

Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis

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ABSTRACT: Despite the wealth of information which exists concerning environmental behavior, it is not known which variable or variables appear to be most influential in motivating individuals to take responsible environmental action. A meta-analysis of environmental behavior research was undertaken in an attempt to determine this. An exhaustive search of the empirically based environmental behavior research conducted over the past decade yielded a substantial number of studies representative of a broad academic base. The characteristics and findings of these studies served as the data for the meta-analysis. As a result of the meta-analysis, the following variables were found to be associated with responsible environmental behavior: knowledge of issues, knowledge of action strategies, locus of control, attitudes, verbal commitment, and an individual's sense of responsibility. A model of predictors of environmental behavior is proposed.

Over the past decade, support has steadily grown among environmental educators for the importance of developing individuals who behave responsibly toward the environment (Stapp 1969; Hendee 1972; Childress and Wert, 1976). This support has

grown to such an extent that it can now be said that the development of environmentally responsible and active citizens has become the ultimate goal of environmental education (Hungerford and Peyton, 1976; Roth 1970; Stapp 1971). Despite agreement as to the importance of this goal, it has not, as yet, been achieved (Roth 1981; Hungerford and Volk, 1983). Curricular and instructional strategies which effectively lead to the development of environmentally responsible individuals have not been implemented in our school systems.

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One of the major impediments to the accomplishment of this goal stems from a lack of knowledge of those factors which have formative effects on the development of environmentally responsible behavior (Linke 1980). This lack of knowledge does not, however, appear to be the result of a scarcity of research on the topic. Interest in environmental behavior research has

recently expanded to involve individuals in a wide array of academic fields, e.g., education, psychology, sociology, engineering, political science, business, forestry, and communications (Borden 1977). Consequently, the volume of research devoted to environmentally responsible behavior has burgeoned over the past ten years. However, the lack of substantive ties between many of these fields has led to a situation in which it is particularly difficult to remain informed about current developments in environmental behavior research. One may speculate that this lack of communication among researchers in different academic areas may partially account for the present status of research with regard to environmental behavior. That is, that while a tremendous variety of variables has been investigated in relation to behavior in an environmental context, there is at present no agreement among researchers as to which of these variables appear to be most strongly associated with responsible environmental behavior. Such information is vital to environmental educators for its potential in terms of providing a sound empirical base on which to construct appropriate curricula for the development of environmentally responsible and active individuals.

The present study attempted to address this concern. The major goals of this study were to analyze and synthesize the environmental behavior research which had been reported since 1971 in an effort (1) to identify those variables which the research indicated were most strongly associated with responsible environmental behavior, (2) to determine the relative strengths of the relationships between each of these variables and environmental behavior, and (3) to formulate a model of environmental behavior representative of the findings synthesized in this research. The primary methodology employed in accomplishing these goals involved the use of the Schmidt-Hunter meta-analysis techniques (Hunter, Schmidt, and Jackson 1982).

Meta-analysis of Research

Meta-analysis is the term applied to groups of precise statistical methods designed to integrate empirical findings of studies addressing the same relationship. The explicit, unambiguous, and operationally defined methods associated with this approach to research integration make it far superior to the more subjective narrative discursive reviews of the literature which have traditionally been employed (Glass, McGaw, and Smith 1982). In the case of this study, this methodology allows the identification of those variables which have been found by the research to be associated with responsible environmental behavior. The methods also permit the determination of the relative strengths of the associations between each of these variables and responsible environmental behavior.

While the characteristics of this methodology and the guidelines for employing it are well documented (see for example, Hunter et al. 1982 and Glass et al. 1982), an attempt will be made in this limited space to briefly acquaint the reader with the general concepts involved. Meta-analysis begins with the set of all studies that an investigator locates which provide empirical evidence bearing on the relationship of interest. Key characteristics and findings from each study are systematically recorded. Study findings are then converted to a common statistic, a point-biserial correlation coefficient in this case. Each statistic is examined across studies and its weighted mean and variance calculated. These values are then corrected for errors due to sampling and for errors due to differences in the reliabilities of the instruments. The resulting mean correlations and accompanying standard deviations are then examined and interpreted.

