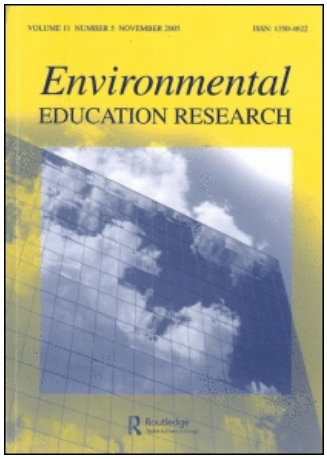

Environmental Education Research
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713416156

Using Bogner and Wiseman's Model of Ecological Values to measure the impact of an earth education programme on children's environmental perceptions

Bruce Johnson [a]; Constantinos C. Manoli [a]
[a] University of Arizona, Tucson, USA

Online Publication Date: 01 April 2008
To cite this Article: Johnson, Bruce and Manoli, Constantinos C. (2008) 'Using Bogner and Wiseman's Model of Ecological Values to measure the impact of an earth education programme on children's environmental perceptions', Environmental Education Research, 14:2, 115 - 127
To link to this article: DOI: 10.1080/13504620801951673
URL: http://dx.doi.org/10.1080/13504620801951673

Environmental Education Research
Vol. 14, No. 2, April 2008, 115–127

Using Bogner and Wiseman's Model of Ecological Values to measure the impact of an earth education programme on children's environmental perceptions

Bruce Johnson* and Constantinos C. Manoli

University of Arizona, Tucson, USA

Investigating the effects of educational programmes on children's environmental perceptions has been hampered by the lack of good theoretical models and valid instruments. In the present study, Bogner and Wiseman's Model of Ecological Values provided a well-developed theoretical model. A validated instrument based on Bogner's Environmental Perception (ENV) scale was used to examine the effects of the Sunship Earth programme on the environmental perceptions of fifth and sixth grade students in the US. Paired sample t-tests showed a statistically significant change toward more pro-environmental perceptions for all factors described in the model for children who participated in Sunship Earth but not for a control group. Additionally, perceptions were shown to be stable over time for a smaller sample of students.

Keywords: earth education, Sunship Earth; environmental perceptions; worldview; Model of Ecological Values; ENV Scale, NEP Scale; TEQ Scale

Introduction

Perceptions of and attitudes toward the natural environment have been of great concern to researchers for many years. Thirty years ago, Pirages and Ehrlich (1974) pointed out that the Dominant Social Paradigm (DSP), comprised of traditional values, attitudes and beliefs that contribute to environmental degradation, had begun to be replaced by new ideas and attitudes, the New Environmental Paradigm (Dunlap 1975). Dozens of studies of environmental perceptions (and the related ideas of attitudes, concern, beliefs, paradigms, values and worldviews) have since been conducted (Blaikie 1992; Bogner 1999; Dunlap and Van Liere 1978; Edgell and Nowell 1989; Furman 1998; Noe and Hammitt 1992; Roberts and Bacon 1997; Scott and Willits 1994; Weigel, Woolston and Gendelman, 1977). All of these studies attempted to get at something similar, how people view the natural environment and the place of humans within it.

Recently, Wiseman and Bogner (2003) pointed out a problem inherent in the common use of environmental perception and attitude instruments measuring first-order factors only. Each tends to yield results specific to that study and not to a more general measure of environmental perceptions. This led to the development of the Model of Ecological Values, built on an instrument designed to measure second-order dimensions. The present study uses the Model of Ecological Values to investigate changes in the perceptions of children involved in an earth education programme.

*Corresponding author. Email: brucej@u.arizona.edu

ISSN 1350-4622 print/ISSN 1469-5871 online

DOI: 10.1080/13504620801951673
http://www.informaworld.com

Measuring environmental perceptions

Researchers have used a plethora of instruments to measure environmental perceptions or worldviews (Dunlap and Jones 2002). One of the first and most widely used, the New Environmental Paradigm (NEP) scale (Dunlap and Van Liere 1978) was designed to measure public acceptance of the emerging orientation. Since then, the NEP has been used in many studies of adult environmental worldviews. It was recently revised and renamed the New Ecological Paradigm (still NEP) scale (Dunlap et al. 2000).

Bogner and Wilhelm (1996) developed a measurement instrument, the Environmental Perception (ENV) scale, to assess environmental perceptions of European adolescents. A second study by Bogner and Wiseman (1999) used the instrument to further develop the ENV scale to measure two dimensions of environmental perceptions, called 'preservation' and 'utilization' of nature. This led to the proposed Model of Ecological Values (Wiseman and Bogner 2003).

