

AN INVESTIGATION OF BOYS' AND GIRLS' ENVIRONMENTAL PERCEPTIONS  
BEFORE AND AFTER PARTICIPATING IN THE EARTHKEEPERS EARTH EDUCATION  
PROGRAM

By

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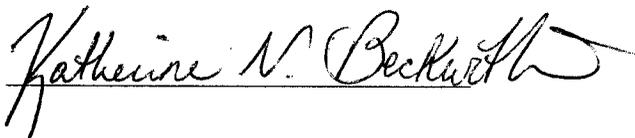
A handwritten signature in black ink, appearing to read 'Bruce Johnson', is written over a horizontal line.

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## **Abstract**

### **Introduction**

As a child I had been interested in nature and science and my family helped me to cultivate my curiosity. On road trips my mother would pull over to the side of the road so that my sister and I could use our binoculars to investigate hawks perched on telephone poles. When other children went to amusement parks, we ventured to national forests and wildlife preserves. Everything about the natural world was interesting and I wanted to investigate it. It took most of my adolescence to realize that my love of the outdoors and my family's adventures and feelings towards the environment were not shared by everyone. My interest in nature continued as I pursued a major in Ecology and Evolutionary Biology. I was first drawn to the field of ecology because of my personal interests in the environment and how its components work, but I have come to realize that a major focus of ecology today is sustainability and conservation, not just the intrinsic beauty of nature. These concepts have different interpretations in different situations, but ecologists understand them as ultimately meaning that humans need to tread more lightly on this planet, use our resources more efficiently, and make educated decisions about consumption.

I decided that it was not enough to simply appreciate nature but that I needed to help others understand how precious our Earth is and how to better use its resources not only for its future, but our own. These realizations lead me to investigate the effectiveness of environmental outreach programs. This chapter explains one group's attempt at changing children's perspectives through Environmental Education and describes a related research question on gender and environmental perception.

The importance of Earth Education and sustainable living has been a topic of concern in previous decades and has a new found importance in our current time. Hot-button issues such as global warming and alternative fuels have leapt from the political debates to dining room tables, although not without a struggle. What scientists have been saying for years is finally starting to be heard in the public domain. The time for citizens to take action is now, but they need to be equipped with appropriate and correct information in order to make informed decisions. A main goal of education is, after all, to empower youth with knowledge that they will hopefully retain and use to make wise life decisions as adolescents and as adults.

There are several environmental education programs currently in existence in the United States, one of which is specifically an Earth Education program (also EE) called Earthkeepers (Van Matre & Johnson, 1988). Maren Brauser describes EE programs as having three components: the head, heart, and hands, which translate as metaphors for the understandings, feelings, and processing components of EE programs (Brauser 2003). These programs do not just present facts, but provide a whole educational and personal experience where participants make a connection to nature. All of these programs are structured and involve the immersion of participants into the natural world and provide opportunities to relate the natural world to the participants' own lives. These programs also contain components called "hookers" and "organizers" to aid the students through the program. "Hookers" are experiences or activities that "hook up" the interest of the participants to make the experience more engaging and interesting. "Organizers" are provided to students in different ways such as "passports" or in the case of Earthkeepers, keys, as ways of helping students organize what they learn and proceed through the program in steps toward completion.

Earthkeepers is a two and one-half day program developed for adolescents aged 10-11 years old that focuses on four ecological concepts: energy flow, cycling, interrelationships, and change. The Earthkeepers experience begins with an invitation to the Earthkeepers Training Centre and a sneak peak into the mysterious E.M.'s lab. Only individuals who have become Earthkeepers are allowed to enter the lab, and students are given a slide show on how to become Earthkeepers by earning a set of four keys that unlock the secret meaning of E.M. The keys to be earned represent knowledge, experience, yourself, and sharing, and are earned after completion of portions of the program. The conceptual encounters experienced by students include a visit to Mama nature's Munchroom where students become aware that it takes many sun-munchers to feed a smaller number of plant-munchers, and animal munchers (food chains); the Great Spec-tackle which introduces students to cycling and molecules; Connection Inspection, which teaches students about interrelationships; and finally, Time Capsules, which allows the participants to learn how the place where they are has changed over time. Another component of the Earthkeepers program is the "magic spot." This is an area of nature that a participant seeks out for themselves and spends time alone contemplating, observing, and sitting quiet and still. This component seeks to connect participants to nature and to bring a sense of feeling or connection to nature.

