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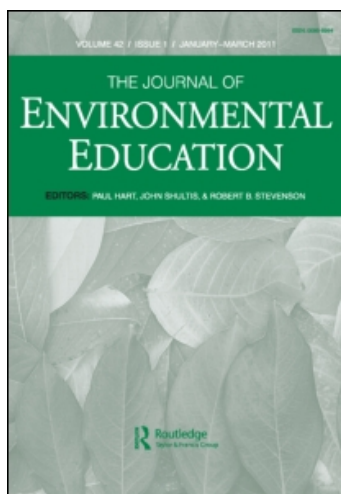
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# The 2-MEV Scale in the United States: A Measure of Children’s Environmental Attitudes Based on the Theory of Ecological Attitude

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The Environmental (2-MEV) Scale questionnaire was developed in Europe to measure adolescents’ attitudes and gauge the effectiveness of educational programs. It also formed the basis for the Theory of Ecological Attitudes. In the present four-year study, the 2-MEV Scale was modified for use with 9–12-year-old children in the United States. Initial results led to wording revisions and elimination of some items. Confirmatory Factor Analyses indicated that the remaining items fit the Theory of Ecological Attitude well. The Revised 2-MEV Scale was able to measure statistically significant changes in the environmental attitudes of participants in earth education programs but not in a control group. The Revised ENV Scale can be used to evaluate programs and to investigate the relationship between environmental attitudes and other variables.

**Keywords** *earth education, environmental attitudes, Theory of Ecological Attitude*

## INTRODUCTION

For many years, educational programs have provided the foundations of environmental awareness and concern about human impact in an effort to shape the development of environmental behavior (Bogner, 1998a, 2004; Gigliotti, 1990; Hungerford & Volk, 1990). While many of these programs aim to familiarize their participants with a plethora of environmental issues and problem-solving skills, others focus their efforts on the attitudinal/emotional component since “When emotional principles are integrated, outdoor nature experience is generally considered . . . to promote environmental action” (Bogner, 1998a, p. 18). Empirical studies support this argument, providing evidence that addressing knowledge alone is not enough to lead to changes in behavior (Borden & Schettino, 1979; Bradley, Waliczek, & Zajicek, 1997; Gigliotti, 1990; Johnson & Manoli, 2008). In addition, some researchers have argued that the most important determinant of behavior is attitude (Eagles & Demare, 1999; Kraus, 1995; Lazarus, Kanner, & Folkman, 1980; Newhouse, 1990).

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Much of the research on the attitude-behavior relationship, however, has been inconclusive. Some researchers have argued for decades that the relationship between attitudes and behavior is weak or nonexistent (Borden & Schettino, 1979; Millar & Tesser, 1989). The empirical evidence provided in support of that assertion, though, has been questioned (Dunlap & Jones, 2002; Gray, 1985; Leeming, Dwyer, Porter, & Cobern, 1993). A number of other researchers support the idea of a strong relationship between attitude and behavior (Hines, Hungerford, & Tomera, 1987; Manoli, Johnson, & Dunlap, 2007; Pooley & O'Connor, 2000).

While there is no consensus on the link between attitude and behavior, there is substantial evidence that environmental attitudes play an important role. It is also clear that more research is needed to better understand the development of attitudes, the effects of education on their development, and the relationships between attitudes and behavior. In order to conduct such research, good measurement tools for environmental attitudes are needed.

