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Abstract

A connection to nature index was developed and tested to measure children's affective attitude toward the natural environment. The index was employed through a survey that investigates students' attitude toward Lagoon Quest, a mandatory environmental education program for all fourth-grade, public school students in Brevard County, Florida. Factor analyses were conducted to explore and confirm different factors in the connection to nature index. A path analysis was conducted to examine the association among variables. The results suggest four dimensions in the children's connection to nature index: (a) enjoyment of nature, (b) empathy for creatures, (c) sense of oneness, and (d) sense of responsibility. Children's connection to nature influences their intention to participate in nature-based activities in the future. Children's connection to nature, their previous experience in nature, their perceived family value toward nature, and their perceived control positively influenced their interest in performing environmentally friendly behaviors.

Keywords

connection, nature, attitude, affective, children

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Introduction

Human behavior is implicated in a number of environmental problems. In addition to solutions that can be offered by experts and policy makers, citizens' conservation actions are needed. Understanding the variables that influence proenvironmental behaviors may help program developers promote proenvironmental actions. Numerous models and studies suggest that attitude is a vital element in behavior (Ajzen, 1985; Stern & Deitz, 1994). Millar and Tesser (1986) suggested that there are two components of attitudes, cognitive and affective. Cognitive components contain one's beliefs about certain objects, whereas affective components contain feelings related to that object. Early studies of proenvironmental behaviors focused on cognitively driven behaviors. Conventional thinking was that increasing knowledge can strengthen attitudes in addition to change behaviors; however, Hungerford and Volk (1990) have suggested that increasing environmental knowledge does not directly contribute to proenvironmental attitudes and, ultimately, behaviors. In recent years, studies have focused on the affective aspects of adults' environmental attitudes and behaviors (Allen & Ferrand, 1999; Geller, 1995; Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004). Understanding young people's environmental attitudes is important because in time they will face environmental problems and will need to have the skills and disposition to work on resolutions for these problems (Bradley, Waliczek, & Zajicek, 1999).

Measuring children's affective attitudes, however, requires a different tool than those previously developed for adults. However, it must be reliable and valid, simple enough for young people to read and understand. Such an index could help us explore the affective aspect of children's attitudes and link them with environmental behaviors. The purpose of this study is to develop a children's connection to nature index and examine how this affective element influences children's proenvironmental choices.

Brevard Public Schools, Florida, has invested in an environmental education program for fourth graders and was interested in conducting an evaluation to explore how the program is perceived and how it affects students. Brevard Zoo is the lead partner in the environmental education program Lagoon Quest and was interested in developing a tool that could indicate or predict long-term environmental interest and the development of a conservation ethic among children. The opportunity of the evaluation enabled us to develop such a tool. This article reviews the literature about affective attitudes toward nature, explores the attitudinal factors that may be relevant to proenvironmental behaviors, explains the development and validation of a

connection to nature index for children, and examines the predictive power of this index.

Literature Review

This study proposed a model to test the factors that were thought to be predictors of proenvironmental behaviors, including affective factors that influence people's attitudes toward nature, relevant nature experiences, self-efficacy, and values. The following sections introduce these associated variables.

Affective Factors That Influence People's Attitudes Toward Nature

The role of attitudes in environmental behaviors remains elusive. Several studies subdivided attitudes into discreet elements and suggested that affective factors, such as emotional affinity, empathy, and sympathy, are essential elements in predicting proenvironmental behaviors (Allen & Ferrand, 1999; Geller, 1995; Kals et al., 1999; Mayer & Frantz, 2004). For example, Kals et al. (1999) investigated the influence of emotional motivations on nature-protective behavior. The results suggested that for both the active members of environmental organizations and the general public, emotional affinity toward nature, indignation, and interest in participating in nature experiences predicted 47% of the variance in behaviors. Similarly, Mayer and Frantz (2004) suggested that their Connectedness to Nature Scale (CNS), which measures adults' affective and experiential connection to nature, can be used to predict environmental behaviors.

