# Nature or Nurture? On the Trail of Determining Variables that Influence Environmental Behavior

Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 18-22, 1995

Amanda Woods-McConney and Andrew McConney
Western Michigan University, Kalamazoo, Michigan

*In this research we describe and discuss a path analysis of an hypothesized model of environmental behavior. In formulating the model, we used variables that had previously been empirically linked to environmental behavior (e.g., knowledge of issues, attitudes) but also included others that had not been assessed in the context of a model explaining environmental behavior (e.g., gender, ethnic affinity, age). Our findings support hypothesized direct influences on environmental behavior of knowledge and skill in environmental action, the opinions of others, fear of environmental catastrophe, environmental sensitivity, locus of control with regard to environmental problem-solving, and environmental attitudes. Further analyses demonstrated the chief influence of knowledge and skill in environmental action, the opinions of others, and fear. We discuss the importance of these findings for building the knowledge base undergirding program and curriculum development efforts in environmental education.*

Please direct correspondence about this paper to
Amanda Woods-McConney
a.woods-mcconney@murdoch.edu.au
School of Education
Murdoch University
South St, Murdoch
Western AUSTRALIA 6150
Ph +61 (0)8 9360 6467

## Introduction

Public awareness of environmental problems is increasing (Sutton, 1993). Evidence for this is found in the media coverage offered to both local and global environmental topics (Hungerford & Volk, 1990) and in the prominence given to intergovernmental gatherings such as the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. Also, the extensive support given to environmental organizations (e.g., The Nature Conservancy, World Wildlife Fund, Greenpeace) and the resources many companies allocate to appear "environmentally friendly" could be seen as reflecting genuine, widespread concern for the environment.

However, heightened public awareness has not prepared society to deal with the complexity and scope of environment problems as there is as yet limited action toward sustainable environmental solutions in the form of "responsible environmental behavior" (Dunlap, 1989; Finger 1993, 1994; Hungerford & Volk, 1990; Rosenbaum, 1991; Zoller, 1990). Traditionally, and at times continuing today, the general assumption about environmental education has been that more knowledge leads to increased awareness that in turn is associated with increased motivation to act responsibly toward the environment. Although in some cases awareness does lead to action, this model has not been widely supported by research; in general, "issue awareness does not lead to behavior in the environmental dimension" (Hungerford & Volk, 1990, p. 17).

For example, a meta-analysis investigating responsible environmental behavior indicated that behavior is associated with knowledge of issues, knowledge of action strategies, locus of control, attitudes, verbal commitment, and sense of responsibility (Hines, Hungerford, & Tomera, 1986-87). In this study, Hines and colleagues noted that personality variables (attitude, locus of control, personal responsibility) are not readily influenced by educational efforts, and called for research into how these factors could be influenced to improve environmental behavior. Hungerford and Volk later proposed a model evolved from that of Hines and co-workers that attempted to explain the relationships among variables, but cautioned that more research is needed "to fully understand the relationships between these variables and behavior" (1990, p. 11). They explained that their revised model included only variables that they considered could be influenced by educational programs (to the exclusion, for example, of variables such as gender, ethnic affinity, and age).

We believe that a model of environmental behavior emphasizing only "educationally significant variables" may confine our understanding. The approach we support is that so eloquently stated by Hines, Hungerford, and Tomera:

> It has long been known that the prediction of behavior is an extremely complex process which is based on a multitude of factors....additional research is needed in an effort to discover those interrelationships which exist between each of the variables in the model. To accomplish this, research efforts must concentrate on *all factors* [our emphasis] in the environmental behavior picture, rather than continuing to isolate individual components from those variables with which they likely interact. (1986-87, p. 8)

For instance, attempts to understand environmental behavior cannot ignore autobiographical research on significant life experiences that shows exposure to role models of

appreciation and concern for the environment is an important factor in influencing responsible environmental behavior (Chawla, 1996a, 1996b, in press; Tanner 1980). Further, a study supported by the Swiss National Science Foundation found that behavior is related to three types of environmental experiences—those of activism, nature, and fear of catastrophes (Finger 1993, 1994). Another relationship that has not been thoroughly examined in environmental education research is that between gender and behavior. Finger (1993) found that females were more fearful of environmental problems and more sensitive to catastrophes. And in Finland, while investigating primary school children's preferences in environmental problem-solving, Aho, Permikangas, and Lyyra (1989) found that girls were able to examine an issue from more points of view than boys. This finding was supported in a study of Florida high-schoolers that found girls to be more interdisciplinary than boys in their suggested solutions to environmental problems (Woods McConney, McConney, & Horton, in press). Similarly, Pozarnik, in studying the values of pupils in environmental dilemmas, reported that "Girls gave less one-sided concrete justifications and more answers on higher levels, and answers connecting both sides of the issue" (1995, p. 56).

**Purpose of the Current Study**

In response to continued shortfalls in behavior there have been calls for environmental education to be a component of both science and liberal education, curricula more relevant to current, real-life problems, and active learner participation in environmental problem-solving (Orr, 1994; Unesco-UNEP #17; Zoller, 1990). However, without understanding better the factors, and relationships among factors, that influence environmental behavior we do not yet have an adequate knowledge base for the development of effective environmental education. Hence, the main objective of this study is an analysis that furthers our understanding of the relationships among variables previously identified as influential in environmental behavior (Finger 1993, 1994; Hines, Hungerford, & Tomera, 1986-87; Ramsey, 1993; Sia, Hungerford, & Tomera, 1985-86) while adding other factors that may also be important (e.g., Aho, Permikangas, & Lyyra, 1989; Blahna & Toch, 1993; Finger 1993, 1994; Pozarnik, 1995; Woods McConney, McConney, & Horton, in press) This study therefore provides a step forward in the ongoing research into environmental behavior, which in turn should help guide our theory, curriculum, and program development efforts in environmental education.