## REVIEW OF THE LITERATURE

Past research often found a weak correlation between attitude and behavior, leading many investigators to claim there is no causal relationship (Wicker, 1969). However, a review of 109 studies by Ajzen and Fishbein (1977) concluded that the disenchantment with the attitude concept was unwarranted. Rajecki (1982) provided four reasons for the discrepancy between attitude and behavior: temporal instability, direct versus indirect experience, normative influence, and attitude-behavior measurement correspondence. Rokeach and Kliejunas (1972) suggested that attitude-toward-object and attitude-toward-situation are both good determinants of behavior. In addition, they also found that verbally expressed attitude can successfully predict overt behavior. Ajzen and Fishbein (1977) provided their own four measures that make up attitudes: a target, an action, a temporal reference, and a situational reference. They found that the closer the target and action components are, the more likely attitude will predict behavior. Thus, there is strong evidence that supports a relationship between attitude and behavior if proper measures are used for both components. Finally, a review of a number of studies on the Theory of Planned Behavior further supported the causal relationship (Ajzen, 1991), and Hines et al. (1987) in a meta-analysis of 51 studies found a moderate positive correlation between attitude and behavior. Evidence indicates that attitudes are part of a set of factors contributing to actions, thus reviving interest, especially within social psychology (Ajzen, 1991; Newhouse, 1990). Today, most researchers agree that attitudinal change does affect behavior; however, in order to detect such a relationship one must use appropriate measures.

### Measuring Environmental Attitudes

Efforts to measure environmental attitudes in particular have led to the development of many assessment instruments (Leeming, Dwyer, & Bracken, 1995). The lack of a common instrument, however, and the use of unsound methodological practices, including work with no clear theoretical framework and/or without appropriate validity analysis, has contributed to the lack of agreement on the importance of environmental attitudes (Armstrong & Impara, 1991; Bogner & Wilhelm, 1996; Evans et al., 2007; Gray, 1985; Leeming et al., 1993; Musser & Malkus, 1994; Van Liere & Dunlap, 1981). First, the widespread use of study-specific attitude measures

prevents comparisons across studies and programs (Bogner & Wiseman, 2002a). Second, in their studies, Dunlap and Jones (2002), Leeming et al. (1993), and Gray (1985) emphasized the need for measures with good psychometric properties (validity and reliability). Third, in addition to the unsound measures, many studies failed to build their efforts on a good theoretical basis, measuring environmental attitudes only at the simple first-order descriptive level (Bennet, 1974; Blaikie, 1992; Bogner & Wiseman, 2004, Johnson & Manoli, 2008).

These issues led to new efforts to develop measures of children's environmental attitude, such as the Children's Attitudes Toward the Environment Scale (CATES) (Musser & Malkus, 1994), the Children's Environmental Attitude and Knowledge Scale (CHEAKS) (Leeming et al., 1995) and the New Ecological Paradigm (NEP) Scale for Children (Manoli et al., 2007). These instruments, though, have also had issues of concern that have limited their widespread use. The CATES "has not been widely used and employs an awkward bipolar answer format" (Manoli et al., 2007, p. 5), and psychometric issues have been raised, such as poor test-retest reliability (Kim, Zeman, & Kostareva, 2007; Musser & Malkus, 1994). While the CHEAKS generally has stronger psychometric properties (Walsh-Daneshmandi & MacLachlan, 2006), it lacks a clearly formulated theoretical basis for its structure. Evans et al. (2007) raised additional concerns about many of the attempts, particularly the CATES (Musser & Diamond, 1999) and the CHEAKS (Leeming et al., 1995), to measure the environmental attitudes of children. These included concerns that items often describe actions over which children typically have no control, items that are difficult for children to understand, and reliance on written statements with forced choice responses, leading to difficulties in maintaining children's interest. The latter is of concern when using instruments with very young children. Finally, the NEP Scale for Children has also been shown to have good psychometric properties and contains items about actions within the realm of children's control and that have been tested for understanding with children, but uses a unidimensional construct, which leads to a limited ability to explain attitude and behavior (Bogner & Wiseman, 2004; Johnson & Manoli, 2008).

Developmentally appropriate measures with strong psychometric properties and clear theoretical frameworks are essential in detecting changes in environmental attitude. They can provide a basis for the evaluation, improvement, and/or further development of educational programs as well as investigations of the relationships between attitude and other variables, such as behavior (Bogner, 1998b; Bogner & Wiseman, 2006; Gowin, 1981; Hungerford & Volk, 1990; Jacobsen, 1991).