In addition to the effects of attitudes on environmental behaviors, Geller (1995) suggested that individuals had to "actively care" about others in a large community to produce the altruistic behaviors necessary for environmental protection. In an expansion of this work, Allen and Ferrand (1999) examined one affective influence, sympathy, on proenvironmental behaviors. They suggested that sympathy was a measure for the psychological and motivational aspects of actively caring. Allen and Ferrand assessed these factors among 121 undergraduates in a state liberal arts college in New York. The most significant finding of their research was that sympathy mediated the relationship between environmentally friendly behaviors and all other factors such as self-esteem and personal control. Their results suggested that sympathy might be the alternative measure of actively caring and is a vital component of proenvironmental behaviors.

Another relevant affective factor is empathy. Schultz (2000) used perspective taking to examine people's empathic response to nature and concluded that taking the perspective of animals being harmed generated feelings of empathy, the "other-oriented feelings of concern about the perceived welfare of another" (p. 402). This suggests that seeing or feeling other creatures being harmed may increase empathy and activate people's motivation to protect them.

Schultz (2002) also suggested that a sense of inclusion with nature is associated with understanding how an individual identifies his or her place in nature, the value that he or she places on nature, and how he or she can affect nature. He suggested that connectedness to nature, caring for nature, and commitment to protect nature are core components of inclusion with nature. If a person experiences inclusion with nature, he or she should care about nature and be committed to protecting it. However, if an individual experiences exclusion from nature, that person will protect himself or herself over nature.

Clayton (2003) developed an Environmental Identity Scale to assess how the natural environment plays a role in a person's self-definition. She proposed that

an environmental identity is one part of the way in which people form their self-concept: a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachments, and/or similarity, that affects the ways in which we perceive and act toward the world; a belief that the environment is important to us and an important part of who we are. (p. 45)

The scale is composed of 24 items that measure concepts such as spending time in nature, enjoyment of nature-relevant activities, learning about nature, responsibility, and sense of oneness.

Mayer and Frantz (2004) followed Aldo Leopold's vision of a land ethic that defined human beings as part of the natural environment, developing a single-factor measure called the Connectedness to Nature Scale. The scale emphasizes relationships between humans and their nonhuman counterparts, their connection to the natural world, and their sense of community. Mayer and Frantz defined connectedness to nature as "an individual's affective, experiential connection to nature." (p. 504)

The above mentioned studies use different instruments to measure connection to nature among adults, but several common elements in these instruments can be identified: sympathy, empathy or caring for nature or its creatures, enjoyment of nature, interest in nature, experience with nature, the individual's

connection with the world, sense of community, fear of nature, and commitment to protect nature. Although some of the elements are similar, researchers define them slightly differently. Moreover, when operationalizing these concepts for children, some of the fine distinctions between them may be lost. There is no existing instrument that includes all of these factors that can appropriately measure children's perception of their connection to nature.

These studies indicate that a variety of affective elements appear to be linked to environmental behaviors. We selected four distinctly different elements that appear to reflect the core attributes of the previously researched concepts for the index tested in this study: (a) enjoyment of nature, (b) empathy for its creatures, (c) sense of oneness, and (d) sense of responsibility. Variables that are not part of connection to nature—such as nature-based experiences, values, and self-efficacy—are also thought to be important components in stimulating proenvironmental behaviors and are described in later section.

Nature-Relevant Experience

Studies of children. Many children in urban environments do not have access to nature. Many parents prohibit their children from exploring wild natural areas because parents and children have little familiarity with nature, parents have concerns about children's safety, and children experience academic pressures and other demands on their time (Louv, 2005). This reduced contact with nature may influence children's development. Empirical research has demonstrated that experiences with nature have a positive influence on children. Davis, Rea, and Waite (2006) suggested that spending time outdoors may help children develop positive values about nature, whereas Wells (2000) suggested that children whose home environments improved the most with regard to greenness after relocation were more likely to have higher levels of cognitive functioning after relocation. Wells and Evans (2003) indicated that natural environments can increase children's psychological well-being. Children whose homes had more nearby nature coped better with life stress than those whose homes lacked nearby natural areas.