An important concept associated with meta-analysis is that of the moderator variable. A moderator variable is considered to be any variable, other than those directly under study, which is found to impinge upon the relationship of interest. Moderator variables may consist of methodological differences in studies, differences in demographic composition of the individuals comprising the study samples, specificity of measures, or other factors which operate by attenuating the effects of the variables under study. Meta-analysis provides a method for establishing the relevance of potential moderator variables. The suspected moderator variable is used to split the studies into subsets which are then meta-analyzed separately. The operation of the particular moderator variable is confirmed in situations in which there are large differences in subset means.

For example, in this study one suspected moderator variable was the use of self-reported measures of behavior as opposed to reliance upon actual behavior as an indicator of responsible environmental behavior. This suspicion was based on skepticism expressed by researchers regarding the validity of the use of self-reported behavior as an accurate indicator of actual behavior. It has been shown that what people indicate on a questionnaire is often inconsistent with their actual behaviors (e.g., Brickman 1972; Deutscher 1973; Wicker 1969, 1971). On this basis, the self-reported versus actual behavior discrepancy was tested to determine whether the use of these different types of behavior measures was indeed acting as a moderator variable.

It was also suspected that the composition of the sample may have had moderating effects on the relationship between a number of variables and environmental behavior. In particular, it was suspected that different correlations would be obtained from studies which relied upon samples comprised either entirely, or in part, of individuals with known ties to environmental organizations (e.g., Sierra Club) than would be obtained from

samples derived from the general population. Meta-analysis of the data was able to provide information concerning the operation of this suspected moderator variable.

Methodology

The steps followed in the analysis and synthesis of environmental behavior research were: (1) location of appropriate studies, (2) extraction of pertinent information from these studies, and (3) analysis and synthesis of the extracted information via the Schmidt-Hunter meta-analysis procedures.

The location of studies involved an exhaustive search of the literature entailing the use of over fifteen secondary sources of information (e.g., *Psychological Abstracts*, *GEO Abstracts*, Educational Resources Information Center, *Dissertations in Eco-Education, Ecology and the Environment: A Dissertation Bibliography*). These sources cited published works, dissertations, government documents, and other fugitive literature. Reference lists for those studies located in this initial search of secondary sources of information were also reviewed in an effort to find additional environmental behavior studies which had not surfaced in the preliminary search of secondary sources.

A list of 380 studies for possible inclusion in the data set emerged. Sixty-five of these works could not be located and were thus eliminated from consideration for inclusion in the data set. Each of the remaining 315 studies were read. Only those studies which assessed variables in association with responsible environmental behavior and which reported empirical data on this relationship were included in the data set. In addition, the search was restricted to studies which had been reported since 1971. These restrictions resulted in the elimination of 187 studies. The remaining 128 studies comprised the data for this study. Ninety-eight of these studies were journal articles, thirteen were reported as dissertations or theses, twelve appeared as unpublished manuscripts, and five of the studies were published in books.

Information was extracted from these studies by recording pertinent characteristics and findings for each study on coding sheets. An analysis of these data resulted in the emergence of a number of major categories of variables which had been investigated in association with responsible environmental behavior. These categories were: (1) cognitive variables, (2) psycho-social variables, (3) demographic variables, and (4) a category of experimental studies comprised of behavioral intervention approaches and classroom strategies aimed at encouraging responsible environmental behavior. These categories of variables were further broken down into subcategories, each of which was meta-analyzed separately. In the end, fifteen separate variables were meta-analyzed in an effort to determine the strength of their

associations with environmental behavior. The findings of the meta-analyses of the first three of these four categories of variables are presented and discussed below (see Table 1).

