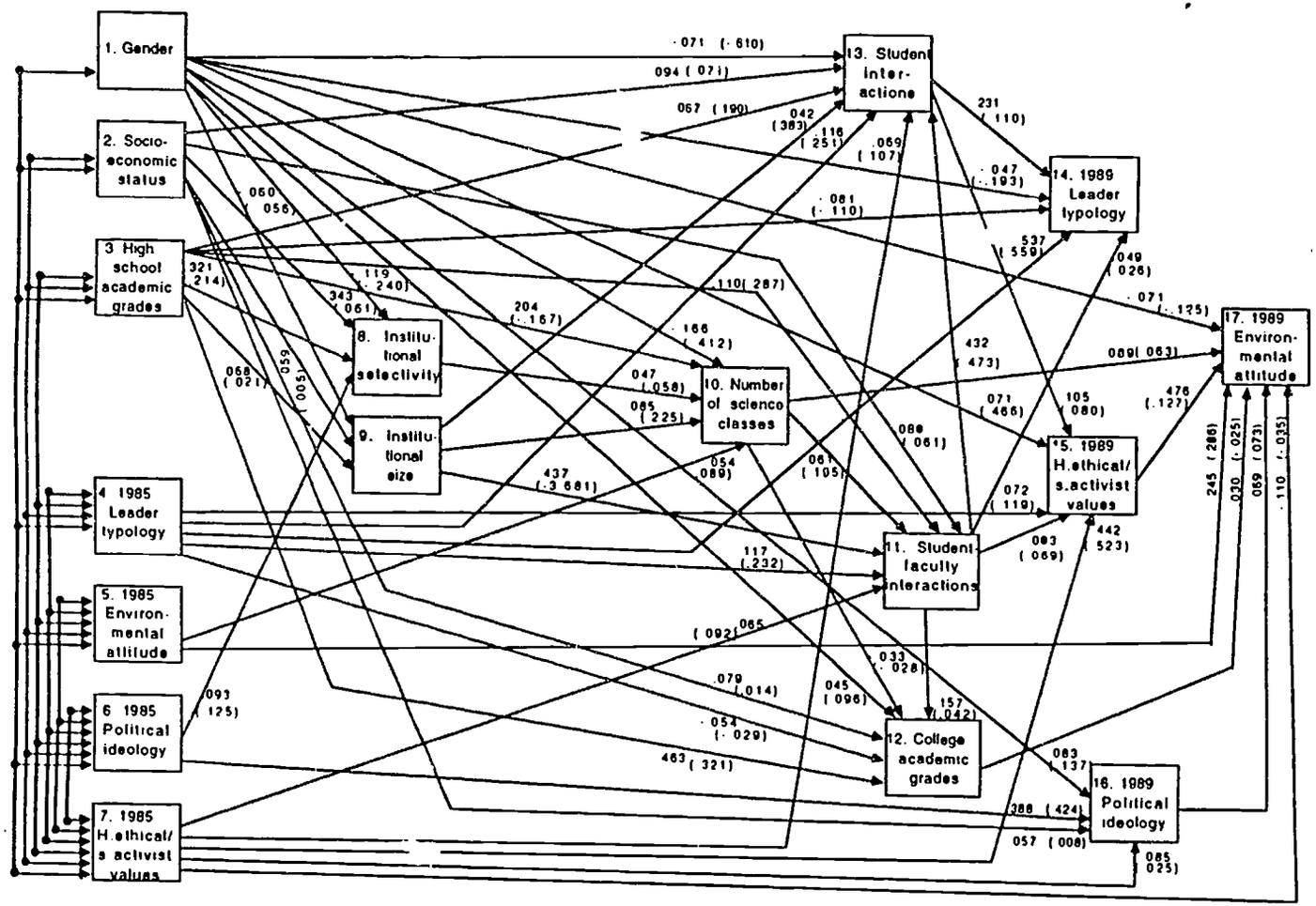


Figure 4. Final model with standardized and unstandardized effects. The unstandardized effect is in parentheses.