### The 2-MEV Scale and the Theory of Ecological Attitude

In the absence of a sound age-appropriate measure, and in an effort to measure European adolescents' environmental attitudes, Bogner and Wilhelm (1996) developed the Environmental Scale (2-MEV). In their first study, they used 69 items from earlier attitudinal scales in order to measure environmental concern and actual behavior toward the natural environment among 2000 10–16-year-old German students. The analysis revealed several subscales of environmental concern including attitudes, verbal commitment, and actual behavior. Extensive use of the preliminary 2-MEV Scale with students from Germany, Denmark, Switzerland, and Ireland (Bogner, 1998a, 1998b, 1999; Bogner & Wiseman, 1997a, 1997b, 1998) helped reduce the number of items to 20. Bogner and his colleagues (Bogner, 2000, 2002; Bogner, Brengelmann, & Wiseman, 2000; Bogner & Wiseman, 2002a, 2002b) continued to test this 20-item scale and its accompanying

conceptual model with other European student populations (e.g., Italian and French) looking at the effects of residential outdoor programs, age and gender differences, profiles of extreme groups, etc., and the 2-MEV Scale was finally reduced to 19 items.

The 2-MEV Scale measures two higher-order factors: Preservation of Nature, the intent to preserve the environment, and Utilization of Nature, the usage of the environment. Preservation is “a biocentric dimension that reflects conservation and protection of the environment” while Utilization is “an anthropocentric dimension that reflects the utilization of natural resources” (Wiseman & Bogner, 2003, p. 787). These two higher-order factors consist of five primary factors; Intent of Support, Care with Resources, and Enjoyment of Nature combine under the higher-order factor of Preservation, while Altering Nature and Human Dominance combine under the higher-order factor of Utilization (Bogner & Wiseman, 1999). In 2003, Wiseman and Bogner formalized the conceptual model, naming it the Theory of Ecological Attitude.

In contrast with a unidimensional construct used in most instruments, such as the NEP, the Theory of Ecological Attitudes (Wiseman & Bogner, 2003) uses a two-dimensional construct, as explained by Johnson and Manoli (2008, p. 116):

The NEP scale places respondents on a continuum from a biocentric (NEP) to an anthropocentric (DSP) worldview. In this view, an individual can either have a biocentric (pro-environmental) or an anthropocentric (anti-environmental) perspective but not both. In contrast, Bogner and Wiseman (1999) see biocentrism (preservation) and anthropocentrism (utilization) as two separate and not necessarily related components of environmental perception.

The Theory of Ecological Attitudes posits that people who have strong Preservation (biocentric) attitudes do not necessarily have weak Utilization (anthropocentric) attitudes. The theory allows individuals to be placed in one of four quadrants rather than on either end of a continuum. A high score on Preservation and a low score on Utilization might be expected of a strong environmentalist, someone with deep concern about conservation. Correspondingly, a low score on Preservation but a high score on Utilization might be expected of someone with apathy toward conservation issues and a view of nature as a source of natural resources to be used for the benefit of human development. These two quadrants are the ends of the NEP/DSP continuum. However, it certainly is conceivable that someone could have a high score on Preservation, indicating a strong desire to protect the environment, but at the same time believe that the primary purpose of the environment is to benefit humans, resulting in a high score on Utilization as well. Johnson and Manoli (2006) reported a study in which children completed both the 2-MEV and NEP, finding that those who had high Preservation and high Utilization scores on the 2-MEV were placed in the center of the NEP/DSP continuum, leading to a misinterpretation of their perceptions as noncommittal. That location on the continuum is more appropriate for those in the fourth quadrant, those with low Preservation and low Utilization scores.

On several occasions, Bogner and Wiseman (Bogner, 2004; Bogner & Wiseman, 2002a, 2004, 2006; Wiseman & Bogner, 2003) used the 2-MEV Scale in conjunction with the New Environmental Paradigm (NEP) scale (Dunlap & Van Liere, 1978, 1984) in order to investigate their relationship and as a cross-test between the two instruments. The combined instrument incorporated eight primary factors: Intent of Support, Care with Resources, Enjoyment of Nature, and Limits to Growth under Preservation of Nature, and Altering Nature, Man over Nature, Balance of Nature, and Human Dominance under Utilization of Nature. While the factor structure of both models was reconfirmed, in some occasions, the items on the NEP scale loaded on

different factors (Bogner & Wiseman, 2002a). Similarly, in the present study, the authors used a combination of the 2-MEV items along with items from the Children's NEP scale (Manoli et al., 2007).