**Method**

Instrument and Variables

We developed the Environmental Issues and Actions Questionnaire (EIA) to gather data for analyzing an hypothesized model of environmental behavior. The variables, direct influences, and hypothesized relationships were compiled from previous environmental education research (Barrow & Morrisey, 1988-89; Blahna & Toch, 1993; Challenger, 1990; Chawla, 1996a, 1996b, in press; Culen, 1997; DeYoung, 1996; Finger 1993, 1994; Fish, 1992; Hines, Hungerford, & Tomera, 1986-87; James, 1993; Lundeberg, Fox & Punchocar, 1994; McConney, McConney, & Horton, in press; Roth & Perez, 1989; Sobel, 1997) and our own professional experiences. Table 1 provides an overview of this study's variables and the sources for their measurement.

_____

place Table 1 about here

The EIA was constructed from the integration and modification of three existing instruments (Barry, 1990; Finger 1993, 1994; Ramsey, 1994), added to questions we created. Two of the instruments were used in previous research (Barry, 1990; Finger 1993, 1994), and Ramsey's was modified from that used in a previous study (Ramsey, 1993, personal communication, 1994). Barry developed the Environmental Issues Survey to measure environmental attitudes and knowledge (1990). The EIS was used in two large-scale, causal-comparative studies that compared the environmental attitudes and knowledge of high-school students in Canada, the United States (Florida and Minnesota), and Germany (Challenger, 1990; Fish, 1992). Finger's (1993) four-year study focused on adult environmental education, one component of which was an investigation of self-reported behavior for 1004 Swiss adults. Ramsey (1993) researched the effects of an instructional methodology, "issue investigation and action training," on eighth-grade students' overt environmental behavior.

Sample

The sample for this analysis comprised 470 undergraduate students enrolled at a large, public, mid-western university. The sample included those students enrolled in one of four courses accessible to the researchers: *Introduction to Environmental Studies*, *Environmental Studies Senior Seminar* (core requirements for majors and minors in environmental studies), *Issues in Social Biology*, and *Non-Western World* (electives fulfilling general education requirements). Breakdowns of students' ethnic affinities, gender, and age groups are given in Tables 2 and 3.

place Table 2 about here

As shown in Table 2, this study included 269 women (58%) and 194 men (42%). All major U.S. racial groups were represented, but by far the majority were White (82%). Students' ages ranged quite broadly from 18–42, but as might be expected from a sample of undergraduate university students, the majority (68%) was in the 20–25 age group.

place Table 3 about here

Data Collection and Method of Analysis

The data for this path analysis were collected by survey. The EIA was given to students during regular class meetings, over a period of one week during the 1995 winter semester. Each administration of the instrument was preceded by the first author giving a short description of the purpose and voluntary nature of the survey. Students completed the questionnaires outside of regular class time.

To analyze the data we used path analysis, which can be viewed as a subset of causal model analysis. This technique has its roots in the path-analytic diagrams developed in the 1920s by Sewell Wright for "untangling genetic and non-genetic influences" (Cohen & Cohen, 1983, p. 80). First, relationships among the independent variables and between the independent variables and self-reported environmental behavior were hypothesized. Figure 1 depicts the hypothesized model in the form of an arrow diagram where lines and arrows reflect direct and indirect influences on environmental behavior. Path analysis was used to test the model, not as a method to discover cause, but to clarify the relationships among, and relative contributions of the variables in the hypothesized model.

_____

place Figure 1 about here

_____

Hypothesized Model

The model depicting hypothesized influences on environmental behavior is based on the literature and our experience as environmental educators. Note in Figure 1 that the variables gender, age, ethnic affinity, leadership, and opinions of others do not have arrows flowing into them. This is reasonable since none of the other variables in the model likely influence these attributes. There are, however, eight other variables for which we suggested at least one influence. Table 4 and the discussion that follows summarizes for each variable its hypothesized influences, references to previous research, and the reasoning underlying these relationships.

_____

place Table 4 about here

_____

*Knowledge*

Knowledge, as measured by the EIA, consists of answers to questions that require factual knowledge of environmental issues, including for example, chloroflourocarbons, fossil fuels, and species extinction (Barry, 1990).

We hypothesized relationships from gender, fear, and age to knowledge. First, a number of studies indicate that males score higher than females on environmental knowledge questions

(Barrow & Morrisey, 1988-1989; Challenger 1990; Fish, 1992; Roth & Perez, 1989). However, Finger proposed that women were more likely to seek knowledge than men (1993). Second, based on Finger's study, we hypothesized a relationship between age and knowledge (1993). He found that the younger the Swiss, the more they want to know about environmental problems. On the other hand, we recognize that knowledge is related to the overall education of a person, thus an older person may have had a greater chance to gain environmental knowledge. Third, we posited a relationship between fear and knowledge as Finger contended that fear motivates the search for more knowledge.

*Attitude*

Attitude, as measured by the EIA, comprises two components. The first is a measure of positive feelings toward environmental issues (Ramsey, 1993) while the second consists of questions that require individuals to choose among strategies in addressing a number of environmental issues (Barry, 1990).

We hypothesized relationships from gender, knowledge, sensitivity, and locus of control to attitude. First, although Fish (1992) did not find significant gender differences in environmental attitudes, the mean attitude scores of females were higher than those of males. Second, traditional thinking in environmental education has argued that increases in knowledge lead to increased awareness and accompanying positive attitudes (Hungerford & Volk, 1990). We included this relationship in the current model to help clarify the contribution of knowledge to environmental attitudes. Third, on the basis of Hungerford and Volk's model of environmental behavior we also felt that a relationship exists between environmental sensitivity and attitudes. Fourth, based on Finger (1993) and Hines, Hungerford, and Tomera (1986/87) we posited an influence of locus of control on attitude. Finger proposed that positive attitudes are not closely aligned with locus of control; he noted that while the Swiss have generally positive attitudes, they feel quite impotent with respect to environmental issues. On the other hand, Hines, Hungerford and Tomera (1986/87) reported a close positive relationship between attitudes and locus of control. We included the relationship in the model to further explore the connection between environmental attitude and locus of control.

*Self-Reported Knowledge and Skill in Environmental Action Strategies*

This variable is a measure of how knowledgeable and skilled an individual feels in using a specific action (i.e., consumerism, persuasion, physical action, political action) as an environmental action strategy.