Model of Ecological Values

The two-dimensional nature of the work of Bogner and colleagues (1999, 2003) contrasts with the work of Dunlap and his colleagues (Dunlap and Van Liere 1978; Dunlap et al. 2000), who see environmental perception as a unidimensional construct. 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. On the other hand, Bogner and Wiseman (1999) see biocentrism (preservation) and anthropocentrism (utilization) as two separate and not necessarily related components of environmental perception. This idea was further elaborated as the Model of Ecological Values (Wiseman and Bogner 2003). This model postulates that preservation and utilization are uncorrelated. Preservation is 'a biocentric dimension that reflects conservation and protection of the environment' and utilization is 'an anthropocentric dimension that reflects the utilisation of natural resources' (Wisemen and Bogner 2003, 787). The model allows for individuals to be placed in one of four quadrants rather than on either end of a continuum (see Figure 1). A high score on preservation and a low score on utilization (PRE+ UT–) might be expected of a strong environmentalist, someone with deep concern about conservation. A low score on preservation but a high score on utilization (PRE– UT+) 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 nature is to benefit humans, resulting in a high score on utilization as well (PRE+ UT+). Individuals in this quadrant would likely be placed in the centre of the NEP/DSP continuum, leading to a misinterpretation of their perceptions as noncommittal when in reality their views might be quite strong. A low score in both dimensions (PRE– UT–) is most likely indicative of someone with a lack of interest in the topic. Such individuals would most likely also, but more appropriately, be placed in the middle of the NEP/DSP continuum.

Bogner and colleagues have used the Model of Ecological Values to investigate the effects of educational programmes on European adolescents' environmental perceptions. The students completed the ENV scale before and after participating in environmental learning programmes. The ENV consists of items with Likert-type responses. In scoring, items are grouped into primary factors under each of the secondary (higher-order) factors. The primary factors of intent of support, care with resources, and enjoyment of nature combine under the higher-order factor preservation. The primary factors of altering nature and human dominance fall under the higher-order factor utilization. Results from those studies were mixed. In a study investigating the effects of

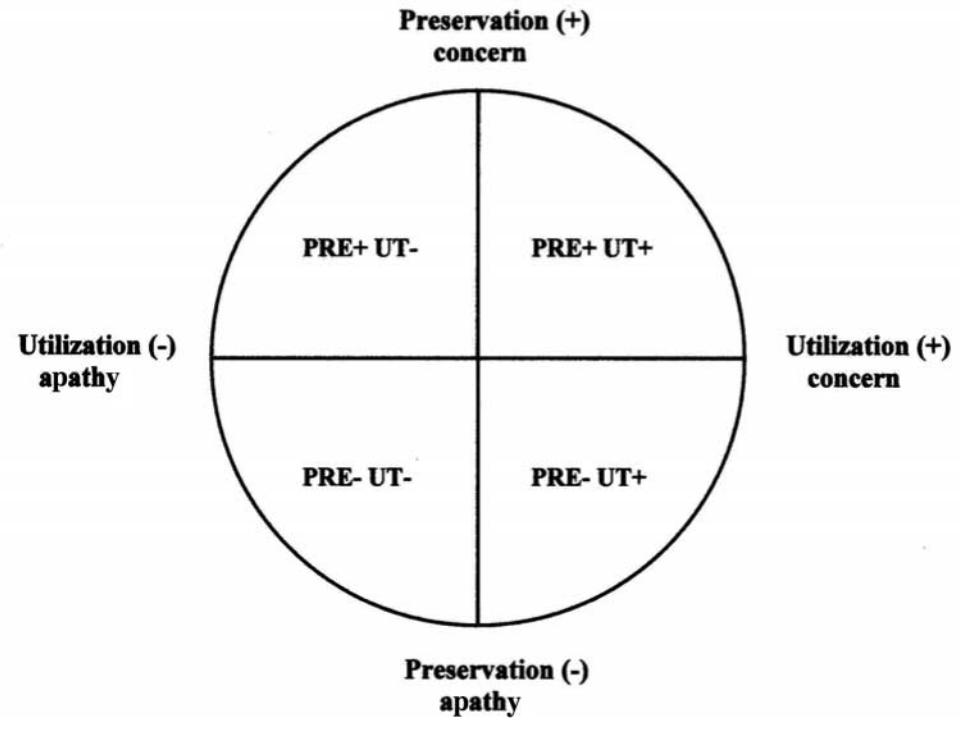

Figure 1. Model of Ecological Values from Wiseman and Bogner (2003).

participation in a one-week residential outdoor ecology programme in a national park in Germany with approximately 450 students (mean age of 12 years), Bogner (2004) found that one of the preservation factors (intent of support) and one of the utilization factors (altering nature) showed statistically significant change. Mixed results were also found in a study involving approximately 200 10- to 16-year-old students participating in a natural history programme in Switzerland (Bogner 1999). There were no changes in the utilization factors and significant increases in two of the three preservation factors (intent of support and enjoyment of nature). In a French study of about 150 11- to 16-year-olds participating in a four-day residential programme consisting of cognitive, participatory ecology and geology activities (Bogner 2002), however, none of the preservation factors showed any changes, while the two utilization factors decreased significantly. The differing results might be due to the differing nature of the programmes themselves. The results do, however, show that educational programmes can influence these perceptions.