Earth Education attempts to inform youth about environmental concerns with the goal that when they make decisions as soon-to-be-voters and consumers, they will keep in mind their decision's impact on the environment in mind. In order to evaluate the effectiveness of these programs, participants are given questionnaires before and after involvement in Earthkeepers so as to evaluate the effectiveness of the program. In the next chapter, studies looking at how participants' perceptions of the environment are changed by Earthkeepers and other EE programs will be discussed. It is important to evaluate if these programs in fact do change the perceptions of their participants as intended. One aspect of the participants that has not been widely investigated is gender. As a whole, the Earthkeepers program has shown to significantly (statistically) affect the perception of the environment towards a more conservational view, but is this view equally shared among boys and girls? The focus of my investigation looks at whether boys and girls perceive the environment in similar ways before and after participation in the Earthkeepers program, and if the program affects environmental attitude change equally in boys and girls.

### **A Review of the Literature**

Previous studies of EE programs have focused on the effects of EE on students' environmental knowledge, attitudes, and behavior. A few of these studies have sought to find trends among participants by looking at participant age or geographic location as predictors of knowledge, attitudes, and behavior before and after the EE programs. There have also been studies that have sought to identify gender differences among school children in terms of cognitive abilities and success in school. Few studies, however have sought to investigate participant gender as an indicator of environmental knowledge, attitude, or behavior. This review of the literature will summarize some of the studies on participant perceptions in Earth Education, gender differences, and finally, gender differences in perception of nature in Earth Education.

#### *Ecological Perceptions*

There are two survey methods for assessing an individual's perception of nature. The first, called the New Ecological Paradigm (NEP) was published in 1978 by Riley Dunlap and Kent Van Liere and later adapted in 2000 (Dunlap, Van Liere, Mertig, and Jones, 2000). The developers of this battery believe it is superior for its wide range of worldview facets, balanced

pro and anti NEP items, and current terminology. The NEP is a series of 15 questions that relate to either pro or anti ecological views. Responders indicate on a five-point Likert-scale how much or little they agree with a particular statement. Based on their responses to the questions, participants are given a score on four sub-factors: ecological limits, balance of nature, human domination, and ecological catastrophe. Scores high (3 to 5 points) on ecological limits and balance of nature but low (1 to 2 points) on human domination indicate that a participant has a preservationist perception of nature. Conversely, scores low on ecological limits and balance of nature and high on human domination indicate a non-ecological or utilitarian view. The other battery for measuring participant perception of the environment is the Environmental Perception battery (ENV) created by Wiseman and Bogner (2003). This battery is similar to the NEP but is applicable to children, looks at utilization of resources, and suggests that environmental perception can be multidimensional rather than linear. One of Wiseman and Bogner's criticisms of the NEP was that it had been developed for and tested on adults rather than children. This was one reason for the development of the ENV (Bogner and Wiseman, 1999). Another criticism was that a possible third category of individuals was left out of the NEP battery. Wiseman and Bogner suggested that individuals do not have to be either preservation minded or utilization minded, but could be a combination of both or even apathetic, perceptions not measured in the NEP. This characterization makes sense, for instance, when considering individuals in natural resources fields who may believe that nature can provide for man, but that man must use the resources within sustainable means. The ENV scale places participants in quadrants based upon how preservation or utilization-minded they are.

Which ever battery is used to determine the perceptions of study participants, the goal is to find out how ecocentric or anthropocentric the views of the participants are. NEP users as well as ENV users would categorize preservationist views as ecocentric while human dominance over nature (NEP) or utilization (ENV) as anthropocentric. As the labels suggest, persons with ecocentric views would be expected to put nature before human needs whereas anthropocentric persons would be expected to view nature as existing for the purpose of being used by humans. ENV users also suggest there is a possibility of persons who fall between ecocentric and anthropocentric views. Thompson and Barton (1994) describe the two views well and attempt to typify individuals who are associated with one view or another, as well as to make observations about how both sides view conservation. They characterize ecocentrism as the belief that nature

should be valued for its own sake, or its intrinsic value, while anthropocentrism is the valuing of nature because of the material or physical benefits it can provide humans, or its instrumental value. Thompson and Barton looked at the perceptions of ecocentric and anthropocentric individuals and found that both viewpoints had positive views toward environmental issues but the difference in their orientation was in their motive for supporting conservation. They found that ecocentric individuals wanted to conserve nature to preserve the intrinsic beauty of nature, while anthropocentric individuals wanted to preserve nature for its “value in maintaining or enhancing the quality of life for humans.” So, it should be noted that anthropocentric individuals can hold conservationist perceptions, but for different reasons than ecocentric individuals.