References

Albrecht, D., Bultena, G., Hoiberg, E., & Nowak, P. (1982). The new environmental paradigm scale. Journal of Environmental Education, 13(3), 39-43.

Arcury, T. A. (1990). Environmental attitude and environmental knowledge. Human Organization, 49, 300- 304.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. Journal of College Student Personnel, 25, 297-308.

Astin, A. W. (1993). What matters in College? Four critical years revisited. San Francisco, CA: Jossey-Bass.

Astin, A. W., Green, K. C., Korn, W. S., & Schalit, M. (1985). The American freshman: National norms for fall 1985. Los Angeles, CA: Higher Education Research Institute, UCLA.

Astin, H. S., & Kent, L. (1983). Gender roles in transition. Journal of Higher Education, 54, 309-324.

Bentler, P. M. (1992). EQS: Structural equations program manual. Los Angeles, CA: BMDP Statistical Software.

Bollen, K. A. (1989). Structural equations with latent variables. New York: John Wiley and Sons.

Borden, R. J., & Francis, J. (1978). Who cares about ecology? Personality and sex differences in environmental concern. Journal of Personality, 46, 190-203.

Borden, R. J., & Schettino, A. P. (1979). Determinants of environmentally responsible behavior. Journal of Environmental Education, 10(4), 35-39.

Brook, R. C., & Smythe, P. C. (1980). Environmental concerns and actions: A social-psychological investigation. Canadian Journal of Behavioral Science, 12(2), 175-186.

Buttel, F. H., & Flinn, W. L. (1978a). The politics of environmental concern: The impacts of party identification and political ideology on environmental attitudes. Environment and Behavior, 10, 17-36.

Buttel, F. H., & Flinn, W. L. (1978b). Social class and mass environmental beliefs. Environment and Behavior, 10, 433-450.

Cabrera, A. F., Nora, A., Castañeda, M. B. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. Journal of Higher Education, 64, 123-139.

Cohen, M. (1973). Environmental information versus environmental attitudes. Journal of Environmental Education, 5(2), 5-8.

Cortese, A. D. (1992). Education for an environmentally sustainable future. Environmental Science and Technology, 26, 1108-1114.

Deavor, J. P. (1992). Report card: U. S. and undergraduate environmental education. Environmental Science and Technology, 26(1), 34-36.

DiChiro, G. (1987). Environmental education and the question of gender. In I. Robottom (Ed.), Environmental education. Practice and possibility. (pp. 23-48). Victoria, Canada: Deakin University.

Dodge, S. (1990a, December 5). More college students choose academic majors that meet social and environmental concerns. The Chronicle of Higher Education, pp. A1, 31-32.

Dodge, S. (1990b, December 5). A course on "Managing the Earth" attracts students at Kalamazoo. The Chronicle of Higher Education, pp. A32.

Dolin, E. J. (1988). Black Americans' attitudes toward wildlife. Journal of Environmental Education, 20(1), 17.

Doob, L. W. (1991). Sustainable people: Hypotheses and a call for publishable research. The Journal of Social Psychology, 13, 601-605.

Dunlap, R. E. (1975). The impact of political orientation on environmental attitudes and actions. Environment and Behavior, 7, 428-454.

Eagen, D. J., & Orr, D. W. (Eds.). (1992). The campus and environmental responsibility. New Directions for Higher Education, No. 77, 20(1).

Fazio, F., & Dunlop, D. L. (1976). Value preferences of college students with reference to environmental chemistry. Journal of Environmental Education, 8(1), 26-31.

Feldman, K. A., & Newcomb, T. M. (1969). The impact of college on students. San Francisco, CA: Jossey-Bass.

Freudenberg. W. R. (1991). Rural-urban differences in environmental concern: A closer look. Sociological Inquiry, 61, 167.

Gifford, R., Hay, R., & Boros, K. (1982). Individual differences in environmental attitudes. Journal of Environmental Education, 14(2), 19-23.