Building on the work of Bogner and his colleagues (Bogner & Wilhelm, 1996; Bogner & Wiseman, 1999; Wiseman & Bogner, 2003), the authors of the present study used the 2-MEV Scale, a well-developed and established instrument built upon a solid theoretical framework and demonstrating validity in many published studies, in the United States for the first time. The 2-MEV Scale was modified and validated over a period of four years with children who participated in earth education programs.

## METHODS

### Participants

A total of 6,843 students from 57 upper elementary and middle schools in Pennsylvania (66%), Louisiana (30%), and Arizona (4%) took part in this study over the period of four years. Their ages ranged from 9–12 years old (4th–6th grade), and their genders were evenly distributed (51% females). All of these students participated in one of two earth education programs, 77% in Earthkeepers (Van Matre & Johnson, 1988) and 23% in Sunship Earth (Van Matre, 1979). Both programs were taught at outdoor centers away from school during the 2003–2007 school years. While demographic information was not collected from individual students, school data were available from the school districts' offices. The students from Louisiana were primarily African American and Caucasian, the students from Arizona were primarily Caucasian and Hispanic, and almost all students from Pennsylvania were Caucasians. The participating schools ranged mostly from low to middle socioeconomic status (SES).

### Programs

Earthkeepers and Sunship Earth are earth education programs designed for 10-to 12-year-olds. They share a common structure, purpose, and educational approach. Both were designed as multi-day experiences, three days for Earthkeepers and five days for Sunship Earth. The programs were run at the three outdoor centers in very similar ways, using the same structure, time frame, and activities. The aims of both programs are to help students construct ecological understandings, develop positive feelings for the natural world, and undertake personal actions to lessen their impact on the natural world. Ecological concepts are taught through participatory activities that bring abstract ecological concepts into the concrete. The same four ecological concepts—energy flow, materials cycling, interrelationships, and change—are taught in both, though in Sunship Earth three more concepts (diversity, community, and adaptation) are added. Feelings are developed through activities that bring the children into firsthand contact with natural places, immersing them in nature and providing opportunities for reflection. The initial three-to five-day experience at one of the centers sets the children up for taking personal action to lessen impact through using less energy and materials and replacing environmental bad habits with good ones. The programs

were selected for the study because they target both attitude and behavior in children. The outdoor centers were selected because they offer the same programs in very different locations with different populations of children.

The Earthkeepers program is designed for 10- and 11-year-olds, typically 4th and 5th grade students in the United States. It is organized around four principles—*Knowledge*, *Experience*, *Yourself*, and *Sharing*—symbolized by four keys marked with the K, E, Y, and S letters, spelling the word KEYS. Earthkeepers begins with a three-day experience away from school at the Earthkeepers Training Centre, where the participants engage in Knowledge (ecological understandings) and Experience (environmental attitudes) activities to earn the K and E keys and become Apprentice Earthkeepers. After the initial experience, the program continues back at home and at school where the students work on the remaining two principles' tasks in order to earn the Y and S keys.

The Sunship Earth program consists of a five-day residential experience for 10- to 12-year-olds, 5th and 6th grade students in the United States, that takes place in a natural area away from school and, like Earthkeepers, continues back in the classroom. At the Sunship Study Station, the program focuses on understandings and attitudes. Participants remember the seven key ecological concepts using the program's "organizer," EC-DC-IC-A: Energy flow, Cycling, Diversity, Community, Interrelationships, Change, and Adaptation. Back at home and school, participants work on applying the understandings and feelings and on changing environmental behaviors and actions.