There are many EE type programs in existence and all of the studies I came across revealed perceptual change toward the environment after participation in the program (For example, Disinger, 2001; Hodgkinson and Innes, 2001; Lindemann-Matthies, 2002; Kruse and Card, 2004; Pande, 2001). The same was true for American administered programs and global programs. Most also share traits with the Earthkeepers program structure as well as experience and personal connection components. It is interesting to note that one study found that some participants in their wilderness program did not perceive nature as existing in their home towns. Haluza-Delay (2001) interviewed a handful of teenage participants before and after a twelve day adventure trip about their experiences and perception of nature. As with the other studies, the participants came away from the experience with a concern for the environment, but when questioned deeper on their ability to act upon their concerns in their own towns, most revealed that this would be impossible because nature did not exist in their homes. The teens has apparently constructed a view of “nature” as being wilderness, “not civilized,” or “where people are not” rather than the idea that nature could be the animals and plants within a city as well as surrounding it. Nature, it seems, can be an illusive or complicated concept to articulate.

While most studies of pre and post program perceptions look simply at change in perception, there have been studies on urban versus rural perception as well as differences in perception based upon age. Bogner and Wiseman (1997) looked at the perceptions of rural and urban pupils in Bavaria. They found that the only difference in perception was the verbal commitment to the environment, both urban and suburban students proclaimed a higher commitment to the environment than rural students. Bogner and Wiseman suggest two possible reasons for this difference. First, they cite that urban students would have been exposed more to

the degradation of nature by the construction of buildings and roads than rural students, and that rural students may have more utilitarian views of nature because of the “nature-extractive tradition of rural culture.” In the same study, Bogner and Wiseman found that participant age affected preservationist-oriented responses. Older students tended to respond more ecocentrically, whereas younger students tended to respond more anthropocentrically. The authors cited that older individuals would have had more education that could influence their perception of the environment.

### *Gender Perceptions*

Gender has long been studied as scientists and laymen alike have tried to determine the reasons for the differences between men and women, or as some studies have attempted, to show that there really is no difference between the sexes. This was especially prevalent during the 1970's when the feminist movement influenced scholars committed to equality (Goetz and Grant, 1988). Gender perception may stem from the societal stereotypes of gender thrust upon individuals beginning at the time of birth (Goetz and Grant, 1988; Lee, 1998; Linn and Hyde, 1991). These include the familiar: pink, dresses, and dolls for girls, and blue, action figures, and policemen for boys. Toddlers as early as three years old can identify these sexual stereotypes although their perception of gender changes as they approach the age of five (Martin and Little, 1990). Three year olds most often associated dresses with girls and toy trucks with boys among other stereotypes, but their responses indicated that one's gender is defined by their dress or toys. For example, the same individual is perceived as female if playing with dolls or wearing pink, but as male if wearing blue and playing with trucks. Apparently, gender in the minds of young children is not fixed. By the age of five, the same children had changed their perception of gender, perceiving it as constant. For example, they now perceived a girl wearing boy's clothes and playing with trucks still female.

The cognitive ability of boys and girls has also been studied to try and identify why there are fewer women in science than men. Both Goetz and Grant (1988) and Linn and Hyde (1991) have looked at the cognitive differences between genders of school children and adolescents. They found very minute differences between the genders and that these differences were specific to types of thinking processes. Initially, studies performed in 1974 showed that there were gender differences in verbal, quantitative, and spatial abilities, with boy's abilities in these areas being stronger. The consensus now is that the differences have been on the decline and are now

quite small. One reason, perhaps, according to Goetz, is that girls now have more equal access to participation in pre-college courses, that there has been some convergence in societal roles, and that there has been a greater participation of women in the workplace in recent decades. The researchers looked at the same cognitive abilities: verbal, quantitative, and spatial and found a difference only in the speed of visual-spatial abilities. One test of abilities involved participants having to rotate three-dimensional objects in their minds, and another involved time of verbal response. Girls in these two tests showed similar accuracy as boys, but were slower to complete the tasks. Linn and Hyde (1991) blur the gender ability gap even further by suggesting that these time differences in visual-spatial ability for girls can be minimized even further by training. Both of these studies also referenced previous studies that suggested boys showed more aggressive behavior than girls, but suggested that the reasoning was actually culturally learned rather than biological sighting that “macho” attitudes and perceptions of males varied greatly between individual males and societies.