Methods

Participants

The participants were 729 upper elementary school students, 240 fifth graders from four public schools in a large city in the southern US and 489 fifth and sixth graders from five suburban schools in an eastern US state. All of the students took part in Sunship Earth, an earth education programme, during the 2004–2005 and 2005–2006 academic years. A group of 143 fifth graders from the same eastern US state served as a control group. The control group originated from one of the treatment schools whose students did not participate in the Sunship Earth programme this year, thus closely resembling the majority of the treatment group used in the study. Demographic information was not collected from individual students; however, school level data were

available through the school districts' offices. Students in the southern state were from schools with mostly African-American or Caucasian populations, while most students in the school in the eastern state were Caucasian. Their schools ranged from those with primarily low socio-economic (SES) students through others with mostly middle SES students.

Educational Programme

All students, except for those in the control group, participated in the Sunship Earth (Van Matre 1979) programme during this study. For students in the southern state, Sunship Earth was conducted at a residential outdoor school outside of the city. In the eastern state, Sunship Earth was offered at a residential environmental centre located in a rural area 30 to 80 miles away from the participating schools. In both cases, students were there for five days and four nights. The follow-through portion of the program continued back at the students' schools for four to six weeks, where they worked on applying what was learned to their own lives.

Earth education programmes are designed to help students construct ecological understandings, develop positive feelings for the natural world, and make choices about their personal environmental behaviours and actions (Brauser 2003; Van Matre 1990). After preparation in the classroom, Sunship Earth consists of a five-day experience that takes place in a natural area away from school and then continues back in the classroom. The initial five-day part of the programme focuses on understandings and feelings. The classroom follow-through part of the programme focuses on applying the understandings and feelings at home and school and on changing students' environmental behaviours and actions.

For the understandings, Sunship Earth concentrates on fundamental ecological concepts, helping students see the big picture of how life works rather than focusing on details such as names and numbers. The programme uses experiential learning to make the abstract concepts concrete based on the IAA (Inform – Assimilate – Apply) Learning Model. For 'Inform', students read about a concept in their learning booklet (Passport). They then 'Assimilate' the concept by engaging in a participatory activity designed to bring the concept into the concrete. For example, students become 'chlorospies' and crawl inside a giant leaf (the Food Factory) to learn how plants turn sunlight energy into food through the process of photosynthesis. To 'Apply' their knowledge, students find an example of the concept nearby in the natural world, writing and drawing about it in the Passport and then explaining the example to a programme leader. All of the activities take place outdoors in a natural setting, providing students with a real world context and with plenty of opportunities for further examples and reinforcement.

The Sunship Earth programme teaches seven ecological concepts: energy flow – how sunlight energy is captured by plants, passed along through food chains, and is lost to the food chain along the way; cycles – how the air, water, and soil cycles recycle the building materials that make up every living and non-living thing; diversity – how a wider variety of living organisms helps ensure survival; community – how plants and animals live together in places that fit their needs; interrelationships – how living things interact with other living and nonliving things; change – how everything is constantly changing, sometimes over long periods of time in stages that we can observe; and adaptations – how living things have features and behaviours that help them survive.

Feelings are also a major component of Sunship Earth. The programme takes place in natural areas where students have opportunities to experience nature first hand. Specific activities that focus on discovery, observation, solitude, and immersion help students learn to appreciate nature. For example, Sunship Earth starts with a sensory-awakening Earthwalk that sharpens senses by using 'magic' paintbrushes to see the incredible colours all around, becoming bugs to crawl along the forest floor, and riding to the tops of the trees in a bosun's chair. Later on, participants spend

a few minutes of solitude each day in a personal 'magic spot'. The goal is to help build positive feelings for the natural world.

The third component of the programme is personal environmental action. Students complete the programme by returning to home and school to work on lessening their impact on the natural world by doing things such as using less energy and fewer materials. They also choose ways of increasing their interactions with nature by finding personal 'magic spots' near their homes and spending more time outdoors.