Studies of adults. Experience in the natural environment may increase the likelihood that people will engage in responsible environmental behaviors, especially if the nature experiences begin at an early age (Chawla, 2007; Nord, Luloff, & Bridger, 1998; Theodori, Luloff, & Willits, 1998; Wells & Lekies, 2006). Wells and Lekies (2006) used a retrospective study to investigate the association between people's childhood nature experience and their current attitudes and behaviors toward the environment. Two thousand American adults between the ages of 18 and 90 were surveyed. The survey enabled people

to report their natural experiences before age 11. The results suggest that participating in wild nature activities (hiking, camping, and hunting) and domestic nature activities (tending flowers and gardening) in childhood related to proenvironmental attitudes and behaviors in adulthood. Indeed, environmental attitude served as a mediator between nature experience and environmental behaviors. People who had more nature experiences during their childhood are more likely to have proenvironmental attitudes, which may further influence their proenvironmental behaviors. Their study suggested that experience in nature before age 11 is associated with the development of influential positive adult attitudes, but nature experiences at other ages may also be influential to people's proenvironmental behaviors.

Wells and Lekies' (2006) findings strengthened the hypothesis that significant life experiences help create environmental professionals (Chawla, 1998, 2007; Tanner, 1980). Tanner (1980) asked 45 participants to provide an autobiographical statement that specified the influential factors that led them to their conservation career. A majority of participants indicated that childhood natural experiences were very influential to their environmentalism. Similarly, Peterson's (1982) interviews with 22 environmental educators suggested that outdoors, family, and love of nature were important contributors to their career choices. Other studies have found that spending a lot of time outdoors, positive experience in natural environments, influential family members or other role models, and good memories in natural areas during childhood or adolescence influence people's interest in the environment in addition to work for its protection (Chawla, 1998, 2007; Chawla & Cushing, 2007). Taken together, these studies suggest that experience in nature during youth may stimulate people's interest in proenvironmental attitudes and practices. The survey associated with the index tested in this study included questions about current nature experiences.

Self-Efficacy

Besides affective attitudes and experiences in nature, there are other essential elements that influence proenvironmental behaviors. According to Ajzen's (1985) theory of planned behavior, perceived behavioral control is a person's perception of his or her ability to perform a particular behavior. Perceived behavioral control is usually measured by asking people how easy or difficult they believe it is to perform certain behaviors. Ajzen suggested that perceived behavioral control is an important predictor of a behavioral achievement. A similar construct, self-efficacy, was proposed by Bandura (1982). He suggested

that perceived self-efficacy refers to “judgments of how well one can execute courses of actions required to deal with prospective situations” (p. 122). From a practical perspective, when writing items for 9-year-old children, it may be challenging to distinguish between the two constructs. Youngsters have little control over decision making but may have a sense of their future capabilities. Thus, our survey asked two questions about their perceived self-efficacy toward future environmental actions.

Values

Stern’s (2000) value-belief-norm model integrated value theory, beliefs about the environment (new environmental paradigm), and norm-activation theory through a causal chain that helps to explain behaviors. A person’s value orientation comes from many sources such as his or her family, education, and cultural background. The value orientation influences people’s ecological worldview, and their worldview further influences the way they act.

Chawla (2007) reported that environmentalists frequently mentioned their childhood role models such as their parents or teachers who allowed them to explore nature freely, engaged in nature experiences with them, or even taught them about nature. She also suggested that childhood interactions with role models who showed the values of nature can be a motivator for environmental professionals to engage in proenvironmental actions. Because youth may be too young to have formed their own values, and because mentors’ values may be important, this study explored whether family members’ values related to the natural environment may be a predictor of children’s interests in environmental friendly practices.

Research Questions

The primary purpose of this study is to develop a children’s connection to nature index using the elements that previous studies have identified. The validity of the index will be enhanced if scores on the index reflect factors (e.g., previous experience in nature, family value toward nature, nature near the home, and knowledge of the environment) that the literature suggests help develop affective attitudes toward nature. To assess the predictive value of the index, connection to nature should be associated with children’s preference for nature-based activities and their interests in participating in environmental behaviors in the future. To test these associations, four specific questions are listed below.

Research Question 1: How do children perceive connection to nature?

Research Question 2: Do family values toward nature, previous experiences in nature, nature near the home, and knowledge about the environment correlate with scores on connection to nature?

Research Question 3: Does connection to nature predict children's interest in participating in nature-based activities?

Research Question 4: Does connection to nature predict children's interest in environmentally friendly practices?