Both the gender stereotypes and publicly perceived differing cognitive abilities of girls may be a contributing factor to the lack of women in science, especially math and physics. James Lee (1998) looked at the perceptions adolescents had of what attributes “constituted” a scientist, attributes believed to belong to one gender or another, and how students saw themselves as having attributes that befitted those perceived scientific qualities. Lee sent out surveys to adolescents asking them to report on the traits of many types of scientists (chemist, biologist, mathematician, geologist for example), their own traits, and if they believed they could become a scientist based on matching their traits with those of the scientists. The overall perception of scientists by both boys and girls was that scientists have masculine traits: “individualistic, hard, unemotional, and want to work with things”. Boys overwhelmingly identified themselves and scientists on the masculine side of the gender spectrum, whereas girls placed scientists on the masculine side and themselves on the feminine side, stating that they think of themselves as: “soft, emotional, and want to work with people.” So, the problem of fewer women in science does not seem to be a cognitive ability one, but one of societal perception of both gender and what qualities constitute a scientist.

#### *Gender perceptions on nature*

Few studies have been conducted on the differences gender may have on an individuals' perception of nature. The following three studies, to my knowledge, best represent the current

research on gender perceptions in EE, and none of them looks at the perceptions of American children as my investigation seeks to do. One study, by Petra Lindemann-Matthies, included gender perception of nature in a larger investigation of how children's perception of biodiversity changed after enrollment in a program called Nature on the Way to School. The study looked at more than four thousand 8-16 year olds in Switzerland and how their ability to recognize and name local plant and animal taxa on their way to school increased after participation in the program. The results of the study suggested that girls initially noticed more taxa, but that participation in the program similarly increased both girls' and boys' perceptions of local flora and fauna. This suggests that girls may be more ecologically aware, but that EE programs affect both genders equally (Lindemann-Matthies, 2002).

The second study, conducted by Steger and Witt in 1989, looked at gender differences in perceptions of ecological threats. In the eighties, nuclear power and acid rain were topics of public concern, and this study surveyed Canadian and American adults belonging to two groups: the general public and environmental activists. A version of the NEP was administered to males and females of these groups and the results varied between the sexes somewhat in the United States, but more so in Canada. The results of the NEP indicated that Canadian women from the public group expressed a "distrust of science and technology," "fear of nuclear power," and have "preservationist identifications" in comparison to males of the same group. In contrast, American women from the public group only showed differences in their preservationist views and "fear of acid rain" in comparison to their male counterparts. The activist groups also showed gender differences with females from both countries having higher preservationist perception of environmental risk than males. In both countries and groups overall, women seemed to have environmental perceptions that were more environmentally skewed than men.

The primary study of gender perception of nature was conducted by Bogner and Wiseman (2002) while testing their newly developed environmental perception battery, "Environmental Perception" (ENV) against another environmental perception battery, called the New Ecological Paradigm (NEP). The ENV battery sought to identify five primary factors in adolescents: "Care with Resources," "Intent of Support," "Enjoyment of Nature," "Altering Nature," and "Human Dominance." Questionnaires were administered during class sessions and scored on the ENV scale. The results showed a distinct pattern between the environmental perceptions of girls and boys. Girls scored high on the three factors: "Care with Resources,"

“Intent of Support,” and “Enjoyment of Nature” and low on “Human Dominance” indicating preservationist views, while boys on the other hand, scored low on the first three factors and high on “Human Dominance” indicating utilitarian views.

The data gathered from these studies suggests that there may indeed be a difference in gender perceptions of nature. In fact, it seems as if there may be a dichotomy among the genders in their view of nature: girls favor preservation or ecocentric views, while boys favor utilitarian or anthropocentric views. This generalization is based on only three studies however, which is why my study on gender perception of nature is relevant to this area of research.