TABLE 1. Summary of Meta-analysis Findings for Descriptive Studies

Variable	Corrected correlation coefficient	Corrected standard deviation	Number of values based on ^a
Verbal commitment	.491	.130	6
Locus of control	.365	.121	14
Attitude	.347	.224	51
Personal responsibility	.328	.121	6
Knowledge	.299	.195	17
Educational level	.185	.122	11
Income	.162	.084	10
Economic orientation	.160	.118	6
Age	-.151	.200	10
Gender	.075	.084	4

^a Several studies reported data on more than one variable.

Meta-analysis of Cognitive Variables

Cognitive variables, for the purpose of this study, included those factors pertaining to knowledge of the environment or to some aspect of an environmental issue. This entailed not only knowledge of environmental problems and their consequences, but may also have pertained to knowledge of how to take action on a particular environmental problem. Seventeen study findings which dealt with cognitive variables measured in association with environmental behavior were coded. All of these outcome measures were the result of descriptive as opposed to experimental studies.

Meta-analysis of these seventeen study findings resulted in a corrected correlation coefficient of .299 ($SD = .195$) between knowledge and environmental behavior. The positive correlation coefficient indicates that those individuals with greater knowledge of environmental issues and/or knowledge of how to take action on those issues were more likely to have reported engaging in responsible environmental behaviors than were those who did not possess this knowledge.

Further, meta-analysis of the cognitive data revealed that the mode of behavior assessment was operating as a moderator variable in the knowledge-behavior relationship. A higher corrected correlation coefficient ($r = .37$, $SD = .202$) was obtained from analysis of those studies which employed actual measures of behavior than was obtained from analysis of those studies which relied upon self-reported behavior assessments ($r = .291$, $SD = .192$).

The population sampled was also confirmed to have attenuated the knowledge-behavior relationship. A substantially larger average correlation coefficient was obtained from those studies whose samples were comprised either entirely, or in part, of individuals with known ties to environmental organizations ($r = .691$, $SD = .063$) than were obtained from samples derived from the general adult population ($r = .268$, $SD = .173$) or from samples comprised of children ($r = .192$, $SD = .071$).

Meta-analysis of Psycho-social Variables

Psycho-social variables included those factors related to individual personality characteristics, including the perceptions individuals have of themselves and of others. The psycho-social variables which were meta-analyzed in relation to environmental behavior included attitudes, locus of control, economic orientation, personal responsibility, and verbal commitment. Because meta-analysis can only be performed on finding bearing on the same relationship, it was necessary to maintain these separate categories for the analysis of the psycho-social variables.

Attitude-behavior Relationship

Attitudinal variables, for the purposes of this study, included those factors which dealt with the individual's feelings, pro or con, favorable or unfavorable, with regard to particular aspects of the environment or objects related to the environment. This category included assessments of general attitude toward the environment or toward ecology, as well as more specific attitudes such as attitudes toward the energy crisis, attitudes toward unleaded gasoline, and attitudes toward taking environmental action. No distinction was made between affective and cognitive components of attitudes.

Fifty-one outcome measures on the attitude-behavior relationship were coded. Meta-analysis of the full set of these studies (see Table 1) resulted in a corrected correlation coefficient of .347 ($SD = .224$). These results indicated the existence of a relationship between attitude and behavior, in that those individuals with more positive attitudes were more likely to have reported engaging in responsible environmental behaviors than were individuals with less positive attitudes.

Further examination of these data was conducted in an effort to determine the nature of the attitudes under study. It was found that there were essentially two types of attitudes studied by researchers: attitudes toward ecology and the environment as a whole, and attitudes toward taking environmental action (e.g., attitudes toward recycling, toward petitioning, toward conserving energy). Forty-two of the attitude studies which were coded dealt with attitudes toward the environment, while nine studies were concerned with attitudes toward

taking action. A slightly stronger relationship was detected between attitude toward action and environmental behavior ($r = .377$, $SD = .145$) than was observed between attitude toward the environment in general and environmental behavior ($r = .338$, $SD = .243$). Thus, the research indicated that both of these types of attitudes were related to behavior in an environmental context.