We hypothesized influences from knowledge, age, and gender to knowledge and skill in environmental action strategies. First, we felt that individuals with greater knowledge and maturity (age) would report higher levels of knowledge and skill in using environmental action strategies. Second, considering that females have a general tendency to discount their capabilities when compared to men, but have in fact been shown to be more interdisciplinary problem-solvers than men (Aho, Permikangas, & Lyyra, 1989; Woods McConney, McConney, & Horton, in press) we suggested that gender would also have an influence on self-reported knowledge and skill in action strategies.

*Locus of Control*

Locus of control is the degree to which individuals feel they have influence over events in their lives and in the world at large. Persons with internal loci feel able to influence outcomes while those with external loci believe that "outside" factors beyond their control determine the outcomes of events (Rotter, 1954). "Individual locus of control" refers to this construct for persons acting on their own, while "group locus of control" refers to the construct for persons as members of a group (Ramsey, 1993). Locus of control in this study was determined by combining individual and group locus of control measures.

We proposed relationships from age, leadership, the opinions of others, susceptibility, knowledge, ethnic affinity, gender, and knowledge and skill in action strategies to locus of control. When Finger (1993) asked respondents what were the main impediments to solving environmental problems he found that they were overwhelmed by the problems and did not feel that they could solve them. Finger also noted an age difference in this phenomenon. First therefore, we hypothesized differences in locus of control due to age. Second, we hypothesized that feelings of natural leadership would positively affect locus of control. Third, because autobiographical research (Chawla, 1996a, 1996b, in press; Tanner 1980) indicates that role models who are active and self-determined provide examples of an internal locus of control, we posited relationships between the opinions of others and a person's susceptibility to influence and locus of control. Fourth, based on the findings of Hungerford and Volk (1990) we hypothesized a relationship between knowledge and locus of control. Fifth, we hypothesized paths from ethnic affinity and gender to locus of control. Blahna and Toch (1993) have noted that non-whites perceived the environmental movement as a "White thing" (p. 23). This perception could be due to the lack of minorities on the staffs of environmental groups and/or the inattention of these groups to the concerns of minority communities. Katherine James (1993, 1995) related a story of an African American who did not feel she belonged in a park where she was working because cultural information was not interpreted. This woman did not realize her connection to the park that was once a part of the underground railroad. Once she was aware of her connection she felt empowered and involved in the park. In addition, groups such as females and minorities that are traditionally excluded from positions of power may exhibit generally external loci of control for solving (environmental) problems. Last, based on Ramsey's work (1993), we hypothesized a path from knowledge and skill in environmental action strategies to locus of control.

*Sensitivity*

The extent of an individual's empathetic feelings and ability to relate to environmental issues is reflected in the sensitivity variable, and is based on a definition proposed by Hungerford and Volk (1990), and further context provided by Marcinkowski and Sward in a review of the research on environmental sensitivity (1995).

We hypothesized relationships from ethnic affinity, gender, age, the opinions of others, and knowledge to sensitivity. First, there are recent suggestions (Blahna & Toch, 1993, James, 1995) that the general inattention of environmental groups to the particular (often different) concerns of minority communities may result in racial differences in sensitivity as it is currently measured. That is, racial groups concerned primarily with environmental justice issues (the placement of heavy industries, waste storage sites, or the availability of clean water) may not respond positively to sensitivity measures of more "distant" issues such as the threat of global warming or acid rain, issues that are more routinely seen as mainstream environmental. Second, Finger found that females were more sensitive to environmental catastrophes (Finger 1993, 1994).

Third, we posited that differences in experience due to age or the opinions of others may also influence sensitivity. If the younger generation has not had a chance to interact with the environment, they may be less empathetic toward the environment. It also seems reasonable to suggest that the opinions of other important people in a person's life are likely to influence that person's sensitivity toward environmental issues. Fourth, based on our work in environmental education programs and Hungerford and Volk's research (1990) we suggest a path from knowledge to environmental sensitivity. Increased knowledge does seem to have a positive influence on sensitivity, at least in the short term.

*Fear*

This variable was based on research that explained environmental behavior through fear of environmental catastrophes (Finger 1993, 1994). Three researcher-developed questions asked students to estimate the extent of their fear on both local and global scales. There is recent concern among environmental educators that too much fear can cause apathy and hopelessness (Sobel, 1997). We believe that it is important to further understand the relationship between fear and inaction or action.

We hypothesized relationships from gender, age, locus of control, knowledge and skill in action strategies, and the opinions of others to fear. Finger (1993) found that in addition to being more sensitive to environmental catastrophes, females were also more fearful of environmental problems. He also noted that younger generations were more fearful. We hypothesized that those with external loci of control would likely have greater fear, while those with greater degrees of knowledge and skill in action strategies would have less fear. Last we suggested a path from the opinions of others to fear as others could influence levels of fear by being supportive or apocalyptic with regard to efforts to participate in solving environmental problems (Sobel, 1997).

*Susceptibility to Influence*

This variable describes the tendency of an individual to do what other people think they should do. Others that may influence the individual include family members, teachers, classmates, friends, and environmentalists.

First, there is a common belief that younger students are more susceptible to the influence of teachers as they do not yet have set attitudes and beliefs about environmental issues. This possible age effect is included in the hypothesized model. Second, females are traditionally thought to be more concerned with team-building than are males; recent mass media surveys characterize females as consensus-builders seeking the input of a broad range of others. We therefore posited a relationship between gender and susceptibility to influence.

*Self-Reported Environmental Behavior*

Since the late 1960s responsible environmental behavior has been called the ultimate goal of environmental education (e.g., Orr, 1994; Ramsey, 1993; Stapp, 1969). Finger's (1993) list of concrete environmental actions was the basis for our measure of environmental behavior. Students were asked to report, on a scale ranging from "always" to "never," how often they *did* the activity described. The list of behaviors included doing what is expected (i. e., recycling, picking up litter, etc.); learning more about the environment; voting for and informing others about the environment; signing petitions in favor of environmental protection; and activism in support of environmental causes.