### **Methods**

The questionnaire data were obtained from four Earthkeepers sites: McKeever Environmental Learning Center, T.R.E.E., Tucson, and Oracle from program years 2005-2006. The total number of student responses used in the analysis was 1286 after elimination of certain responders who did not meet the analysis criteria. Participant responses were eliminated if they had special needs, did not attend the full program, or gave patterned responses on the answer sheet. To determine if there was a significant difference in perceptual change after participating in the program a paired t-test comparing pre and post-questionnaire responses was run separately for each gender using a 95% confidence level. The difference between pre and post responses was calculated by subtracting the pre score from the post score and then dividing the result by the pre score to get an overall percent loss or gain. Participant gender's effects on ecological perceptions was studied by running an Analysis of Variance test (ANOVA) with 95% confidence level, again comparing the pre and post program scores. All questionnaire subfactors were compared in this analysis. An Effect Size test ( $\eta^2$ ) was then run for the factors that were shown to be statistically significant ( $p < 0.05$ ) to determine how strong of a difference in perception there really was between the genders.

### **Results**

This chapter reports the pre and post-program scores for boys and girls as well as the output for the statistical tests run on their questionnaire responses. The first section presents data showing the change in boys' environmental perceptions after attending the Earth Keeper's program and then reports the change in girls' environmental perceptions after attending the

program. The second section then compares the pre-program scores for boys to girls, the post-program scores for boys to girls, and then compares the overall change in scores for boys to girls.

A paired t-test was used to analyze the change in environmental perceptions of the participants. Boys' environmental perception scores had an overall statistical increase ( $p < 0.05$ ) for the factor of preservation and decrease for the factor of utilization. Their initial scores were 3.0 or higher which indicated that their perceptions were pro-environmental before attending Earthkeepers (see table 1). The increase in their preservation factor score and decrease in the utilization factor score indicate a shift toward an even more pro-environmental viewpoint. The change in the primary factors of preservation and utilization were due to a specific change in one sub factor. The change in preservation was due almost entirely to a 25% increase in the sub factor of care with resources as boys' scores on the sub factors of intent to support nature and enjoyment of nature did not increase with statistical significance. For the factor of utilization, boys' perceptions about dominance over nature did not increase statistically meaning that the increase in their utilization score was actually based upon their near 28% decrease in perceptions about altering nature.

Table 1. Changes in environmental perceptions pre to post program for boys.

Factor	<i>n</i>	Mean Scores			<i>t</i>	<i>P</i> *
		Pre-test	Post-test	Change in score		
<b>PRESERVATION TOTAL</b>	<b>467</b>	<b>3.75</b>	<b>3.84</b>	<b>.09</b>	<b>-3.06</b>	<b>.002</b>
Intent of support	498	3.63	3.65	.02	-0.50	.619
<b>Care with resources</b>	<b>497</b>	<b>3.77</b>	<b>4.02</b>	<b>.25</b>	<b>-6.61</b>	<b>.000</b>
Enjoyment of nature	493	3.82	3.80	-.02	0.45	.651
<b>UTILIZATION TOTAL</b>	<b>465</b>	<b>2.52</b>	<b>2.36</b>	<b>-.16</b>	<b>5.41</b>	<b>.000</b>
<b>Altering nature</b>	<b>485</b>	<b>2.93</b>	<b>2.65</b>	<b>-.28</b>	<b>7.56</b>	<b>.000</b>
Human dominance	492	1.98	1.99	.01	-0.22	.826

\**Italic* values indicate statistical significance.

For girls, the difference in environmental perception scores pre to post-program was also statistically significant ( $p < 0.05$ ) in both the primary factors of preservation and utilization. Girls' views were also pro-environmental before attending the program (above 3.0) and these results show that girls' preservation scores increased after attending the program and that their utilization scores decreased (fell below 3.0) after attending the program. An increase in a preservation score indicates that girls' perceptions about preservation were strengthened by the program (see table 2). Likewise, the decrease in the utilization score also indicates a shift toward a more pro-environmental view. Although girls' overall preservation scores increased

statistically the increase was due more to their change in the sub factor of care with resources rather than the sub factors intent of support or enjoyment of nature (this was the same sub factor in which boys increased). All three sub factors increased statistically after participation in the program, however the percent change in the sub factor of care with resources was 28% whereas intent was 7% and enjoyment was 11%. In the factor of utilization, girls again changed in one sub factor more than another. Under the factor of utilization are the sub factors altering nature and dominance over nature. While both sub factors decreased statistically indicating a more pro-environmental view, girls' perceptions about altering nature decreased by about 22% which was the same sub factor boys changed the most in, whereas the dominance sub factor decreased by about 9%, whereas boys showed little change in this sub factor.