Several moderator variables were detected in the attitude-behavior relationship. As was the case with the knowledge-behavior studies, mode of behavior assessment was found to have attenuated the attitude-behavior relationship. Higher attitude-behavior correlations were obtained in situations in which actual behaviors were assessed ($r = .427$, $SD = .290$) than were obtained in instances in which behaviors were determined via self-reported means ($r = .334$, $SD = .209$). The population which was sampled was also found to have affected the strength of the relationship between attitude and environmental behavior. Meta-analysis of those studies which sampled populations comprised of individuals with ties to environmental organizations resulted in a higher correlation ($r = .593$, $SD = .273$) than was obtained from the analysis of studies which either sampled the general adult population ($r = .328$, $SD = .202$) or which sampled children ($r = .328$, $SD = .198$). As was the case with the knowledge-behavior relationship, the size of the corrected correlation coefficient for the studies which employed environmental group members was substantially higher than were those values obtained for the other two groups sampled. This indicated that the use of environmental group members did attenuate the relationship between attitudes and environmental behavior.

Locus of Control-behavior Relationship

Locus of control is a general concept which is not restricted to behavior in an environmental context. Locus of control represents an individual's perception of whether or not he or she has the ability to bring about change through his or her own behavior. The concept is based on the belief that some individuals do not attempt to bring about change because they attribute change to chance or to powerful others (e.g., God, parents, government) rather than to their own behaviors. This perception is termed an external locus of control. Internal locus of control individuals, on the other hand, believe that their activities are likely to have an impact (Peyton and Miller, 1980).

Six studies were coded which dealt specifically with the relationship between individual locus of control and responsible environmental behavior. An additional nine studies were located which assessed what was referred to as an individual's "efficacy perception." This variable was defined as an individual's perception of his or her effectiveness in a given situation. Despite the dif-

ference in terminology, it was felt that these variables in fact referred to the same concept. The studies in these groups were thus analyzed as one set, labeled locus of control.

Meta-analysis of the fifteen studies which dealt with the relationship between locus of control and responsible environmental behavior resulted in a corrected correlation coefficient of .365 ($SD = .121$). This finding indicated that those individuals who have an internal locus of control were more likely to have reported engaging in responsible environmental behaviors than were individuals exhibiting a more external locus of control.

Verbal Commitment-behavior Relationship

Verbal commitment referred to an expressed intention to act upon a specific matter, in this instance, an environmental problem. Despite the use of the term "verbal" by the authors of the studies which addressed this relationship, commitment was assessed in all cases by the use of written instruments. Thus, commitment was a measure of intention, not necessarily expressed verbally.

Six studies were coded which assessed the relationship between intention and environmental behavior. Meta-analysis of these studies (see Table 1) resulted in a corrected correlation coefficient of .49 ($SD = .130$). Thus, those individuals who express an intention to perform some action related to the environment were more likely to have reported engaging in environmental behaviors than were individuals who had expressed no such intentions.

Personal Responsibility-behavior Relationships

This psycho-social variable represented individual's feelings of duty or obligation. This obligation was either expressed in reference to the environment as a whole (e.g., social responsibility, personal responsibility to help the environment) or in reference to only one facet of the environment (e.g., personal responsibility felt for reducing air pollution, for buying lead-free gasoline, for recycling).

Six studies were meta-analyzed which dealt with this relationship resulting in a corrected correlation coefficient of .328 ($SD = .121$). Thus, those individuals who felt some degree of personal responsibility toward the environment were more likely to have engaged in responsible environmental behaviors than were individuals who held no such feelings of responsibility.