We hypothesized relationships from fear of environmental catastrophe, environmental attitudes, knowledge and skill in environmental action strategies, locus of control, environmental sensitivity, and the opinions of others to environmental behavior. First, Finger (1993) has proposed that education does not have much of a bearing on environmental problem-solving and behavior, and in some cases may even be counterproductive. Finger's study suggested that fear of problems may be central in determining environmental behavior. Second, the commonly held view that positive attitudes lead to more positive environmental behavior has not been supported by research (Hungerford & Volk, 1990). We included the hypothesized influence of attitude to further investigate the relationship between it and behavior. Third, a number of environmental educators contend that skill in using action strategies influences environmental behavior (Hines, Hungerford, & Tomera, 1986/87; Hungerford & Volk, 1990; Ramsey, 1993). Fourth, Hines, Hungerford and Tomera (1986/87) and Finger (1993) contend that locus of control influences environmental behavior. For example, although a majority of Swiss believe that the environment is their number one problem, they do not feel as though they have the power to change environmental problems. Furthermore, Sobel (1997) discusses young childrens' feeling of hopelessness and disempowerment due to the overwhelming nature of environmental problems presented in elementary curriculum. Finally, based on Hungerford and Volk's work (1990) and our personal experience in environmental education, we posited that environmental sensitivity and the opinions of others would influence environmental behavior.

**Results**

The First Step: Zero-Order Regression Coefficients

To proceed with the path analysis after developing the initial model, we calculated the regression coefficients for each relationship posited in the model (Cohen & Cohen, 1983). That is, we tested each path in Figure 1 by regressing each variable thought to be influenced by others-shown by having one or more arrows to it-on every variable thought to influence it. The results of these simple regressions are reported in Table 5. Of course, variables like gender, age, and ethnic affinity would not have other influences in this model. We retained only those paths (relationships between two variables) that showed a significant regression coefficient.

_____

place Table 5 about here

_____

The Second Step: Trimming the Model

As the result of testing each path in the model by simple regression, and as shown in Table 5, a number of hypothesized paths were found non-significant, and eliminated. For instance, the hypothesized influences of ethnic affinity on locus of control and sensitivity, the influences of gender on knowledge, attitude, locus of control, sensitivity, susceptibility to influence, and fear, and the influences of age on self-reported knowledge and skill, susceptibility to influence, and fear were eliminated in this manner. Also eliminated were hypothesized influences of fear on knowledge, knowledge on knowledge and skill in action strategies, and knowledge on locus of

control. On the other hand, all hypothesized direct paths (from attitude, knowledge and skill in action strategies, fear, sensitivity, opinions of others, and locus of control) to environmental behavior were retained. The "trimmed" model is arrived at by this process of elimination, and is given in Figure 2.

_____

place Figure 2 about here

_____

The Third Step: Estimating Direct and Indirect Influences

To gain useful, comparative information from the analysis, one more step is necessary. This is the estimation of direct and indirect influences of the independent variables on environmental behavior. The direct influence of each independent variable is estimated by the regression of environmental behavior on that variable, when all other measured influences on the dependent variable are included in the equation (Cohen & Cohen, 1983). In other words, direct influences are the regression coefficients of each independent variable in a simultaneous analysis of all measured influences. The path coefficients (direct influences) for each variable posited to directly influence environmental behavior are included in Figure 2 (e.g., the estimated direct influence of attitude on environmental behavior is .01).

As shown in Figure 2, the relative order of magnitude of direct influences on environmental behavior was found to be: self-reported knowledge and skill (.28), fear (.17), opinions of others (.17), sensitivity (.12), locus of control (.11), and attitude (.01). It should be noted, however, that only self-reported knowledge and skill in environmental action, fear, and the opinions of others were demonstrated significant direct effects by simultaneous multiple regression.

Indirect influences, on the other hand, are effects mediated by other intervening variables. They are estimated by calculating the difference between the total influence of an independent variable and its direct influence on self-reported environmental behavior. The direct, sum of indirect, and total influences for each variable can be seen in Table 6. As shown in the table, knowledge and skill in environmental action strategies had the strongest overall influence on self-reported environmental behavior (.36). The second most influential factor on environmental behavior was the opinions of others (.25), and this was followed by fear of environmental catastrophe (.17).

_____

place Table 6 about here

_____

**Discussion**

Markedly different from other, traditionally discipline-focused domains of education, environmental education must have as its primary goal and concern the development of a citizenry whose behavior is responsive and responsible toward local and global environments (North American Association for Environmental Education, 1997; Orr, 1994; Ramsey, 1993, Stapp, 1969). Pointedly, if we as environmental educators take seriously our implicit mandate to work for a reverse in direction in the degradation of the environment, then we must be concerned not only with awareness and attitude, knowledge and sensitivity, but ultimately with how these variables interplay to shape behavior. We thus view this research as important for the development of effective programs and curricula in environmental education because it provides insight into the relative importance of the factors influencing responsible environmental behavior. In effect, it makes a start in providing answers to the call from Chawla, Hines, Hungerford, Marcinkowski, Orr, Tanner, Tomera, Volk, Zoller, and many other actively engaged environmental educators, to research how environmental education can influence the opportunities that individuals will take environmentally responsible actions in their lives.

A number of findings stand out from this path analysis:

1. Environmental behavior is complex. While a number of influences were eliminated in trimming the initial hypothesized model, the final model retained many relationships in need of further, in-depth exploration and study;
2. Although knowledge of environmental issues and attitudes toward environmental concerns may be worthy goals in and of themselves, (and indeed, these two variables are strongly related in this study), in the context of the other variables measured here, they are not sufficient to influence environmental behavior in a positive direction;
3. This analysis underscores the important difference between knowledge of issues ("knowing about") and knowledge and skill in action strategies ("knowing what to do and how to do it"). Knowledge and skill in action strategies showed the strongest influence on self-reported environmental behavior. Given the numerous variables included in this analysis, this result adds considerable weight to Ramsey's (1993) contention that we must be very concerned with developing students' know-how and skill in environmental action if we are ultimately concerned with how they act in relation to the environment;
4. These results also support the importance of the opinions of others (Chawla, 1996a, 1996b, in press; Ramsey, 1994; Tanner, 1980) and fear (Finger 1993; Sobel, 1997) as strong influences on environmental behavior;
5. Contrary to what had previously been suggested by Hines, Hungerford, and Tomera (1986/87) this analysis did not support a strong relationship between environmental attitudes and locus of control. Rather, the results supported Finger's contention that generally positive attitudes are not closely aligned with locus of control toward the environment, when other influences are taken into account;
6. The findings of this path analysis do not support important roles for gender or ethnic affinity as influences on environmental behavior. Ethnic affinity's lack of influence may be explained by the low ethnic diversity of our sample (83% White). Gender's lack of influence is more difficult to explain, especially in light of the findings observed in a number of studies on interdisciplinary approaches to problem-solving and values in the environmental domain (Aho, Permikangas, & Lyyra, 1989; Pozarnik, 1995; Woods McConney, McConney, & Horton, in press). However, it may simply be the case that