Outdoor centres and schools in Australia, Canada, the US and the UK have been offering Sunship Earth since the late 1970s. Research on the programme has been conducted in several of those locations (Martin 2003). While the studies have consistently shown gains in student understandings as a result of the programme, the results have been more mixed for feelings. Most commonly, feelings have been operationally defined as attitudes, and these have typically been measured with a written attitude instrument. Changes toward a more pro-environmental attitude from pre-test to post-test were found by Bires, Johnson and McFadden (1982), Payne (1981) and van Wissen (1992). It should be noted that while Payne found statistically significant gains in attitudes, they were not any greater than gains found in a very different programme to which Sunship Earth was being compared. Keen (1991) and Mulligan (1989), on the other hand, found no statistically significant changes in attitudes as a result of the Sunship Earth programme.

Martin (2003) pointed out that the mixed results of studies examining attitude change might be due to problems with how attitudes were defined and measured. In particular, these studies lacked a theoretical model of attitudes or perceptions and a validated instrument for measuring them. Indeed, some of these results seem inconsistent with anecdotal evidence from those who have been involved with the programme for many years. Sunship Earth is often praised for its emphasis on feelings and its effects on student attitudes. The present study was designed to take advantage of a well-developed theoretical model of values and a more reliable and valid instrument in order to address some of these concerns.

Instrument

Perceptions were measured using The Environment Questionnaire (TEQ) (see Appendix A). The TEQ is composed of 25 items taken from the ENV (Bogner and Wiseman 1999) and also from the NEP scale (Dunlap et al. 2000). Only the 16 items that contribute to the Model of Ecological Values were used in this analysis. Items from both the ENV, which was developed and tested in Europe, and the NEP were modified for use with children in the US. Validation of the TEQ included interviews and pilot testing with children as well as exploratory and confirmatory factor analyses and is reported elsewhere (Johnson and Manoli 2007; Manoli, Johnson and Dunlap 2007).

The TEQ was administered to students both before and after participating in the programme. The instrument was completed one to two weeks before the beginning of the programme and anywhere from two to six weeks after the initial five-day experience away from school for those who participated in SSE. Control group students also completed the TEQ two times six weeks apart. Because not all students completed both the pre and post instruments, only those whose completed pre and post instruments could be matched were used in this analysis. If a student did not answer one or more items, that student's scores were not used in the analysis. Complete and matched pre- and post-tests were received from 482 (61%) of the 729 participating Sunship Earth students and 127 (89%) of the 143 control students.

Additionally, in order to check for stability of perceptions over time, the TEQ was administered to 75 of the participating Sunship Earth students one year earlier. This allowed for a comparison of students' TEQ scores from one year prior to participating in the Sunship Earth

Table 1. Environmental perception components as measured by TEQ.

Component	Factor	Sample item
Preservation	Intent of support	If I ever have extra money, I will give some to help protect nature
	Care with resources	I always turn off the light when I do not need it any more
	Enjoyment of nature	I would like to sit by a pond and watch dragonflies
Utilization	Altering nature	Weeds should be killed because they take up space from plants we need
	Human dominance	People are supposed to rule over the rest of nature

programme to just before the programme. In order for the measurement of these perceptions to be valuable, they must be able to show stability over time. If they fluctuate wildly from one occasion to the next, without an educational intervention, then measuring them is of little worth.

Items in the TEQ are statements about the environment with a five point Likert-type response set of 'strongly agree', 'agree', 'not sure', 'disagree' and 'strongly disagree'. Scoring involved assigning points, from five points for 'strongly agree' to one point for 'strongly disagree'. Items were then grouped into factors. The five primary factors – intent of support, care with resources, enjoyment of nature, human dominance, and altering nature – are each made up of three or four items (see Table 1). For each of these factors, means were calculated. Mean scores were also calculated for the two higher-order factors – preservation (consisting of intent of support, care with resources, and enjoyment of nature) and utilization (consisting of human dominance and altering nature) as well.

For each of the primary and secondary (higher-order) factors, mean scores range from 1.0 to 5.0. For preservation and its three factors, mean scores between 3 and 5 indicate a pro-environmental perception while mean scores between 1 and 3 indicate the opposite. The reverse is true for utilization and its two factors. Mean scores between 1 and 3 indicate a pro-environmental perception while mean scores between 3 and 5 indicate the opposite.

Findings

Pre- and post-programme mean scores were compared using a paired-sample t-test. As can be seen in Table 2, mean scores increased statistically toward a more pro-environmental perception for preservation and all three of its primary factors for the students who participated in Sunship

Table 2. Environmental perceptions: mean pre-test and post-test comparisons for sunship earth participants.

		Mean scores				
	n	Pre-test	Post-test	*t*	*p*	*Effect size*
Preservation total	461	3.62	3.80	–7.29	.001*	.26
Intent of support	476	3.54	3.70	–5.36	.001*	.20
Care with resources	470	3.63	3.86	–6.08	.001*	.27
Enjoyment of nature	474	3.69	3.83	–3.93	.001*	.15
Utilization total	445	2.52	2.30	8.57	.001*	.32
Altering nature	461	2.86	2.59	8.86	.001*	.37
Human dominance	456	2.09	1.94	4.61	.001*	.20

Notes: * Statistically significant difference ($p < .001$) between pre- and post-test.