Economic Orientation-behavior Relationship

Economic orientation referred to an individual's cost consciousness and concern about the economic impact of certain responsible environmental behaviors and environmental regulations. For example, Heberlein and

Black (1976) found that those individuals who believe that lead-free gasoline saves money were significantly more likely to purchase it than were individuals who did not hold this economic belief. Van Liere and Dunlap (1981) determined that individuals who favored spending more money to reduce pollution reported taking significantly more environmental actions than did individuals who were not in favor of increased environmental spending.

Meta-analysis of the six studies which dealt with this relationship (see Table 1) resulted in a corrected correlation coefficient of .162 ($SD = .118$). Because of the small magnitude of this correlation coefficient support for the existence of a strong relationship between an individual's economic orientation and responsible environmental behavior was not obtained from the meta-analysis.

Meta-analysis of Demographic Variables

Those demographic variables which were assessed in association with responsible behavior included age, income, education, and gender. Table 1 summarizes the findings of the meta-analyses of these four subsets of variables. Because of a lack of data on instrument reliability, corrections for measuring error were not possible. However, sampling error was corrected for.

An average correlation of .162 ($SD = .084$) was obtained for the relationship between income and environmental behavior. The small magnitude of this relationship indicates a weak relationship between income and responsible environmental behavior. Individuals with higher incomes appeared to be only slightly more likely to have reported engaging in responsible environmental behaviors than did lower income individuals.

Meta-analysis of the eleven studies coded with findings on the relationship between educational level and environmental behavior resulted in an average correlation coefficient of .185 ($SD = .122$) which indicated that more highly educated individuals were slightly more likely to have reported engaging in responsible environmental behaviors than were less educated persons. However, the size of the average correlation coefficient relative to the corrected standard deviation indicated the uncertainty of the relationship, i.e., even though the corrected correlation coefficient is positive, the directionality of the relationship is questionable (Hunter et al. p. 58).

Meta-analysis of the ten studies which reported findings on the relationship between age and environmental behavior resulted in an average correlation coefficient of $-.151$ ($SD = .200$). This indicated that younger individuals were slightly more likely to have reported engaging in responsible environmental behaviors than were older individuals. However, since the standard

deviation was larger than the correlation coefficient itself, it appears that the age-environmental behavior relationship is tenuous.

Only four studies were coded which addressed the relationship between gender and responsible environmental behavior. Meta-analysis of these studies resulted in an average correlation coefficient of only .075 ($SD = .084$). As was the case with the age-behavior relationship, the standard deviation was larger than the correlation itself. This finding, coupled with the very small correlation coefficient indicated that there appears to be no relationship between gender and responsible environmental behavior based on the studies coded.

Meta-analysis of Experimental Studies

This category of studies involved the use of strategies which attempted to bring about responsible environmental behavior either through classroom approaches or through behavioral intervention strategies.

It was not possible to meta-analyze the results of those experimental studies which fell under the heading of classroom approaches due to the diversity and small number of these studies. However, narrative integration of the findings of these studies revealed that classroom strategies which included emphasis on a combination of the following factors were successful in increasing the incidence of environmental behavior: knowledge of environmental issues, discussions of alternative solutions to environmental problems, the development of issue investigation skills, environmental problem-solving skills, values discussions, and action-taking skills (Asch and Shore, 1975; Ramsey 1979; Klingler 1980). In addition, it appeared that programs which consisted of short-term exposures (e.g., one day) were ineffective in encouraging the development of responsible environmental behavior (McCutcheon 1981; Partian 1979).

Behavioral intervention strategies consisted of the employment of some type of behavior modification technique aimed at increasing the incidence of a particular target behavior. Ninety outcomes were coded which dealt with this category of study. The majority of the behaviors targeted dealt with energy consumption and littering. These studies were further broken down according to the type of behavior modification strategy employed (i.e., the offering of appeals, information, incentives, and feedback). Meta-analysis of these categories revealed that overall, behavioral intervention strategies were effective in increasing the incidence of the target behaviors (see Table 2).