proclivity for examining issues or problems from many points of view (women) is not related to environmental behavior. Still, it is interesting to note that gender has a small negative influence on knowledge and skill in action strategies (and indirectly on behavior) perhaps supporting the view that women tend to underestimate their abilities.

To summarize, a further point or two (not directly related to the path analysis) are necessary. These data reflected only mediocre (moderately positive) self-reported environmental behavior for the 470 undergraduates surveyed (the overall average for environmental behavior was 22 on a scale of 8-40, with higher scores being more positive). When asked to rate the relative influences of sources of information about environmental issues (knowledge), most students chose mass media (television, newspapers, etc.) with school classes as a close second. When asked to choose the most significant influence on their environmental sensitivity, students opted for education by a wide margin. This differs from autobiographical studies that emphasized leaders who facilitated action in others (Chawla, 1996b, in press). The active leaders did not emphasize education as much as the undergraduate university students in the current study. This may be due, in part, to the context of the students as they are immersed in the university experience. However, it may also reflect the influence that education has on individuals who are not as developed in their roles as environmental leaders. If an individual is unfamiliar, or only vaguely familiar with a topic, they may be more likely to rely on education to provide the knowledge base for further understanding and ultimate action in the discipline. For example, an individual with a limited understanding of art will probably rely more heavily on art classes to increase both their general understanding and expertise in the techniques (i.e. painting, sculpture, etc.) of the field.

It is encouraging that most students rated their education as having the most influence on their environmental sensitivity, and in general, their classes as influential sources of information (i.e., our message as environmental educators may be "reaching fertile ground"). However, it was also very clear from this path analysis that sensitivity and knowledge are weak influences on behavior, in the context of other measured influences. The same can be said for environmental attitudes. These results strongly suggest that as educators we need to spend more time facilitating our students' development of knowledge and skills in environmental action. In other words, while our students may be open to considering the messages of environmental education, those messages may currently not be complete; environmental education may be overemphasizing environmental problems and degradation (enhancing fear of catastrophe), but not spending enough time and resources on *what can be done and how to do it*.

**References**

Aho, L. Permikangas, T., & Lyyra, S. (1989). Finnish primary school children's preferences in environmental problem solving. *Science Education*. *73* (5), 635-642.

Barrow, L. H., & Morrisey, J. T. (1988-1989). Energy literacy of ninth-grade students: A comparison between Maine and New Brunswick. *The Journal of Environmental Education, 20*(2), 22-25.

Barry, K. (1990). *The design and validation of the Environmental Issues Survey (EIS).* Unpublished master's thesis, Florida Institute of Technology.

Blahna, D. J., & Toch, M. F. (1993). Environmental reporting in ethnic magazines: Implications for incorporating minority concerns. *The Journal of Environmental Education, 24*(2), 22-29.

Challenger, G. E. (1990). *A cross-cultural comparison of environmental awareness: Experiences related to environmental knowledge and attitude*. Unpublished master's thesis, Florida Institute of Technology.

Chawla, L. (1996a). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *The Journal of Environmental Education, 28*.

Chawla, L. (1996b, in press). Life paths into effective environmental action. Manuscript submitted for publication.

Cohen, J. & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. (2nd ed.) Hillsdale, NJ: Lawrence Erlbaum Associates.

Culen, G. R. (1994). The Effects of an Extended Case Study on Environmental Behavior and Associated Variables, Unpublished Dissertation, Southern Illinois University at Carbondale.

DeYoung, R. (1996). Some psychological aspects of reduced consumption behavior: The role of intrinsic satisfaction and competence motivation. *Environment and Behavior*, *28*(),

Dunlap, R. E. (1989). Public opinion and environmental policy. In J. P. Lester (Ed.), *Environmental politics and policy*. Durham, NC: Duke University Press.

Finger, M. (1993). *Environmental adult learning in Switzerland*. (Occasional Papers Series No. 2). Columbia University, Teachers College, Center for Adult Education.

Finger, M. (1994). From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, *50*(3), 141-160.

Fish, T. E. (1992). *A comparison of environmental knowledge and attitudes between secondary school students in the United States and the Federal Republic of Germany*. Unpublished master's thesis, Florida Institute of Technology, Melbourne, FL.

Gough, A. (1994, April*). The founders 'Down Under': Narratives of the environmental education movement*. Paper presented at the annual meeting of American Educational Research Association, New Orleans, LA.

Hines, J. M., Hungerford, H. R. & Tomera, A. N. (1986-1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education, 18*(2), 1-8.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education, 21*(3), 8-21.

James, K. (1993). A qualitative study of factors influencing racial diversity in environmental education. Unpublished Dissertation: University of Minnesota.

James, K. (1995, Spring). Creating a multiculturally diverse profession. *Pathways*. New York State Outdoor Education Association Newsletter, pp. 14-18.

Marcinkowski, T., & Sward, L. (1995). Environmental sensitivity: A review f the research 1980-1995. Paper presented at the Annual Meeting of the North American Association of Environmental Education, Portland, Maine.

North American Association for Environmental Education. (1997). *Environmental guidelines for excellence: What school-age learners should know and be able to do*. National Project for Excellence in Environmental Education.

Orr, D. W. (1994). *Earth in mind: On education, environment, and the human prospect.* Washington DC: Island Press.

Pozarnik, B. M. (1995). Probing into pupil's moral judgment in environmental dilemmas: A basis for 'teaching values.' *Environmental Education Research*, *1*(1), 47-58.