Gray, D. B., Borden, R. J., & Weigel, R. H. (1985). Ecological beliefs and behaviors: Assessment and change. Westport, CT: Greenwood.

Graham, W. (1991). MexEco?: Mexican attitudes toward the environment. Environmental History Review, 15(4), 1.

Greenall, A. (1987). A political history of environmental education in Australia: Snakes and ladders. In I. Robottom (Ed.), Environmental education: Practice and possibility. (pp. 3-21). Victoria, Canada: Deakin University.

Gutteling, J. M., & Wiegman, O. (1993). Gender-specific reactions to environmental hazards in the Netherlands. Sex Roles, 28, 433-447.

Hackett, G. (1985). The role of mathematics self-efficacy in the choice of math-related majors of college women and men: A path analysis. Journal of Counseling Psychology, 32, 47-56.

Higher Education Research Institute. (1991). The American college student, 1989: National norms for the 1985 and 1987 freshman classes. Los Angeles, CA: Higher Education Research Institute, UCLA.

Hoover, K. E., & Schutz, R. E. (1963a). Development of a measure of conservation attitudes. Science education, 47, 63-68.

Hoover, K. E., & Schutz, R. E. (1963b). A factor analysis of conservation attitudes. Science education, 47, 54-62.

Hoover, K. E., & Schutz, R. E. (1964). Conservation attitudes of science majors as compared with those of non-science majors. Journal of Research in Science Teaching, 2, 108-110.

Jaus, H. H. (1982). The effect of environmental education instruction on children's attitudes toward the environment. Science Education, 66(5), 89-92.

Keniry, J. (1993, September/October). Environmental movement booming on campuses. Change, pp. 42-49.

Lacy, W. B. (1978). Interpersonal relationships as mediators of structural effects: College student socialization in a traditional and an experimental university environment. Sociology of Education, 51, 201-211.

Loehlin, J. C. (1992). Latent variable models: An introduction to factor, path, and structural analysis (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Maloney, M., Ward, M., & Braucht, G. (1975). A revised scale for the measurement of ecological attitude and knowledge. American Psychologist, 30, 787-790.

Neter, J., Wasserman, W., Kutner, M. H. (1989). Applied linear regression models (2nd ed.). Homewood, IL: Irwin.

Noe, F. P., & Snow, R. (1989). Hispanic cultural influence on environmental concern. Journal of Environmental Education, 21(2), 27.

Oetting, E. R., & Beauvais, F. (1987). Peer cluster theory, socialization characteristics, and adolescent drug use: A path analysis. Journal of Counseling Psychology, 34, 205-213.

Parker, C., & Schmidt, J. (1982). Effects of college experience. In H. Mitzel (Ed.), Encyclopedia of Educational Research (5th ed.). New York: Free Press.

Pascarella, E. T. (1980). Student-faculty informal contact and college outcomes. Review of Educational Research, 50, 545-595.

Pascarella, E. T. (1985). Students' affective development within the college environment. Journal of Higher Education, 56, 640-663.

Pascarella, E. T., Ethington, C. A., & Smart, J. C. (1988). The influence of college on humanitarian/civic involvement values. Journal of Higher Education, 59, 412-437.

Pascarella, E. T., Smart, J. C., & Braxton, J. (1986). Postsecondary educational attainment and humanitarian and civic values. Journal of College Student Personnel, 27, 418-425.

Pascarella, E. T., Smart, J. C., Ethington, C., & Nettles, M. T. (1987). The influence of college on self-concept: A consideration of race and gender differences. American Educational Research Journal, 24, 49-77.

Pascarella, E. T. & Terenzini, P. T. (1979). Interaction effects in Spady's and Tinto's conceptual models of college dropout. Sociology of Education, 52, 197-210

Pascarella, E. T. & Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. Journal of Higher Education, 51, 60-75.

Pascarella, E. T., & Terenzini, P. T. (1991). How college affects students: Findings and insights from twenty years of research. San Francisco, CA: Jossey-Bass.