Table 3. Environmental perceptions – mean pre-test and post-test comparisons for control group.

		Mean scores				
	n	Pre-test	Post-test	*t*	*p*	*Effect size*
Preservation total	118	3.68	3.61	1.73	.086	–
Intent of support	123	3.77	3.60	3.48	.001*	.20
Care with resources	124	3.70	3.61	1.08	.282	–
Enjoyment of nature	123	3.57	3.56	0.19	.851	–
Utilization total	117	2.39	2.34	0.90	.372	–
Altering nature	124	2.77	2.68	1.32	.190	–
Human dominance	119	1.88	1.89	–0.13	.893	–

Notes: *Statistically significant difference (p <.001) between pre- and post-test.

Earth. Means decreased, indicating a more pro-environmental perception, for utilization and both of its primary factors. Effect sizes for the different factors were low to moderate, with the largest for altering nature and the smallest for enjoyment of nature. This is not particularly surprising given that the mean for altering nature started out as the least environmentally positive, leaving more room for change, and that for enjoyment of nature as the most environmentally positive, limiting the amount of change that could occur.

While there were no statistically significant changes in the higher-order factors of preservation or utilization for the control group (see Table 3), there was a statistically significant decrease in intent of support, one of the primary factors of preservation. Why that happened is unclear.

In order to further examine the perceptions of the two groups, treatment and control, an independent-sample *t*-test of the mean pre- and post-programme change scores was also carried out (see Table 4). This analysis was chosen because the treatment and control groups had unequal samples sizes and so unequal power to detect differences (Haertel 2006). The analysis revealed statistically significant differences between the treatment and control groups for both higher-order factors of preservation and utilization and three of the five primary factors (intent of support, care with resources and altering nature). Scores in the treatment group changed more from pre- to post-programme than did the scores of the control group. Scores for all primary and secondary factors became more pro-environmental for the treatment group but not for the

Table 4. Changes in perceptions – independent-sample t-test of mean score changes between the control and the treatment group.

		Mean score change			
	df	Treatment	Control	*t*	*p*
Preservation	668	.15	–.07	4.71	.000*
Intent of support	705	.14	–.17	5.48	.000*
Care with resources	694	.21	–.08	3.56	.000*
Enjoyment of nature	699	.10	–.01	1.71	.090*
Utilization	641	–.22	–.05	–2.79	.006*
Altering nature	679	–.29	–.08	–2.97	.003*
Human dominance	668	–.12	.01	–1.89	.060*

Notes: * Statistically significant difference (p < .001).

control group. There was not a statistically significant difference between the amount of change in enjoyment of nature (preservation) and human dominance (utilization) scores between the two groups.

The majority of students participating in the Sunship Earth program in both locations began with pro-environmental perceptions in all of the factors. After participating in Sunship Earth, their perceptions for the most part moved toward an even more pro-environmental perspective. Looking at the two higher-order factors, 394 (84%) of the students started with a positive preservation value on the pre-test. On the post-test, 416 (88%) had a positive value. Conversely, 371 (81%) of the students started with a negative (pro-environmental) utilization value on the pre-test, while 403 (87%) had a negative value on the post-test.

Using the quadrants in the Model of Ecological Values, most students (326 or 73%) were located in the positive preservation and negative utilization quadrant (PRE+ UT–) before the programme, while 368 (81%) were located there after the programme. The second most common quadrant was positive preservation and positive utilization (PRE+ UT+), with 52 students (12%) on the pre-test and 34 (8%) on the post-test. Few students were located in the other two quadrants either before or after the programme. The negative preservation and positive utilization quadrant (PRE– UT+) had 30 students (7%) before and 22 (5%) after Sunship Earth. The negative preservation and negative utilization quadrant (PRE– UT–) had 40 students (9%) before and 32 (7%) after the programme. While most students did not change quadrants, an examination of the spread of quadrant scores shown in Figures 2 and 3 reveals that many shifted toward a more pro-environmental perspective within a quadrant.