Instrumental Development

Five 4th-grade classes in Brevard County were visited in fall 2005 and spring 2006 as a first step in developing the tool to measure children's connection to nature. Student interviews were conducted to better understand fourth-graders' experiences with and their attitude toward the natural environment, their nonschool experiences in nature, and their interest in environmentally friendly practices. To alleviate students' stress, small group interviews were conducted in the back of their classrooms. Four to five students were interviewed at a time, and about 80 students were included in 15 group interviews. Questions such as "When was the last time you went to a natural place? Where did you go? What did you do there? How did you feel?" and "What are you interested in learning about the environment?" were asked during the interviews. Some words were tested during the interview to check appropriate vocabulary for fourth graders. The information derived from the interviews was used to develop the connection to nature index and other questions in a survey.

Items in the connection to nature index reflect the following constructs: enjoyment of nature, empathy for its creatures, sense of oneness, and sense of responsibility. A total of 22 items were pilot tested in two 4th-grade classes in Brevard County. A 5-point response format (1 = *strongly disagree* and 5 = *strongly agree*) was used. The items were selected to measure children's attitudes toward the natural environment. The reliability score from the pilot test was a Cronbach's alpha of .76. Two items with similar meaning and four items with negative interitem correlation were deleted. After the six items were dropped, the reliability of the index increased considerably (Cronbach's $\alpha = 0.87$).

A survey was constructed to include this connection to nature index and a number of other variables that could affect affective attitudes and proenvironmental practices. A total of 15 items were developed to measure self-reported environmentally friendly practices, 2 item were used to measure self-efficacy,

4 items measured children's interest in participating in nature-based activities in the future (e.g., fishing), 6 items measured children's previous experience in nature, and 1 item was used to measure children's perception of nature near their home. Instead of asking about children's values toward nature, children's perception of their family's values toward nature was measured because 9-year-old children's current values toward nature could be strongly influenced by their families. Knowledge was measured with a test that was developed to evaluate learning from a school environmental education program and modified after student interviews. The final version of the knowledge test consisted of 18 multiple-choice questions.

Data Collection

Data collection began in fall 2006 and continued through spring 2007 as a part of the Brevard Public Schools' Lagoon Quest program. The study population comprised about 5,500 fourth-grade students. Because all students were included and no personal information was collected from the students, the school district assumed responsibility for confidentiality. Parent permission was not required because the survey was a required part of the school program. Because attitudes change slowly, it was not reasonable to expect significant differences between a pre- and postmeasure of connection to nature, so this information was collected with a student attitude survey after the teachers completed the entire Lagoon Quest unit. The survey was conducted in the schools' computer labs, using the school system's website. For schools who did not have computer access, the teachers distributed paper-based surveys to their students.

Data Analysis

Data analysis started in May 2007 with the Statistical Package for the Social Sciences (SPSS) Version 11.0. Missing data were replaced by the series mean for each variable, and the relationships were tested at the significance level of $p < .05$. Exploratory factor analysis was conducted to extract different factors in the connection to nature index. To verify children's perception of connection to nature, a confirmatory factor analysis was conducted using LISREL Version 8.7.

A correlation analysis was conducted to analyze the associations between connection to nature and three variables that could influence children's attitudes toward nature: (a) experience, (b) nature near the home, and (c) family values toward nature. A path analysis was conducted with LISREL 8.7 to

determine whether connection to nature predicts children's interest in participating in nature-based activities. Finally, a model to predict children's environmentally friendly behavior was tested and reconstructed using LISREL 8.7.

Results

Research Question 1

A total of 1,432 students responded to the survey, out of them, 26% were the fourth graders. The nonrespondents were randomly spread across geographical locations within Brevard County and across the rank of the schools (when ranked by student achievement scores). A number of reminders were sent to improve the response rate, but it was not possible to contact nonrespondents due to confidentiality. The distribution of responses, however, suggests a nonresponse bias is unlikely. Although the index was designed to measure enjoyment of nature, empathy for creatures, individual's connection with the world, sense of community, and commitment to protect nature, the exploratory factor analysis suggests a different set of factors. Exploratory factor analysis indicates three major factors in the connection to nature index: personal enjoyment of nature (six items), human-nature interdependence (six items), and concern for living creatures (four items). Personal enjoyment of nature explained 35% of the variance in scores on the index, whereas human-nature interdependence and concern for living creatures each explained 7% and 8%, respectively, of the variance. All three factors together account for 50% of the variance.