Formulation of an Environmental Behavior Model

The prediction of responsible environmental behavior is not a simple process. It appears to involve a number of variables, none of which are likely to operate without

TABLE 2. Summary of Meta-analysis Findings for Experimental Studies

Variable	Corrected correlation coefficient	Corrected standard deviation	Number of values based on ^a
Incentives	.690	.245	47
Appeals	.707	.210	16
Information	.472	.289	8
Feedback	.278	.106	13

^a Several studies reported data on more than one variable.

interacting with others. The development of a model becomes a difficult task when it is considered that the majority of the studies reported in the literature failed to measure interactions among the variables studied.

The model proposed here is based upon the meta-analyses results reported in this paper and on additional data summarized in the original research (Hines 1984). Those variables included in the model are proposed to be related to behavior in the following fashion (see Figure 1).

An individual who expresses an intention to take action will be more likely to engage in the action than will an individual who expresses no such intention. However, on the basis of this research, it appears that intention to act is merely an artifact of a number of other variables acting in combination (e.g., cognitive knowledge, cognitive skills, and personality factors). Before an individual can intentionally act on a particular environmental problem, that individual must be cognizant of the existence of the problem. Thus, knowledge of the problem appears to be a prerequisite to action. However, an individual must also possess knowledge of those courses of action which are available and which will be most effective in a given situation. Indeed, experimental studies (which were not meta-analyzed) reported by Asch and Shore (1975), by Ramsey (1979), and by Klingler (1980) all provided support for inclusion of knowledge of action strategies in the model. A critical component of these programs was the development of knowledge of appropriate actions which could be taken to help alleviate a number of environmental problems. To indicate the importance of and the distinction between these two categories of knowledge, separate components for both knowledge of environmental issues and knowledge of how to act on these issues were included in the environmental behavior model.

Another critical component which appears to influence whether an individual converts this knowledge into action is skill in appropriately applying this knowledge to a given problem. This factor was included as a component of the model despite the fact that a skill variable was not one of the categories which were meta-