To check for stability over time, mean perception scores for a subgroup of participants available from one year before participating in Sunship Earth were compared to their mean scores just prior to taking part in Sunship Earth using a paired-sample *t*-test (see Table 5). There were

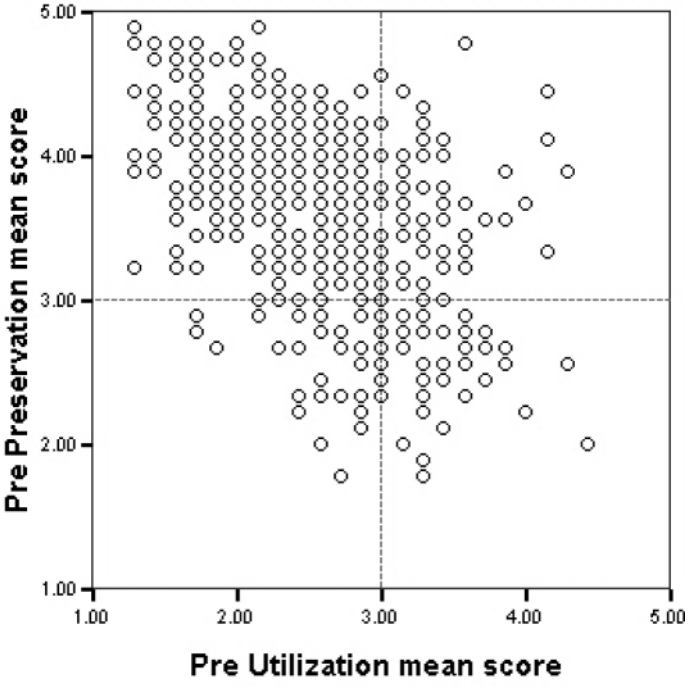

Figure 2. Model ecological values quadrant scores before participation in the programme.

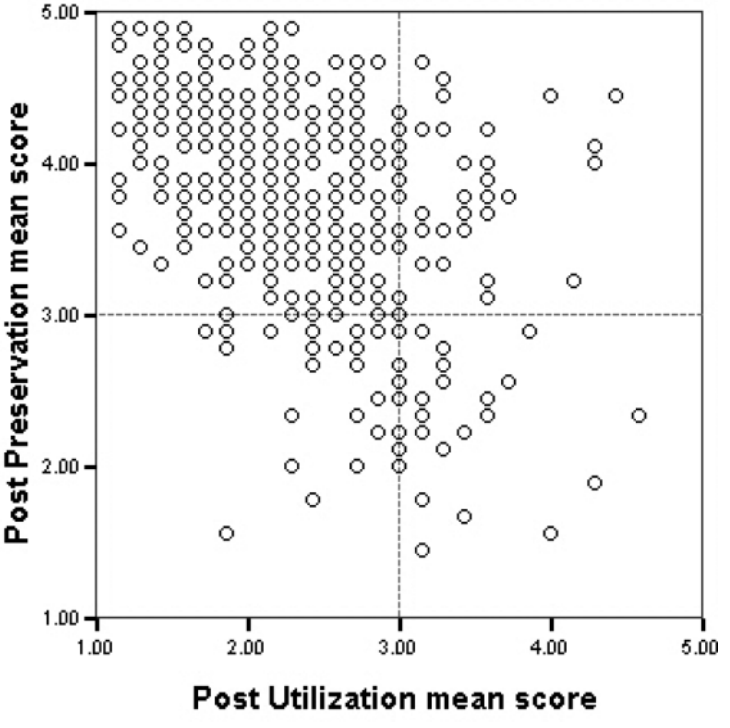

Figure 3. Model ecological values quadrant scores after participation in the programme.

no statistically significant changes in any of the primary or higher-order factors indicating that, at least for this subgroup, environmental perceptions had remained the same over the course of the year.

Discussion

The findings here differ from those reported by Bogner (1999, 2002, 2004), who found that only some of the components of environmental perception were changed following participation in an

Table 5. Changes in perception means for each factor over two years.

		Mean scores			
	n	Year 1	Year 2*	*t*	*p*
Preservation total	73	3.99	3.94	0.69	.494
Intent of support	74	3.82	3.92	–1.11	.270
Care with resources	74	4.05	3.97	0.71	.483
Enjoyment of nature	73	4.13	3.91	2.02	.047
Utilization total	72	2.31	2.27	0.53	.598
Altering nature	74	2.68	2.64	0.31	.755
Human dominance	72	1.81	1.79	0.22	.826

Notes: * Means are from the pre-Sunship Earth administration of the TEQ. No changes were statistically significant ($p < .001$).

environmental learning programme. In the present study, all five primary factors changed significantly toward a more pro-environmental perception. However, there were several possible differences in Bogner's studies that may account for this, including differences in the countries in which the studies were conducted and in the type of settings (classroom or outdoors) in which the programmes were run. Two reasons, though, seem more likely to have contributed to these findings: differences in the ages of the participating students and differences in the programmes' goals and designs.