## Procedure

The Earth Education Research and Evaluation Team (EERET) at the University of Arizona has been using the 2-MEV Scale in ongoing research investigations of children's ecological understandings, attitudes, and actions and the relationships among them (Johnson & Manoli, 2008). The 2-MEV is part of a larger environmental attitude instrument, The Environment Questionnaire (TEQ), composed of items taken from the 2-MEV Scale (Bogner & Wiseman, 1999) and the NEP Scale for Children (Manoli et al., 2007). The TEQ uses a 5-point Likert-style response set, from "*Strongly agree*" (5 points) to "*Strongly disagree*" (1 point) and a neutral respond of "*Not sure*." The TEQ was administered twice to each student, one to two weeks before participating in the Earthkeepers or Sunship Earth program (pre) and four to six weeks after participating in the program (post).

**Year One.** Before administering the questionnaire during the first year of the study, 2-MEV items were revised to reflect American instead of European English, and several words were replaced with more children-friendly words or phrases. Halfway through year one, additional vocabulary changes were made based on initial feedback, including interviews with children to check for understanding and results. Similar changes in wording had previously been done with the NEP items to create the Children's NEP, reported elsewhere (Manoli et al., 2007).

In year one, 1,283 Earthkeepers and Sunship Earth participants from Arizona, Louisiana, and Pennsylvania completed the TEQ (19 2-MEV items and 15 Children's NEP items). Both pre- and post-questionnaire datasets were randomly split in two, using one half for an Exploratory Factor Analysis (EFA; principal-components analysis with varimax rotation using SPSS software) and the other half for a Confirmatory Factor Analysis (CFA; structural equation model using AMOS software; Pedhazur & Schmelkin, 1991; Tabachnick & Fidell, 1996). The results of the analysis



along with feedback from the students and their classroom teachers at the end of year one led to further revisions of the TEQ in year two.

*Year Two.* In year two, a sixth option to the Likert scale, “Do not understand,” was added in order to determine if there were still any problematic items. The questionnaire was then completed by a total of 1,070 students of the same age and from schools in the same areas (and in many occasions from the same schools) as in year one. Using the results from the pre-questionnaire dataset, the TEQ was revised one more time (as described below) and a CFA was conducted.

*Years Three and Four.* During the following two years of the study, no further changes were made to the items. Instead, the questionnaire was tested for its ability to detect changes in students’ environmental attitudes after participation in educational programs. Data from 277 students who had attend the Sunship Earth program at the outdoor center in Pennsylvania were examined for statistically significant changes (paired sample t-test) between mean pre- and post-scores. The same examination was done with data from 1,090 students who attended the Earthkeepers program in Pennsylvania, Louisiana, and Arizona. In addition, another 312 students from Pennsylvania and Arizona served as a control group to allow an additional check on the ability of the instrument to detect change due to education programs.

## RESULTS

### Year One

Using one half of the 34-item TEQ (19 2-MEV and 15 Children’s NEP items) pretest dataset, an unconstrained EFA revealed nine factors with Eigenvalues over 1.0, explaining 49.91% of the variance. Seven items had very low loadings, however, and three items loaded almost equally on two different factors. Further analyses were run constrained to different numbers of factors and with different items dropped. The best solution appeared to be one with 24 of the 34 items, arranged in six factors, explaining 49.24% of the variance. An EFA run with the posttest dataset also resulted in the same 24 items arranged in six factors, explaining 54.06% of the variance. The six factors were named and arranged in the two secondary factors of Preservation and Utilization. Preservation consisted of Enjoyment of Nature, Eco-Crisis, and Intent of Support while Utilization consisted of Altering Nature, Human Dominance, and Limited Impact; factors originating from the two instruments (2-MEV and NEP).

A CFA was then conducted with the second half of the pre-questionnaire dataset to test the six-factor, 24-item model that resulted from the EFA. Fit indices were mixed.  $\chi^2/df$  ratio (2.29) was higher than the frequently recommended maximum of 2.0. GFI (.93) and AGFI (.91) were above the minimum .90 level, but TLI (.88) and CFI (.89) were not. RMSEA (.05) was right at the maximum level to indicate good model fit statistics.