Table 2. Changes in environmental perceptions pre to post program for girls.

Factor	<i>n</i>	Mean Scores			<i>t</i>	<i>P</i> *
		Pre-test	Post-test	Change in score		
<b>PRESERVATION TOTAL</b>	<b>423</b>	<b>3.87</b>	<b>4.03</b>	<b>.16</b>	<b>-5.70</b>	<b>.000</b>
<b>Intent of support</b>	<b>452</b>	<b>3.84</b>	<b>3.91</b>	<b>.07</b>	<b>-2.24</b>	<b>.026</b>
<b>Care with resources</b>	<b>451</b>	<b>3.86</b>	<b>4.14</b>	<b>.28</b>	<b>-7.65</b>	<b>.000</b>
<b>Enjoyment of nature</b>	<b>453</b>	<b>3.90</b>	<b>4.01</b>	<b>.11</b>	<b>-2.90</b>	<b>.004</b>
<b>UTILIZATION TOTAL</b>	<b>404</b>	<b>2.30</b>	<b>2.13</b>	<b>-.17</b>	<b>5.67</b>	<b>.000</b>
<b>Altering nature</b>	<b>429</b>	<b>2.63</b>	<b>2.41</b>	<b>-.22</b>	<b>6.27</b>	<b>.000</b>
<b>Human dominance</b>	<b>438</b>	<b>1.86</b>	<b>1.77</b>	<b>-.09</b>	<b>2.46</b>	<b>.014</b>

\**Italic* values indicate statistical significance.

The increases in preservation factor scores and decreases in utilization factor scores for both boys and girls indicate that both genders' environmental perceptions became more pro-environmentally oriented after attending the Earthkeepers program.

An analysis of variance test (ANOVA) was run on the pre-test scores for both boys and girls with a measure of association ( $\eta^2$  or  $\eta^2$ ) run on those factors that were significantly significant ( $p < 0.05$ ). The ANOVA test compared the mean pre-test scores for each factor and sub factor for boys against the mean pre-test scores for each factor and sub factor for girls. The output of this test resulted in statistically significant differences between the pre-test scores of boys compared to the pre-test scores of girls for all factors and sub factors (see table 3). Since a higher preservation score or a lower utilization score indicates a pro-environmental view, these results indicate that on average, girls were initially more preservation-minded before attending the Earthkeepers program than boys. The measure of association test run on these data looked for the strength of association between these differences in pre-test scores for boys and girls. In

other words, how great of a difference was the difference between the scores? The results of the  $\eta^2$  test indicated that the difference between scores was indeed very minute based upon the near zero values for  $\eta^2$ . This means, that although there was a statistical difference between the pre-test scores for boys and girls, the difference between the scores was small, so girls had only a slightly more pro-environmental attitude before entering the Earthkeepers program compared to boys.

Table 3. Comparison of boys' and girls' environmental perceptions pre and post-program