In two of the previous studies (Bogner 1999, 2004), average ages of students were 12.5 years. In the third study (Bogner 2002) the average age was 14 years. In the present study, students were younger; almost all were 10- or 11-years-old. Perhaps the environmental perceptions of younger students are more amenable to change. The authors are further investigating this possibility in a study with 13- and 14-year-olds.

The differences between programmes can be seen not only in the kinds of activities in which students were engaged but also in the goals of the programmes. In one of the three previous studies (Bogner, 1999) the focus was an extracurricular unit on an endangered species of migrant bird. The programmes in the other two studies (Bogner 2002, 2004) were more similar to Sunship Earth in that they were residential, at least for some of the students, and consisted of structured, participatory activities. The Sunship Earth programme, however, placed a direct emphasis on exposing students to new environmental perceptions. The programme also incorporated personal environmental actions and behavioural change as integral parts of the programme. It is possible that the design of the programme was a key factor in the encouraging findings. Using the Model of Ecological Values to compare Sunship Earth programmes to other residential environmental learning programmes involving students of similar ages and backgrounds would help to investigate that possibility.

The findings of the present study also differ from some of the previous studies conducted on the Sunship Earth programme. Some of those studies found positive changes in students' environmental attitudes, while others did not. As previously noted, concerns have been raised about the quality of those findings. In the present study, changes were found in all of the factors, using a well-conceived theoretical model and a validated instrument.

Also of interest were the findings of where students were located in the Model of Ecological Values quadrants. While the majority of students fell into the positive preservation/negative utilization quadrant (PRE+ UT–) both before and after the programme, a substantial number were located in the positive preservation/ positive utilization quadrant (PRE+ UT+). These are the individuals who would have been lost if looking at this on the NEP/DSP continuum. There is evidence in the present study to uphold Bogner and Wiseman's (1999) separation of the preservation and utilization dimensions of environmental perception.

Limitations in this study include the samples used and a possible ceiling effect on scores. While students from several schools in two very different states were included, the sample is not necessarily representative of children who take part in environmental learning programmes. Low and middle SES schools were selected, and Caucasian and African-American students were well represented, but few students of other backgrounds were included. Further, the control group comes from one of the treatment schools in the eastern US that did not participate in Sunship Earth that year. Ideally, a control group comprised of students from both locations would have been more appropriate for comparison but this was not possible.

Finally, the fact that so many of the students started out with pro-environmental perceptions means there was not a great deal of room for change in that direction, a ceiling effect. Such change did indeed occur however, but the opportunity for a much greater change in that direction would only be possible if many more students with less pro-environmental perceptions were included in the study.

Conclusion

The Model of Ecological Values is a powerful perspective for examining environmental perceptions in children and for evaluating the effects of environmental learning programmes on those perceptions. More research is needed, however, to further test the use of the model. The authors are currently conducting studies of earth education programmes in other parts of the US and in other countries. Upcoming plans include studies of comparison programmes, of control groups who study environmental topics in regular classroom settings, and analyses of the relationships between environmental perception, ecological understandings, and behavioural change. One of the authors is also using the model in a longitudinal study to investigate changes in the environmental perceptions of children over a five-year period. Of course, the model and instrument could be used to evaluate the effectiveness of environmental learning programmes in a variety of settings. Bogner and Wiseman's Model of Ecological Values provide a much-needed theoretical tool for examining these and other important questions about the role of education in our relationship with the natural world.

Notes on contributors

Bruce Johnson is Associate Professor and Department Head of Teaching and Teacher Education at the University of Arizona, where he teaches environmental learning and science education. He is Director of the university's Earth Education Research and Evaluation Team and serves as International Programme Coordinator for The Institute for Earth Education.

Constantinos Manoli is a post-doctoral fellow at the University of Arizona and is the Research Coordinator of the Earth Education Research and Evaluation Team. His research focuses on the relationship between children's environmental perceptions and their environmental actions.

References

Bires, F., B. Johnson, and J. McFadden. 1982. Evaluation of the spring 1982 Sunship Earth program at McKeever Environmental Learning Center, Sandy Lake, Pennsylvania. Unpublished master's project, George Williams College, Downers Grove, Illinois.

Blaikie, N.W.H. 1992. The nature and origins of ecological world views: An Australian study. *Social Science Quarterly* 73: 144–65.

Bogner, F.X. 1999. Empirical evaluation of an educational conservation programme introduced in Swiss secondary schools. *International Journal of Science Education* 21: 1169–85.

Bogner, F.X. 2002. The influence of a residential outdoor programme to pupil's environmental perception. *European Journal of Psychology of Education* 17: 19–34.

Bogner, F.X. 2004. Environmental education: One programme – two results? *Fresenius Environmental Bulletin* 13, no. 9: 814–19.

Bogner, F.X,. and M.G. Wilhelm. 1996. Environmental perspectives of pupils: The development of an attitude and behaviour scale. *The Environmentalist* 16: 95–110.