The efforts to combine the 2-MEV and the NEP Scales did not appear to be as fruitful as in Bogner & Wiseman’s work (Bogner, 2004; Bogner & Wiseman, 2002a, 2004, 2006; Wiseman & Bogner, 2003), therefore, a decision was made to focus on their Theory of Ecological Attitude and reduce the number of the Children’s NEP items. Additional CFAs were conducted, including and/or excluding different questionnaire items. The best fit indices were obtained with 18 rather than 24 items, arranged in five primary factors, resembling those proposed in Bogner’s Theory

of Ecological Attitude. Fit indices were better.  $\chi^2/df$  ratio was 1.86. The GFI (.96), AGFI (.95), CFI (.95), and TLI (.95) were above the frequently recommended minimum level of .90. RMSEA (.04) was better than the recommended level of .05. The revised instrument included 16 items from the 2-MEV questionnaire and 2 items from the NEP scale.

Year Two

Student, teacher, and program leader feedback from year one led to more wording revisions before the program participants completed the instrument in year two. Minor revisions were made to 16 of the 18 items. The revised instrument, with the additional option “Do not understand,” was then completed by 1,070 students during year two. The results revealed two more problematic items as a number of students, particularly the younger ones (4th grade), had difficulties comprehending their meaning (selecting “Do not understand”). This led to the deletion of the two items, “When I am older I am going to join and be involved in an environmental group (if I am not already a member)” and “I especially love the soft rustling of leaves when the wind blows through the treetops,” lowering the number of the scale items to 16. Another CFA was then run with the pre-questionnaire dataset (see Figure 1). Fit indices were better than year one, indicating that the model fit the data well.  $\chi^2/df$  ratio was 2.25. GFI (.98), AGFI (.97), CFI (.96), TLI (.95) and RMSEA (.03) all showed improvement over the fit indices in year one.

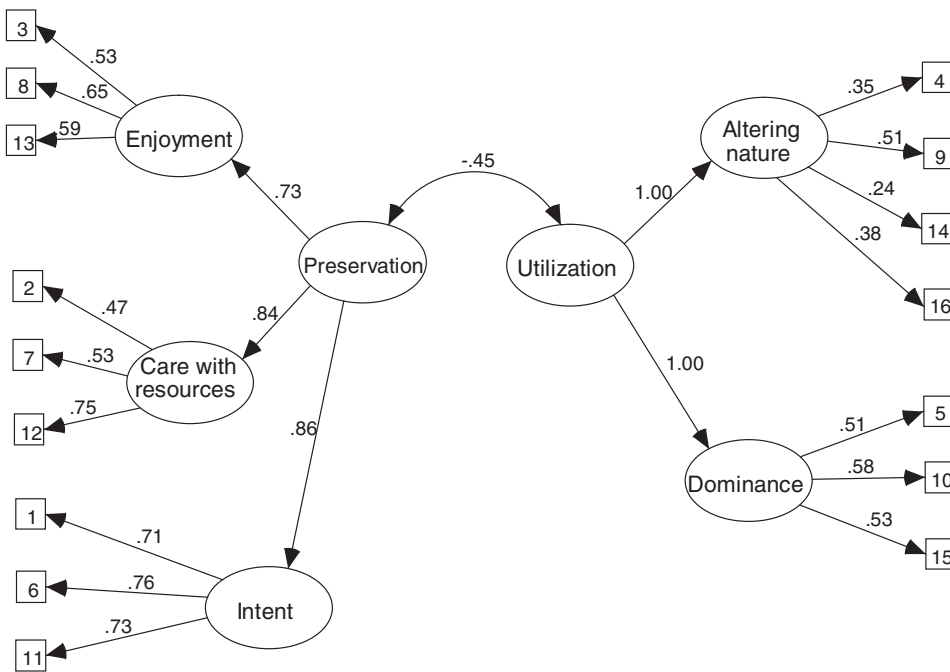


FIGURE 1 Year two confirmatory factor analysis model.