Pre-Program	Mean Score		<i>F</i>	df	MSE	<i>P</i> *	$\eta^2$
	Boys	Girls					
<b>PRESERVATION TOTAL</b>	<b>3.75</b>	<b>3.87</b>	<b>15.49</b>	<b>898, 899</b>	<b>6.09</b>	<b>.000</b>	<b>.017</b>
<b>Intent of support</b>	<b>3.63</b>	<b>3.84</b>	<b>23.26</b>	<b>898, 899</b>	<b>13.61</b>	<b>.000</b>	<b>.025</b>
<b>Care with resources</b>	<b>3.77</b>	<b>3.86</b>	<b>5.63</b>	<b>898, 899</b>	<b>3.43</b>	<b>.018</b>	<b>.006</b>
<b>Enjoyment of nature</b>	<b>3.82</b>	<b>3.90</b>	<b>4.93</b>	<b>898, 899</b>	<b>3.47</b>	<b>.027</b>	<b>.005</b>
<b>UTILIZATION TOTAL</b>	<b>2.52</b>	<b>2.30</b>	<b>21.10</b>	<b>898, 899</b>	<b>8.20</b>	<b>.000</b>	<b>.023</b>
<b>Altering nature</b>	<b>2.93</b>	<b>2.63</b>	<b>23.07</b>	<b>898, 899</b>	<b>12.91</b>	<b>.000</b>	<b>.025</b>
<b>Human dominance</b>	<b>1.98</b>	<b>1.86</b>	<b>6.79</b>	<b>898, 899</b>	<b>3.58</b>	<b>.009</b>	<b>.008</b>
Post-Program	Mean Score		<i>F</i>	df	MSE	<i>P</i> *	$\eta^2$
	Boys	Girls					
<b>PRESERVATION TOTAL</b>	<b>3.84</b>	<b>4.03</b>	<b>20.65</b>	<b>898, 899</b>	<b>10.20</b>	<b>.000</b>	<b>.022</b>
<b>Intent of support</b>	<b>3.65</b>	<b>3.91</b>	<b>25.31</b>	<b>898, 899</b>	<b>18.56</b>	<b>.000</b>	<b>.027</b>
<b>Care with resources</b>	<b>4.02</b>	<b>4.14</b>	<b>4.34</b>	<b>898, 899</b>	<b>2.58</b>	<b>.038</b>	<b>.005</b>
<b>Enjoyment of nature</b>	<b>3.80</b>	<b>4.01</b>	<b>17.50</b>	<b>898, 899</b>	<b>13.44</b>	<b>.000</b>	<b>.019</b>
<b>UTILIZATION TOTAL</b>	<b>2.36</b>	<b>2.13</b>	<b>25.89</b>	<b>897, 898</b>	<b>11.54</b>	<b>.000</b>	<b>.028</b>
<b>Altering nature</b>	<b>2.65</b>	<b>2.41</b>	<b>25.42</b>	<b>897, 898</b>	<b>14.44</b>	<b>.000</b>	<b>.028</b>
<b>Human dominance</b>	<b>1.99</b>	<b>1.77</b>	<b>13.95</b>	<b>898, 899</b>	<b>8.22</b>	<b>.000</b>	<b>.015</b>

\**Italic* values indicate statistical significance.

An analysis of variance test (ANOVA) was also run on the mean change in scores (post-test minus pre-test score) for both boys and girls with a measure of association ( $\eta^2$  or  $\eta^2$ ) run on those factors that were significantly significant ( $p < 0.05$ ). The ANOVA test compared the mean change in scores for each factor and sub factor for boys against the mean change in scores for each factor and sub factor for girls. The output of this test resulted in statistically significant differences between the mean change in scores of boys compared to the mean change in scores of girls for the factor of preservation and the sub factor of enjoyment of nature (see table 4). The difference in mean change in scores for the other preservation sub factors and all of utilization and its sub factors were not statistically significant. This means that girls changed in their perception of enjoyment of nature more than boys, but that within the other sub factors of preservation, the factor of utilization and its sub factors, boys and girls changed their perceptions of the environment equally. The results of the  $\eta^2$  test indicated that the difference between

preservation and enjoyment of nature scores was again minute based upon the low values for  $\eta^2$ . This means, that although there was a statistical difference between the mean change in scores for boys and girls in the area of enjoyment of nature, the difference between the scores was very small. These results indicate that the Earthkeepers program overall affects the attitudes of boys and girls equally.

Table 4. Comparison of changes in boys and girls environmental perceptions pre and post-program.

Factor	Change in score		<i>F</i>	df	MSE	<i>P</i> *	$\eta^2$
	Boys	Girls					
<b>PRESERVATION TOTAL</b>	<b>.09</b>	<b>.16</b>	<b>4.19</b>	<b>888, 889</b>	<b>1.47</b>	<b>.041</b>	<b>.14</b>
Intent of support	.02	.07	1.48	948, 949	0.85	.224	-
Care with resources	.25	.28	0.32	946, 947	0.22	.572	-
<b>Enjoyment of nature</b>	<b>-.02</b>	<b>.11</b>	<b>5.92</b>	<b>944, 945</b>	<b>3.87</b>	<b>.015</b>	<b>.16</b>
UTILIZATION TOTAL	-.16	-.17	0.05	867, 868	0.02	.824	-
Altering nature	-.28	-.22	3.41	912, 913	0.81	.065	-
Human dominance	.01	-.09	1.30	928, 929	2.09	.254	-

\**Italic* values indicate statistical significance.

Boys and girls initially had pro-environmental perceptions before attending Earthkeepers and these perceptions were strengthened by the program as indicated by an increase in boys and girls preservation scores and decrease in utilization scores. Girls did have a slightly more pro-environmental response on the questionnaires than the boys indicating that on average girls are more preservation-minded than boys. While significant, this difference was shown to be minute by the  $\eta^2$  test. The overall impact of the program on boys' and girls' perceptions showed that girls were impacted more than boys for the factors of preservation and enjoyment of nature, but again, these differences were shown to indicate a very small difference that indicates that the Earthkeepers program affects male and female participants equally.