Bogner, F.X., and M. Wiseman. 1999. Toward measuring adolescent environmental perception. *European Psychologist* 4: 139–51.

Brauser, M. 2003. Earth education programs. *Zeitschrift Für Erlebnispädagogik* 23, no. 5/6: 23–31.

Dunlap, R.E. 1975. Sociological and social-psychological perspectives on environmental issues: A bibliography No. 916. Monticello, IL: Council of Planning Librarians.

Dunlap, R.E., and R.E. Jones. 2002. Environmental concern: Conceptual and measurement issues. In *Handbook of environmental sociology,* ed. R.E. Dunlap, and W. Michelson. Westport, CT: Greenwood Press.

Dunlap, R.E., and K.D. Van Liere. 1978. The "new environmental paradigm". *Journal of Environmental Education* 9, no. 4: 10–19.

Dunlap, R.E., K.D. Van Liere, A.G. Mertig, and R.E. Jones. 2000. Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues* 56: 425–42.

Edgell, M.C.R., and D.E. Nowell. 1989. The new environmental Paradigm scale: Wildlife and environmental beliefs in British Colombia. *Society and Natural Resources* 2: 285–6.

Furman, A. 1998. A note on environmental concern in a developing country: Results from an Istanbul survey. *Environment and Behavior* 30: 520–34.

Haertel, E.H. 2006. Reliability. In *educational measurement,* ed. R.L. Brennan, 65–110. Westport, CT: Praeger.

Johnson, B., and C.C. Manoli. 2007. Validating the environmental perception scale with children in informal education settings. Manuscript submitted for publication.

Keen, M. 1991. The effect of the Sunship Earth program on knowledge and attitude development. *Journal of Environmental Education* 22, no. 3: 28–32.

Manoli, C.C., B. Johnson, and R.E. Dunlap. 2007. Assessing children's environmental worldviews: Modifying and validating the New Ecological Paradigm Scale for use with children. *Journal of Environmental Education* 38, no. 4: 3–13.

Martin, D. 2003. Research in earth education. *Zeitschrift Für Erlebnispädagogik* 23, no. 5/6: 32–47.

Mulligan, M.E. 1989. Environmental attitudinal change: Does the Sunship Earth program make it happen? Unpublished masters thesis, Brock University, St. Catharines, Ontario, Canada.

Noe, F.P., and W.E. Hammitt. 1992. Environmental attitudes and the personal relevance of management actions in a park setting. *Journal of Environmental Management* 35: 205–16.

Payne, P.G. 1981. A comparative study of the effects of two outdoor/environmental education instructional approaches on the attitudes and knowledge of selected sixth grade children. Unpublished masters thesis, University of Oregon, Eugene.

Pirages, D.C., and P.R. Ehrlich. 1974. *Ark II: Social response to environmental imperatives.* San Francisco, CA: W.H. Freeman.

Roberts, J.A., and D.R. Bacon. 1997. Exploring the subtle relationships between environmental concern and ecologically conscious consumer behavior. *Journal of Business Research* 40: 79–89.

Scott. D., and F.K. Willits. 1994. Environmental attitudes and behavior: A Pennsylvania survey. *Environment and Behavior* 26: 239–60.

Van Matre, S. 1979. *Sunship Earth: An earth education program for getting to know your place in space.* Martinsville, IN: American Camping Association.

Van Matre, S. 1990. *Earth education: A new beginning.* Greenville, WV: The Institute for Earth Education.

van Wissen, F.A. 1992. Promoting responsible environmental behavior through earth education camps: Sunship Earth and Earthkeepers. Unpublished masters thesis, Dalhousie University, Halifax, Nova Scotia, Canada.

Weigel, R.H., V.L. Woolston, and D.S. Gendelman. 1977. Psychological studies of pollution control: An annotated bibliography. Mimeograph. Department of Psychology, Amherst, MA.

Wiseman, M., and F.X. Bogner. 2003. A higher-order model of ecological values and its relationship to personality. *Personality and Individual Differences* 34: 783–94.

Appendix. The Environment Questionnaire – revised ENV items – arranged by Model of Ecological Values factors

Preservation

Intent of support

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

Care with resources

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

Enjoyment of nature

I would really enjoy sitting at the edge of a pond watching dragonflies in flight.
I really like to be able to go on trips into the countryside – for example to forests or fields.
I feel good in the silence of nature.

Utilization

Altering nature

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

Human dominance

Building new roads is so important that trees should be cut down.
Because mosquitoes live in marshes and swamps, it would be better to drain these and use them for farming.
People are supposed to rule over the rest of nature.

Note: In the TEQ that is completed by participants, items are mixed and are not identified by factor.