To validate the factors, confirmatory factor analyses were conducted to test two possible models for the connection to nature index. To test the three-factor model, the items were loaded based on the values derived from the exploratory factor analysis ($\chi^2 = 228.01$, $df = 97$, root mean square error of approximation [RMSEA] = 0.04, expected cross-validation index [ECVI] = 0.35, goodness of fit index [GFI] = 0.93, and adjusted goodness of fit index [AGFI] = 0.90). A four-factor model was also tested using the 16 items categorized into four factors: enjoyment of nature, empathy, oneness, and responsibility ($\chi^2 = 233.53$, $df = 97$, RMSEA = 0.04, ECVI = 0.35, GFI = 0.93, and AGFI = 0.90). The dimensions that were derived from the four-factor model make more sense to describe the construct. One item has multiple paths to two factors that suggest that this item could not be explained by a single factor. The factor loadings are listed in Table 1.

Table 1. Confirmatory Factor Analysis

Enjoyment of nature	Factor loadings
I like to hear different sounds in nature	.79
I like to see wild flowers in nature	.73
When I feel sad, I like to go outside and enjoy nature	.73
Being in the natural environment makes me feel peaceful	.81
I like to garden	.63
Collecting rocks and shells is fun	.63
Being outdoors makes me happy ^a	.36
Empathy for creatures	
I feel sad when wild animals are hurt	.75
I like to see wild animals living in a clean environment	.72
I enjoy touching animals and plants	.63
Taking care of animals is important to me	.78
Sense of oneness	
Humans are part of the natural world	.65
People cannot live without plants and animals	.59
Being outdoors makes me happy ^a	.34
Sense of responsibility	
My actions will make the natural world different	.70
Picking up trash on the ground can help the environment	.67
People do not have the right to change the natural environment	.51

a. Items had multiple paths.

Research Question 2

To ensure that the connection to nature index is a valid measure, we explored whether the scores on the index covary with variables that are suggested influences on the development of affective attitudes toward nature: knowledge of the environment, perception of family values, previous experience in nature, and nature near the home (Ajzen, 1985; Stern, 2000; Wells & Lekies, 2006).

Composite variables were created to represent all constructs. The average scores of 16 items in the connection to nature index, the average of 3 items measuring students' perception of their family's value toward nature, the average of 5 items measuring students' previous experiences in nature, and the total scores on 18 questions measuring students' knowledge about the environment were calculated.

Table 2. Correlation Between Connection to Nature and Other Factors

Variables	Family value toward nature	Previous experience in nature	Knowledge of environment	Nature near home
Connection to nature	0.43**	0.21**	0.13**	0.08*

* $p < .05$. ** $p < .01$.

There was a significant positive correlation between scores on the connection to nature index and each of the four variables: (a) students' perceived family values toward nature ($r = .43, p < .01$), (b) students' previous experience in nature ($r = .21, p < .01$), (c) students' knowledge about the environment ($r = .13, p < .01$), and (d) students' near-home natural environment ($r = .08, p < .05$; Table 2). This suggests that the connection to nature index is indeed measuring an important affective attitude toward nature.

Research Question 3

To understand the predictive path between interest in participating in nature-based activities and other independent variables (i.e., family values toward nature, previous experience in nature, nature near the home, knowledge of environment, and connection to nature), a path analysis was conducted. The results support the proposed model in Figure 1 ($\chi^2 = 0.86, df = 1, p = .64$, GFI = 1, AGFI = 1, root mean square residual [RMSR] = 0). The strongest factor in predicting students' interest in participating in nature-based activities was connection to nature ($\beta = .38, p < .05$). Students' previous experience in nature ($\beta = .18, p < .05$) and their perceived family values toward nature ($\beta = .12, p < .05$) both had direct influence on their interest in participating in nature-based activities and an indirect influence through connection to nature. Nature near the home and knowledge about the environment had indirect influences on students' interest in participating in nature-based activities. Through their contributions to connection to nature, 27% of the variance in student's interest in participating in nature-based activities was explained in this model.