Ramsey. J. M. (1993). The effects of issue investigation and action training on eighth-grade students' environmental behavior. *Journal of Environmental Education*, *24*(3) 31-36.

Rosenbaum, W. A. (1991). *Environmental politics and policy*. (2nd ed.). Washington DC: Congressional Quarterly Press.

Roth, R. E., & Perez, J. (1989). Twelfth grade student knowledge and attitudes toward the environment in the Dominican Republic: An assessment. *The Journal of Environmental Education, 20*(3), 10-14.

Rotter, J. (1954). *Social learning and clinical psychology*. Englewood Cliffs, NJ: Prentice Hall.

Shuman, D. K. (1995). Factors that influence commitment to teaching environmental education: Development and test of a causal model. Paper presented at the Annual Meeting of the North American Association of Environmental Education, Portland, Maine.

Sia, A., Hungerford, H. R. & Tomera, A. N. (1985-1986). Selected predictors of responsible environmental behavior: An analysis. *The Journal of Environmental Education, 17*(2), 31-40.

Stapp, W. (1969). The concept of environmental education. *The Journal of Environmental Education, 1*(3), 31-36.

Sobel, D. (1995). *Beyond Ecophobia: Reclaiming the heart in nature education*. Orion Monograph.

Sutton, P. (1993). Environmental education: What can we teach? *Convergence*, *22*(4) 5-11.

Tanner, T. (1980). Significant life experiences. *The Journal of Environmental Education, 11*(4), 20-24.

Unesco-UNEP. (17). *A comparative survey of the incorporation of environmental education into school curricula*. Unesco-UNEP International Environmental Education Programme, Environmental Educational Series #17, Federal Republic of Germany.

Woods McConney, A., McConney, A. A., & Horton, P. B. (In press). Gender differences in the environmental decision-making of secondary school students. In Patricia J. Thompson (Ed.), *Environmental issues for the 21st century: International and interdisciplinary perspectives*. New York: Peter Lang Publishing Company.

Unesco-UNEP. (1989). Environmental education means environmental solutions. Unesco-UNEP Environmental Education Newsletter, *14*(1), 1-3.

Zoller, U. (1990). Environmental education and the university: The "problem solving-decision making act" within a critical systems-thinking framework. *Higher Education in Europe*, *15*(4), 5-14.

Table 1

Source of Questions and Scoring Rules for the Path Analysis Variables

| Variable | Source of questions to measure this variable | Measured in previous work | Scored as: |
|---|---|---|---|
| Self-reported environmental behavior (dependent variable) | Finger 1993 | Yes | Total score |
| Leadership | current authors | No | Total score |
| Susceptibility to influence | Ramsey, 1994 | No | Total score |
| Knowledge | Barry, 1990 | Yes | Total score |
| Attitude | Barry, 1990; | Yes | Average |
| | Ramsey, 1994 | No | |
| Knowledge and skill in action strategies | Ramsey, 1993 | Yes | Total score |
| Sensitivity | current authors | No | Total score |
| Opinions of others | Ramsey, 1994 | No | Total score |
| Fear | Finger 1993 | Yes | Total score |
| Locus of control -group | Ramsey, 1993 | Yes | Average |
| -individual | Ramsey, 1993 | Yes | |

Table 2

Breakdown of the Study Sample by Gender and Ethnic affinity

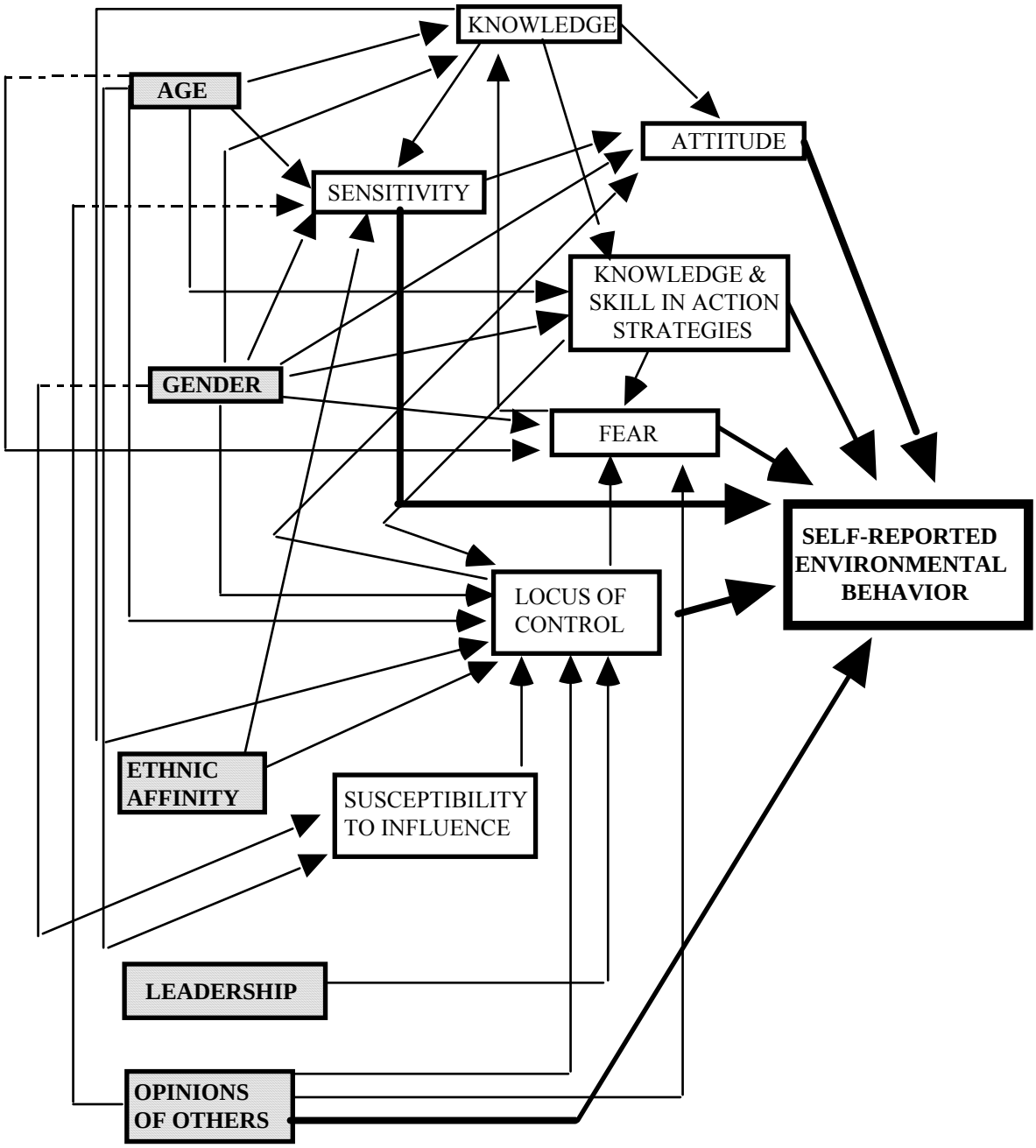
| Ethnic affinity | Females | Males | Total |
|---|---|---|---|
| Asian | 11 | 11 | 22 |
| African American | 19 | 9 | 28 |
| Hispanic | 14 | 5 | 19 |
| Native American | 6 | 2 | 8 |
| Pacific Islander | 1 | 0 | 1 |
| White | 218 | 167 | 385 |
| Total | 269 | 194 | 463 |