## Discussion

This section first reports the conclusions of this study and then proceeds to reflect on the study's limitations, the logical next steps for research, and finally the implications of these results for the Earthkeepers Program.

### Conclusions

The results of this study indicate three main findings. First, that participants of Earthkeepers perceptions became more pro-environmental after attending the program, secondly, that on average girls' perceptions of nature before attending the Earthkeepers program were

statistically higher than boys' but that this difference was small, and thirdly that girls' perceptions were changed more than boys, again the difference being small.

The findings of this study were in line with the few previous studies on gender and environmental perceptions reviewed at the beginning of this report. The main findings, that environmental education programs impact the participants by increasing their pro-environmental perceptions and decreasing their utilization perceptions and that girls on average have more preservationist perceptions than boys were also found by Steger and Witt (1989), Bogner and Wiseman (2002), and Lindemann-Matthies (2002). The limitations of these studies were however that they did not look at how different the perceptions between boys and girls were. This study showed that the perceptions of girls were statistically more pro-environmental both pre and post program but that the differences were small. It should be noted however, that the difference between gender environmental perceptions was real, and that the small difference does not necessarily indicate an insignificant difference. One must consider that the goal of Earthkeepers is to change the participants' perceptions and that changing a person's personal views is a difficult task. Recall that children's perception of gender and gender roles in science (James Lee, 1998; Martin and Little, 1990) are deeply rooted within American culture and media. The same can be said for perceptions about environmental preservation or utilization, so therefore any change in perception or difference between perceptions should be considered a real change, however small.

#### *Limitations of the study*

The primary limitation of this study is the fact that it relies upon the study participants to provide the data via questionnaires. While other studies rely on empirical data that can be physically measured, the environmental perceptions of the participants are just that, perceptions, and furthermore, they are self-reported. Environmental perception questionnaires such as the NEP and ENV have been used since the 1970's and their validity has been tested many times over the course of their use (Bogner and Weismann, 1999; Bogner and Weismann, 2002; Bogner and Weismann, 2003; Dunlap 2000) so their ability to accurately depict the perceptions of the study participants has been accepted, however the validity of the findings can only be as valid as the participant responses. In other words, the results are based on the assumption that participants are responding truthfully to the questionnaires and that there is no incentive to

respond in one fashion or another. In addition to the limitations to how the data were gathered, is the limitation of generalizing these findings to other environmental education programs. While these data and findings are pertinent to the Earthkeepers programs at the four study locations, the responses represent a small portion of the participants in Earth Education nationally, as well as globally. They also only represent participants in the program over the span of two years. This is not to say that these findings cannot be used to provide insight into gender and environmental perceptions, or even the effects of environmental education programs, but caution should be taken when considering extrapolating these findings to a larger demographic.

### *Suggestions for further research*

The three previously known studies (Steger and Witt, 1989; Bogner and Wiseman, 2002); and Lindemann-Matthies, 2002) in combination with this study provide a basis for future studies in the area of gender and environmental perception research. These studies have each been limited to only one program and perhaps to only one or two years of data. Future studies should consider pooling larger samples of data from over many years, many locations, and from different types of environmental education programs. This would be the most comprehensive approach to gender and environmental perception studies, but would be an enormous undertaking. A more feasible task would be for each EE program to collect many years worth of data from each of its program locations and to use this data to draw conclusions about the effectiveness of their own program and the perceptions of their own participants.

### *Implications for the Earthkeepers Program*

The results and conclusions of this study imply that the goal of the Earthkeepers program to change the participants' perceptions to be more pro-environmental is working and that although there are differences in the way that boys and girls perceive nature, the program overall affects both genders equally. Had the study found that only boys' or only girls' perceptions were changing after participation in the program indicating a gender bias, then the program should have taken those findings into consideration and evaluated how the program could be modified to better suit both genders. This is not the case however, and the Earthkeepers program should be pleased to know that this study found no gender bias within their program. It should be noted however, that since differences in gender perceptions of nature were found to exist, that the

program should continue monitoring the success of the program among and between each gender as it has done previously with the general monitoring of the program's success.

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