TABLE 1  
Mean Pre- and Post-questionnaire Score Comparisons for Sunship Earth

	<i>N</i>	<i>Mean scores</i>		<i>t</i>	<i>p</i>	<i>Effect size</i>
		<i>Pre-test</i>	<i>Post-test</i>			
<i>Preservation total</i>	244	3.52	3.71	-5.64	.000*	.27
Intent of support	244	3.41	3.57	-3.65	.000*	.19
Care with resources	244	3.49	3.78	-5.51	.000*	.34
Enjoyment of nature	244	3.66	3.80	-2.83	.005*	.15
<i>Utilization total</i>	244	2.59	2.39	5.74	.000*	.31
Altering nature	244	2.89	2.65	5.90	.000*	.33
Human dominance	244	2.18	2.05	2.78	.006*	.17

Note: \* Statistically significant difference ( $p < .01$ ) between pre- and post-questionnaire scores.

### Years Three and Four

First, the mean pre- and post-scores of the primary and secondary 2-MEV factors for children who attended only the Sunship Earth program were calculated. While the participants had pro-environmental attitudes before they attended the program (their mean pre- scores were over 3 for the preservation factors and lower than 3 for the utilization factors), a paired-samples t-test analysis revealed a statistically significant change in all primary and secondary factors toward even more pro-environmental attitudes (see Table 1). The effect sizes ranged from low to moderate.

Next, an analysis of the Earthkeepers participants' mean pre- and post-scores in year four also revealed a statistically significant change in all primary and secondary factors (see Table 2). Similarly, the participants' attitudes were pro-environmental before the program and became even more pro-environmental afterward. Effect sizes ranged from low to moderate.

In contrast with both the Sunship Earth and Earthkeepers results, the control group's mean factor scores remained at the same level between the pre- and post-questionnaire assessments (see Table 3). With the exception of one primary factor, Intent of Support, there were no statistically significant changes in the control group's environmental attitudes six weeks after the

TABLE 2  
Mean Pre- and Post-questionnaire Score Comparison for Earthkeepers Participants

	<i>N</i>	<i>Mean scores</i>		<i>t</i>	<i>p</i>	<i>Effect size</i>
		<i>Pre-test</i>	<i>Post-test</i>			
<i>Preservation total</i>	580	3.68	3.91	-9.48	.000*	.33
Intent of support	580	3.63	3.81	-5.63	.000*	.22
Care with resources	580	3.76	4.10	-9.98	.000*	.41
Enjoyment of nature	580	3.65	3.82	-5.34	.000*	.19
<i>Utilization total</i>	580	2.50	2.27	8.42	.000*	.35
Altering nature	580	2.87	2.59	8.38	.000*	.36
Human dominance	580	1.99	1.86	4.41	.000*	.17

Note: \* Statistically significant difference ( $p < .01$ ) between pre- and post-questionnaire scores.

TABLE 3  
Mean Pre- and Post-Questionnaire Score Comparisons for Control Group

	<i>N</i>	<i>Mean scores</i>		<i>t</i>	<i>p</i>
		<i>Pre-test</i>	<i>Post-test</i>		
<i>Preservation total</i>	207	3.76	3.67	2.86	.005*
Intent of support	207	3.75	3.60	3.50	.001*
Care with resources	207	3.84	3.77	1.33	.185
Enjoyment of nature	207	3.70	3.64	1.24	.216
<i>Utilization total</i>	207	2.50	2.45	1.39	.167
Altering nature	207	2.94	2.83	2.20	.029
Human dominance	207	1.92	1.93	-0.26	.793

Note: \* Statistically significant difference ( $p < .01$ ) between pre- and post-questionnaire scores.

pre-questionnaire. The decrease in the primary factors of Intent of Support, however, was large enough to significantly affect the secondary factor of Preservation. This is an unexpected result, and not enough is known about what took place between pre- and post-administrations to be able to speculate about the cause. An independent variables t-test analysis revealed no statistically significant differences between the control groups' scores and those of participants in Sunship Earth or Earthkeepers on the pre-, suggesting that all three groups of students held similar environmental attitudes on the pre-questionnaire.