Note. Seven students did not report an ethnic affinity.

Table 3

Breakdown of the Study Sample by Age

| Age | Count |
|---|---|
| 15–20 | 129 |
| 20–25 | 320 |
| 25–30 | 13 |
| 30–35 | 5 |
| 35–40 | 1 |
| 40–45 | 2 |
| Total | 470 |




Note. Lines and arrows in bold indicate direct influences on environmental behavior.

Figure 1. The Hypothesized Model of Influences on Environmental Behavior.

Table 4

Variables, Direct Influences, and Sources of Support for Relationships in the Hypothesized Model of Environmental Behavior

| Outcome variable | Hypothesized direct influence | Most directly supported by: |
|---|---|---|
| Knowledge | Gender | Barrow & Morrisey, 1988-89; Challenger 1990; Finger 1993; Fish, 1992; Roth & Perez, 1989 |
| | Age | Finger 1993, 1994 |
| | Fear | Finger 1993, 1994 |
| Attitude | Gender | Fish, 1992; Challenger, 1990 |
| | Knowledge | Hungerford & Volk, 1990 |
| | Sensitivity | Hungerford & Volk, 1990 |
| | Locus of control | Hines, Hungerford, & Tomera, 1986-87 |
| Knowledge and skill in action strategies | Gender | Lundeberg, Fox, & Puncochar, 1994; Woods McConney, McConney, Horton (in press) |
| | Age | personal experience/judgment |
| | Knowledge | personal experience/judgment |
| Locus of control | Ethnic affinity | Blahna & Toch, 1993 |
| | Gender | personal experience/judgment |
| | Age | Finger 1993, 1994 |
| | Leadership | personal experience/judgment |
| | Opinions of others | personal experience/judgment |
| | Susceptibility to influence | personal experience/judgment |
| | Knowledge | Hungerford & Volk, 1990 |
| | Knowledge and skill in action strategies | Ramsey, 1993; personal experience/judgment |

Table 4 (table continues)
Variables, Direct Influences, and Sources of Support for Relationships in the Hypothesized Model of Environmental Behavior

| Outcome variable | Hypothesized direct influence | Most directly supported by: |
|---|---|---|
| Sensitivity | Ethnic affinity | Blahna & Toch, 1993 |
| | Gender | Finger 1993 |
| | Age | personal experience/judgment |
| | Opinions of others | personal experience/judgment |
| | Knowledge | personal experience/judgment |
| Fear | Gender | Finger 1993. |
| | Age | Finger 1993, 1994. |
| | Opinions of others | personal experience/judgment |
| | Locus of control | personal experience/judgment |
| | Knowledge and skill in action strategies | personal experience/judgment |
| Susceptibility to influence | Gender | personal experience/judgment |
| | Age | personal experience/judgment |
| Self-reported environmental behavior | Sensitivity | Hungerford & Volk, 1990 |
| | Attitude | "common view" |
| | Fear | Finger 1993, 1994 |
| | Opinions of others | personal experience/judgment |
| | Locus of control | Hines, Hungerford, & Tomera, 1986-87 |
| | Knowledge and skill in action strategies | Hines, Hungerford, & Tomera, 1986-87; Hungerford & Volk, 1990; Ramsey, 1993 |

Table 5

Zero-Order Regression Coefficients for Each Variable in the Hypothesized Model

| Path from | To | ß | Adjusted a | p |
|---|---|---|---|---|
| Attitude | Self-reported environmental behavior | .22 | .008 | <.0001* |
| Knowledge and skill in action strategies | √ | .53 | √ | <.0001* |
| Fear | √ | .47 | √ | <.0001* |
| Sensitivity | √ | .44 | √ | <.0001* |
| Opinions of others | √ | .47 | √ | <.0001* |
| Locus of control | √ | .41 | √ | <.0001* |
| Fear | Knowledge | .07 | .017 | **.1335** |
| Gender | √ | -.10 | √ | **.0258** |
| Age | √ | .16 | √ | .0007* |
| Gender | Attitude | .07 | .0125 | **.1350** |
| Locus of control | √ | .17 | √ | .0002* |
| Sensitivity | √ | .32 | √ | <.0001* |
| Knowledge | √ | .58 | √ | <.0001* |
| Age | Knowledge and skill in action strategies | .06 | .01 | **.2188** |
| Gender | √ | -.12 | √ | .0077* |
| Knowledge | √ | .06 | √ | **.2056** |
| Leadership | Locus of control | .22 | .007 | <.0001* |
| Gender | √ | .07 | √ | **.1544** |
| Ethnic affinity | √ | -.04 | √ | **.4106** |
| Age | √ | .14 | √ | .0021* |
| Knowledge | √ | .10 | √ | **.0313** |
| Opinions of others | √ | .40 | √ | <.0001* |
| Susceptibility to influence | √ | .25 | √ | <.0001* |
| Knowledge and skill in action strategies | √ | .41 | √ | <.0001* |

Note. Probability values shown in bold text reflect paths eliminated from the model.