Research Question 4

To explore the factors that can predict interest in environmentally friendly practices, an additional path analysis was conducted to test the associations

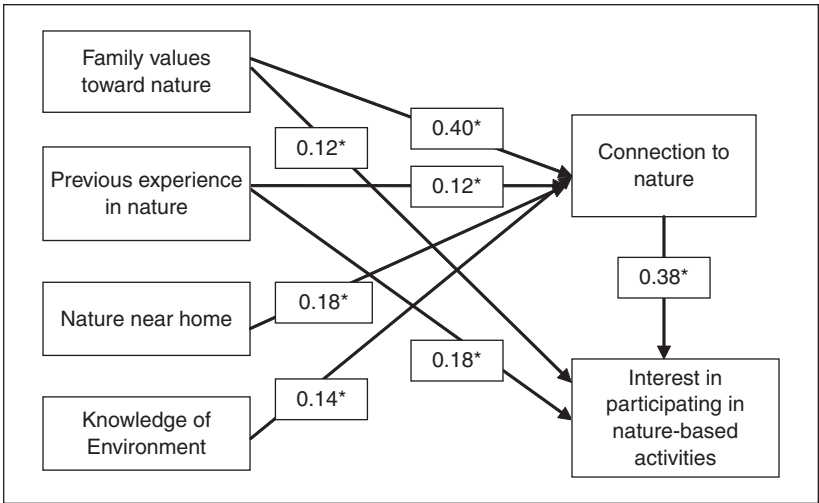


Figure 1. The factors that predict students' interest in participating in nature-based activities
* $p < .05$.

among predictor and outcome variables. The final model suggests that students' connection to nature ($\beta = .30, p < .05$), their perceived family values toward nature ($\beta = .30, p < .05$), their self-efficacy ($\beta = .28, p < .05$), and their previous experience in nature ($\beta = .11, p < .05$) all have direct influence on their interest in environmentally friendly practices. In addition, students' knowledge about the environment ($\beta = .12, p < .05$) and their near-home nature ($\beta = .11, p < .05$) indirectly influence their interest in environmentally friendly practices. A total of 54% of the variance in students' interest in environmentally friendly practices is explained in this model ($\chi^2 = 4.49, df = 2, p = .11, GFI = 1, AGFI = 0.98, RMSR = 0.038$; Figure 2).

Discussion

This study suggests that children's perception of connection to nature consists of enjoyment of nature, empathy for creatures, sense of oneness, and sense of responsibility. Some items can be explained by multiple factors because these factors are highly correlated or because vocabulary appropriate for children cannot differentiate nuances distinctly. This index may be best suited to a narrow age range (from 8-10 years) because vocabulary and interests will change with age.

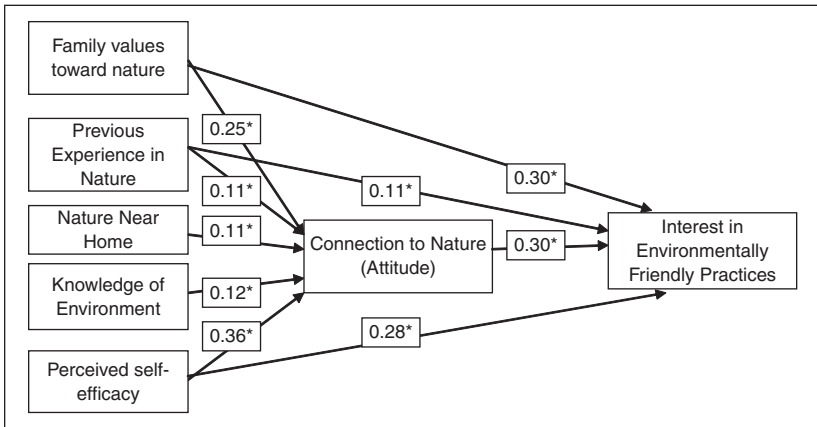


Figure 2. The factors that predict students' interests in environmentally friendly practices

* $p < .05$.

A natural environment near children's homes has been thought to influence their psychological well-being (Wells, 2000), but previous research did not investigate the influence of a natural environment near children's homes on affective attitudes toward nature. The results of this study demonstrate a significant correlation between children's connection to nature and nature near their homes. One possible explanation for the relationship is that children who can easily access and play in nature develop more robust connections with nature. Another explanation is that children's parents' decide where to live, which may reflect their attitudes toward nature, which in turn affects their children's attitudes toward nature.

Moreover, connection to nature is correlated to other variables that foster positive affective attitudes, such as family values, previous experiences in nature, and knowledge of the environment. These correlations are supported by previous studies about affective attitudes toward the environment or nature (Kals et al., 1999).