Pavel, D. M, & Padilla, R. V. (1993). American Indian and Alaska Native postsecondary departure: An example of assessing a mainstream model using national longitudinal data. Journal of American Indian Education, 32(2), 1-23.

Pedhazur, E. (1982). Multiple regression in behavioral research. New York: Holt, Rinehart, and Winston.

Pettus, A. M., & Giles, M. B. (1987). Personality characteristics and environmental attitudes. Population and Environment Behavioral and Social Issues, 9, 127-137.

Polinard, J. L. (1979). Attitudes toward environmental quality: Area, ethnicity and SES (Contract No. 68-01-2683). Washington, DC: U.S. Environmental Protection Agency.

Ray, J. J., & Lovejoy, F. H. (1984). Attitude toward the environment as a special case of attitude toward all living things. Journal of Social Psychology, 123, 285-286.

Roth, R. E. (1973). A model for environmental education. Journal of Environmental Education, 5(2), 38-39.

Seligman, C. (1989). Environmental ethics. Journal of Social Issues, 45, 169-184.

Shirgley, R. L. (1990). Attitude and behavior are correlates. Journal of Research in Science Teaching, 27, 97-113.

Siegfried, W. D., Tedeschi, R. G., & Cann, A. (1982). The generalizability of attitudinal correlates of proenvironmental behavior. Journal of Social Psychology, 118, 287-288.

Solomon, L. S., Tomaskovic-Devey, D., & Risman, B. J. (1989). The gender gap and nuclear power: Attitudes in a politicized environment. Sex Roles, 21, 401-414.

Spady, W. G. (1971). Dropout from higher education: Toward an empirical model. Interchange, 2(3), 38-62.

SPSS-X™ user's guide (3rd ed.). (1988). Chicago, IL: SPSS.

Steiner, R. L. (1973). Attitudes of Oregon high school seniors toward environmentally oriented science related social issues. Science Education, 57(4), 417-436.

Stern, P. C., Dietz, T. B., & Black, J. S. (1985-86). Support for environmental protection: The role of moral norms. Population and Environment Behavioral and Social Issues, 8, 204-222.

Stern P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. Environment and Behavior, 25, 322-348.

Tabachnick, B. G., & Fidell, L. S. (1989). Using multivariate statistics (2nd ed.). New York: HarperCollins.

Taylor, D. E. (1989). Blacks and the environment. Toward an explanation of the concern and action gap between Blacks and Whites. Environment and Behavior, 21, 175.

Terenzini, P. T. & Wright, T. M. (1987a, May). The influence of academic and social integration on students' personal development during four years of college. Paper presented at the annual Forum of the Association for Institutional Research, Kansas City, KS. (ERIC Document Reproduction Service No. ED 293 439)

Terenzini, P.T., & Wright, T. M. (1987b, February). Students' personal growth during the first two years of college. Paper presented at the annual meeting of the Association for the Study of Higher Education, San Diego, CA. (ERIC Document Reproduction Service No. ED 281 463)

Theophilides, C., Terenzini, P. T., Lorang, W. (1984). Relation between freshman-year experience and perceived importance of our major educational goals. Research in Higher Education, 20, 235-252.

Thompson, J. C., & Gasteiger, E. L. (1985). Environmental attitude survey of university students: 1971 vs. 1981. Journal of Environmental Education, 17(1), 13-22.

Tinto, V. (1987). Leaving college: Rethinking the causes and cures of student attrition. Chicago, IL: University of Chicago.

Van Liere, K. D., & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypothesis, explanations and empirical evidence. Public Opinion Quarterly, 44, 184-197.

Vining, J., & Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. Journal of Applied Psychology, 22, 1580-1607.

Williams, E. (1991). College students and recycling: Their attitudes and behaviors. Journal of College Student Development, 32, 86-88.

Williams, S., & McCrorie, R. (1990). The analysis of ecological attitudes in town and country. Journal of Environmental Management, 31, 157.

Zeidler, D. L., & Schafer, L. E. (1984). Identifying mediating factors of moral reasoning in science education. Journal of Research in Science Teaching, 21(1), 1-15.