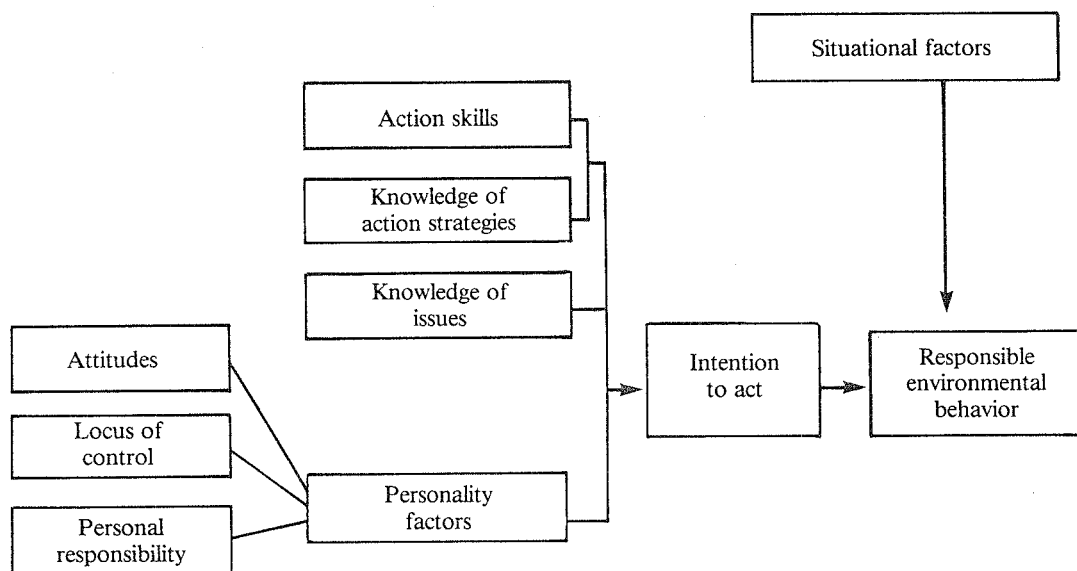


FIGURE 1. The Proposed Model of Responsible Environmental Behavior

analyzed in this study. The erroneous assumption is often made that skills evolve naturally from knowledge. However, the Ramsey (1979) and Klingler (1980) studies provide strong evidence that this is likely not the case. In these studies it was found that treatments employing both knowledge and cognitive skill components resulted in significant increases in the numbers of actions reported as compared to those programs which employed only cognitive knowledge components. Thus it appears that skill in the application of action strategies to issues, combined with the appropriate knowledge, endow individuals with the abilities to take action.

Abilities alone are not sufficient to lead to action. In addition, an individual must possess a desire to act. One's desire to act appears to be affected by a host of personality factors. These include locus of control, attitudes, and personal responsibility. Thus, an individual with an internal locus of control, positive attitudes toward the environment and toward taking action, and with a sense of obligation toward the environment will likely develop a desire to take action. If the requisite abilities to act are also present, action will likely follow. If these abilities are absent, action will not be likely to follow.

The pathway discussed thus far indicates those factors which appear to be most strongly associated with responsible environmental behavior and their suspected mode of operation. One remaining category exists

which can interrupt this pathway to action—these are situational factors. Situational factors, such as economic constraints, social pressures and opportunities to choose different actions, may enter the picture and serve to either counteract or to strengthen the variables in the model. For example, if an individual has the cognitive ability, desire, and opportunity to help stop pollution by contributing to a local toxic waste fund, but simply cannot afford to do so, that person will not engage in the environmental action and, in this instance, the model's main pathway will not be followed.

Situational factors may not only decrease, but may also increase the incidence of responsible environmental behaviors. For instance, a person may curb energy consumption only to save money and to collect the incentives offered in association with reduced consumption. While this person obviously possesses the knowledge and abilities to conserve, his actions have likely not stemmed from a deep-seated desire to conserve fossil fuels, but rather from personal and financial bases. Thus, in situations in which individuals do not possess those personality characteristics which would lead to the development of a desire to help alleviate environmental problems, these individuals may be enticed into behaving responsibly toward the environment by the application of behavioral intervention strategies.

The complexity of the environmental behavior model and the operation of ever-changing situational factors

illustrate the uncertainty involved in the prediction of environmental behavior. However, the model indicates several areas which are amenable to change by the efforts of environmental educators. The knowledge and skill components, and perhaps the personality components of the model, may be affected through the efforts of environmental educators. Approaches which address both affective and cognitive experiences and which provide individuals with opportunities to develop and to practice those skills necessary to lead to environmental action must be developed and implemented in our school systems. The knowledge and skill components can be addressed via issue identification, issue investigation, and action-taking approaches.

The personality components of the model, however, are not as readily influenced through educational efforts. Definitive research concerning those factors which lead to the development of an internal locus of control, positive attitudes toward the environment and toward action-taking, and a sense of responsibility are needed to direct the efforts of environmental educators.

It is not known at what point a person will forego economic and other personal benefits to do what preserves the integrity and stability of the environment. While the pathway represented in the model by knowledge, skills, and personality factors is the more desirable pathway by which to encourage environmentally responsible behavior, it may be more efficacious, in the case of certain environmental problems, to manipulate situational factors in order to produce the desired behavior changes.

It has long been known that the prediction of behavior is an extremely complex process which is based on a multitude of factors. The findings of this meta-analysis and the subsequent development of an environmental behavior model serve to narrow the focus of the environmental behavior picture by determining those factors which appear to be most strongly associated with responsible environmental behavior. However, 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 in the environmental behavior picture, rather than continuing to isolate individual components from those variables with which they likely interact.

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