This study suggests six findings regarding children's connection to nature (affective attitude toward nature), their interest in participating in nature-based activities, and their interest in environmentally friendly practices. First, connection to nature was the strongest independent variable that influenced children's interest in participating in nature-based activities, accounting for about 22% of the variance. Thus, children who enjoy nature, have empathy for other living creatures, have a sense of oneness, and feel responsibility for

nature are more likely to develop interest in spending more time in nature, which may in turn enhance children's physical and psychological health. This also validates previous studies that experiences in nature positively influence environmental attitudes and behavior (Chawla, 1998, 2007; Wells & Lekies, 2006). Second, family values toward nature are a strong predictor of children's connection to nature and their interest in environmentally friendly practices. This suggests that young children's attitudes and behaviors are highly influenced by their family members, who transmit values about nature to them (Kals et al., 1999).

Third, the results suggest that connection to nature is a strong predictor of children's interests in environmentally friendly practices, accounting for 35% of the variance. This finding is consistent with Mayer and Frantz's (2004) work suggesting that connectedness to nature is a significant predictor of ecological behaviors. Fourth, previous experience in nature increases children's connection to nature, which suggests that spending more time in nature helps children develop a stronger connection to nature. Fifth, self-efficacy was also a predictor of children's interest in environmentally friendly practices, which is consistent with Bandura's (1982) theory that a person who believes that he or she is competent for a certain action is more likely to perform that action. This implies that providing environmental education opportunities that increase children's knowledge and skills for solving environmental problems may help promote proenvironmental actions (Hungerford & Volk, 1990).

Sixth, an interesting finding of this research is that self-efficacy was also a strong predictor of connection to nature. This suggests that the development of connection to nature is influenced by children's sense that they are able to help the environment. Providing hands-on environmental education to children may be a unique opportunity to enhance children's affective attitudes toward nature and their interest in protecting nature.

Limitations

This study has several contextual and design limitations that may affect the results. The original development of the connection to nature index included the elements suggested by previous studies, but some elements such as fear of nature were excluded after the pilot test because children were unable to respond consistently to those items. This may be because certain words generate responses that are inconsistent with other environmental attitudes (snakes, bats, and spiders). Further research may explore the effects of fear on children's affective attitudes. Also, the connection to nature index was a unidirectional index, which asked children about the level of their connection with

nature, but we did not ask about the level of their lack of connection with nature. Future studies may explore the relationship between children's connection and lack of connection to nature.

The data were collected through a computer website and through paper copies. The confusion around ordering a paper version may have reduced the response rate; using computers may have affected accuracy as participants were not clear about how to correct errors. Moreover, the attitude survey was a cross-sectional design. The data were collected after the Lagoon Quest was implemented because some elements in the survey required program experiences to be answered. Therefore, the results allow us to test the predictive ability of the connection to nature index but prohibit us from examining the actual program effects. Also, students from different schools completed the program at different times, making it unlikely that one event would influence all respondents but more likely that an event might influence some respondents.

Implications

This study developed and tested a connection to nature index for children, which is composed of four major elements: enjoyment of nature, empathy for its creatures, sense of oneness, and sense of responsibility. The findings show that nature near the home, knowledge about the environment, and previous experience in nature were positively associated with children's connection to nature. These findings suggested that learning, understanding, experiencing nature, and living close to nature could positively influence the development of children's affective attitude toward nature. Moreover, family values toward nature are a strong factor that can influence children's connection to nature. In circumstances where we cannot change children's near-home environment, nonformal educators could provide more opportunities such as environmental education or outdoor education programs for children and their families to learn about and experience nature. This should also increase their interest in participating in nature-based activities as well as their development of proenvironmental actions. We suggest that city planners, developers, and schools should include easy access to natural areas in their plans, not only to promote healthy communities for children and their families but also to provide opportunities for children to develop a connection to nature.

The connection to nature index is a promising tool to predict children's interest in participating in nature-based activities and performing environmentally friendly practices in the future. For environmental educators who are interested in measuring children's affective attitudes toward nature or

predicting their interest in proenvironmental actions, this index can be a useful instrument. Researchers could explore how children develop a connection to nature, how it changes over time, how it influences children's interest in environmentally friendly actions, and how children develop long-term conservation ethics. A longitudinal study is needed to provide the most beneficial data.

Declaration of Conflicting Interests

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