Table 5 (table continues)

Zero-Order Regression Coefficients for Each Variable in the Hypothesized Model

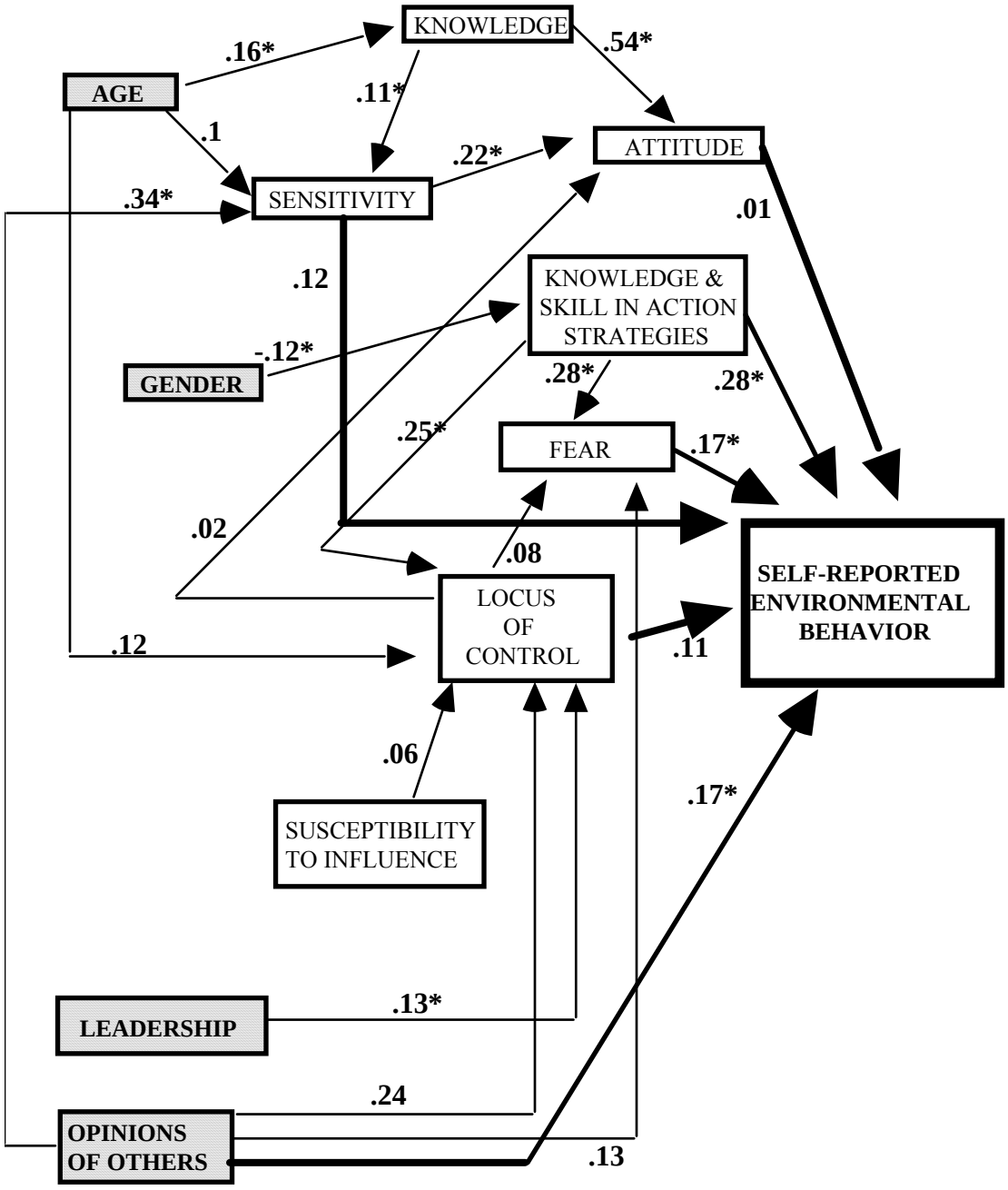
| Path from | To | ß | Adjusted a | p |
|---|---|---|---|---|
| Gender | Sensitivity | .08 | .0125 | **.1048** |
| Ethnic affinity | √ | .04 | √ | **.4101** |
| Age | √ | .14 | √ | .0022* |
| Opinions of others | √ | .35 | √ | <.0001* |
| Knowledge | √ | .14 | √ | .0020* |
| Age | Susceptibility to influence | .00 | .025 | **.9878** |
| Gender | √ | .04 | √ | **.4458** |
| Age | Fear | .10 | .0125 | **.0330** |
| Gender | √ | .05 | √ | **.2641** |
| Knowledge and skill in action strategies | √ | .40 | √ | <.0001* |
| Locus of control | √ | .28 | √ | <.0001* |
| Opinions of others | √ | .34 | √ | <.0001* |

Note. Probability values shown in bold text reflect paths eliminated from the model.

Table 6

Direct, Indirect and Total Effects on Self-Reported Environmental Behavior

| Variable | Direct effect | Sum of indirect effects | Total effect |
|---|---|---|---|
| Knowledge | 0.00 | 0.02 | 0.02 |
| Attitude | 0.01 | 0.00 | 0.01 |
| Knowledge and skill in action strategies | 0.28 | 0.08 | 0.36 |
| Locus of control | 0.11 | 0.01 | 0.12 |
| Sensitivity | 0.12 | 0.00 | 0.12 |
| Fear | 0.17 | 0.00 | 0.17 |
| Susceptibility to influence | 0.00 | 0.01 | 0.01 |
| Opinions of others | 0.17 | 0.08 | 0.25 |
| Age | 0.00 | 0.03 | 0.03 |
| Gender | 0.00 | -0.04 | -0.04 |
| Leadership | 0.00 | 0.01 | 0.01 |




Notes. Lines and arrows in bold indicate direct influences on environmental behavior; ***** indicates statistically significant relationships.

Figure 2. The Trimmed Model of Influences on Environmental Behavior.