## DISCUSSION

The four-year analysis allowed revision, refinement, and validation of the 2-MEV Scale with 9–12-year-old children in the United States. Wording adjustments and elimination of unsuitable items during the first two years of the study provided the basis for the modifications of the instrument, while years three and four assessed the ability of the Scale to detect changes in attitude after participation in educational programs.

We conclude that the 16-item revised 2-MEV Scale (see Appendix A) is appropriate for measuring environmental attitudes in children ages 9–12 in the United States. The structure of the items, with two secondary (higher order) and five primary factors proposed in the Theory of Ecological Attitude was confirmed. The revised Scale is capable in detecting changes in children's environmental attitudes after they have attended educational programs.

### Limitations

While our study includes a diverse sample of students from three different states in the United States, it might not necessarily represent the broader population of children who take part in environmental learning programs such as Earthkeepers and Sunship Earth. The majority of the participants were Caucasian and African-American students from low and middle SES schools. Caution is advised in generalizing the results of the study with other samples of students different from those who participated in the study. In addition, the students in the control group originated from only two of the three states in which we gathered data; data were not able to be collected

from a control group in Louisiana, in spite of efforts to do so. A control group comprised of students from all three locations would have been more appropriate for comparison purposes. However, the purpose of the control group in the study was not to compare program sites, so the impact is minor. Finally, while there was a statistically significant, consistent increase in pro-environmental attitudes, the changes were not large. Low to moderate effect sizes for change in attitudes are not necessarily unimportant, however. First, the majority of the students who participated in the study held pro-environmental attitudes before attending the programs, leaving less room for change in that direction (ceiling effect). This is a common finding in children of this age and does not appear to be a problem specific to this instrument. Second, the more important question is whether these changes are important. That is a question beyond the current study.

## Recommendations

The 2-MEV Scale is a well-developed instrument with a good theoretical framework used successfully since 1994 in Europe to investigate adolescents' environmental attitudes. Although the present study provides evidence that it can be used with children in the United States, more research is needed to further test the use of the model with students from different socioeconomic backgrounds and a variety of environmental programs.

As a tool, the 2-MEV Scale can be used both in program evaluations and in further research on children's environmental attitudes. How do attitudes develop and change over time? Are these attitudes stable? To what extent do they change as a result of new experiences, influence of peers, exposure to media, or education? What are the relationships between environmental attitudes and knowledge of ecological process or environmental issues?

Finally, in order to determine if the consistent but small to moderate changes in attitude are important, examinations must be made of the relationships between environmental attitudes and behavior. Some recent work has been done to indicate that a strong relationship exists even when the changes in attitudes are small to moderate (Manoli & Johnson, 2008) and other work using the 2-MEV is underway. The first author has also conducted a five-year longitudinal study of one group of children's ecological understandings, attitudes, and behaviors using the 2-MEV Scale as well as other instruments, interviews, and observations. A follow-up study of the same children after completing high school is planned, allowing investigation of the long-term impact of these changes.

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## APPENDIX A

### The Revised 2-MEV Scale Arranged by Factors

#### PRESERVATION

##### Intent of support

1. If I ever have extra money, I will give some to help protect nature.
6. I would help raise money to protect nature.
11. I try to tell others that nature is important.

##### Care with resources

2. To save energy in the winter, I make sure the heat in my room is not on too high.
7. I always turn off the light when I do not need it any more.
12. I try to save water by taking shorter showers or by turning off the water when I brush my teeth.

##### Enjoyment of nature

3. I would like to sit by a pond and watch dragonflies.
8. I like to go on trips to places like forests away from cities.
13. I like the quiet of nature.

#### UTILIZATION

##### Altering nature

4. People have the right to change the environment (nature).
9. I like a grass lawn more than a place where flowers grow on their own.
14. To feed people, nature must be cleared to grow food.
16. Weeds should be killed because they take up space from plants we need.

##### Dominance

5. Building new roads is so important that trees should be cut down.
10. Because mosquitoes live in swamps, we should drain the swamps and use the land for farming.
15. People are supposed to rule over the rest of nature.

Note: In the Revised 2-MEV completed by participants, items are mixed and not listed by factor.