

## Increasing Children's Positive Connection To, Orientation Toward, and Knowledge of Nature through Nature Camp Experiences

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### ABSTRACT

What do children actually carry away from participating in planned activities in natural areas such as those in outdoor camps and schools? Prior research has seldom been rigorous in establishing participants' connection to, knowledge of, and orientation toward nature before intervention, followed by a clear specification of what range of experiences in nature are included in an intervention, together with the rigorous assessment at post-test, after the educational intervention. This study provided such a design for children who attended an outdoor nature camp in the Pennsylvania woods. Fifth-grade campers (177) were administered pre-test and post-test measures. Findings demonstrated significant gains in areas of connection to, knowledge of, and orientation toward nature. Relative to prior developmental literature, the gains made by the children through their nature camp experience are particularly broad and significant. Overall, the data derived from this study show impressive impacts of a four-day outdoor nature program and will help inform future efforts to improve the quality and impact of outdoor nature camps and similar experiences in nature.

### KEYWORDS

experimental design, nature awareness, nature camp, Nature Education, nature connectedness

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### Introduction

Childhood is moving indoors. With technology on the rise and spaces for outdoor play on the decline, most children are developing primarily in classrooms and homes instead of the outdoors. This generation's increasing technology gives more reason for children to stay in the living room, experiencing the natural world vicariously through a television screen or a computer or cell phone interface. However, the difference that separates this new generation of children from the previous generation does not rest solely on

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the technology introduced in the past decade. The subsequent effects of children spending more time indoors include a decrease in exposure to nature. As each generation of children spends less and less time in nature, there is a clear demand for researchers to examine if any adverse effects will follow (Chawla, 2009; Louv, 2006; van den Berg & van den Berg, 2010).

### *The Introduction of Nature to Psychology*

Previous research (Tanner, 1980; Wells, 2000; Wells, 2006) introduced the concept of nature experiences to the field of psychology to examine the effects nature might have. Nearing the end of the twentieth century, a study by Tanner (1980) emerged as the first of its kind concerning formative influences on the lives of 45 dedicated conservationists. These experiences of hours spent outdoors or having examples of parents or teachers fostering an interest in nature were stated to be the single most important influence on individuals (Tanner, 1980 as cited in Wells, 2006).

Wells (2000) shifted the focus on nature towards the outcome of children's cognitive functioning while living in a poor, urban environment as contrasted with a greener, more natural environment. At this time, research began to examine cognitive or attentional benefits of nature experience. The restorative effects that were identified in this new study were increases in positive behavior, knowledge, and motivation after being in a greener, more natural environment, almost as if they had been restored to their previous levels before being affected by the urban environment and lack of nature (Wells, 2000). Wells' (2000) findings showed the restorative qualities of the housing a child lives in accounts for an additional 19% variance in attentional capacity of cognitive functioning when the environment is changed, beyond the 50% of variance the study previously determined to be explained by the pre-move attentional capacity.

This additional 19% variance statistic includes controls for differences in the quality of housing and surrounding socioeconomic status variables to focus solely on the restorative qualities of the natural environment. Even in a modest sample size of 17 children, this shows the profound effect of nature on a child's cognitive functioning while living in these environments. This outcome is consistent with some prior studies using non-longitudinal methods, but which also suggest that children who lived around more natural areas found benefits on their cognitive functioning and attentional capacity (Kaplan & Kaplan, 1983; Kaplan & Kaplan, 1989; Hartig, Mang, & Evans 1991; Kaplan, 1995; Wells, 2000).

This study shows significant positive gains when living in a more natural environment. The longitudinal design allows for comparisons between the pre-move and post-move environments. However, the design of this study is still focusing on the examination of short-term effects. The post-move test was given to the children after four months of living in the new, greener environment with higher ratings of more natural views in and outside of the house with less built environment surroundings (Wells, 2000).

### ***Environmental Trajectories in Adulthood***

Using a long-term focus, Wells (2006) investigated if childhood participation with nature would motivate an individual toward adult environmentalism. The study was designed to compare “wild” and “domesticated” to see how these childhood experiences influenced different environmental behaviors for adulthood. Wells (2006) defined “wild” nature as hiking or playing in the woods, camping, and hunting or fishing. “Domesticated” nature was defined as picking flowers or produce, planting trees or seeds, and caring for plants.

The participants included 2,004 adults aged 18-90 from the 112 most populated areas across the nation (excluding Alaska and Hawaii). The participants were interviewed using 108 questions about participants’ own childhood experiences in nature and their current attitudes toward the environment as adults. The results showed both “wild” as well as “domesticated” nature participation in childhood had a statistically significant effect on environmental attitudes toward adulthood in a positive direction (Wells, 2006).

### ***Connection to Nature***

The connection to nature variable originated in a study by Bragg, Wood, Barton, and Pretty (2013). Bragg et al. (2013) aspired to create a measure to determine a specific level of a person’s connection to nature. Using a sixteen-item questionnaire called the Connection to Nature Index (CNI), this measure was able to assign a point value to a person that reflected their overall attitude toward the environment (Bragg et al., 2013). The CNI includes four categories of questions: enjoyment of nature, empathy for creatures, sense of oneness, and sense of responsibility. The development of this index allows for a standardized test to be given before and after nature exposure experiences.

### ***Role of Environmental Education***

Andrejewski (2011) used a quasi-experimental research design to investigate the role of a residential environmental education program on a variety of variables in children including connection to nature, outdoor play behavior, and environmental stewardship attitude. The results from the study indicated stronger significant positive gains were found for the experimental/outdoor nature camp vs. control/classroom children in ecological knowledge, connection to nature, outdoor play behavior, and environmental stewardship behavior. The mean gains were fairly modest, with the largest mean increase being 19.1% for ecological knowledge in the treatment group (Andrejewski, 2011).

The newest developmental research on the topic comes from Erdoğan (2015), who assessed the effects of a summer environmental education program (SEEP). This program consisted of six modules in science, biodiversity, sports, art, drama, and psychology. For all modules, the students were encouraged to actively involve themselves in the first-hand experiences. The students were given a theoretical lesson in a laboratory or classroom and then participated in

an outdoor component such as plant collection, bird watching, drawing pictures of nature, observation of soil, etc. (Erdogan, 2015). This study aimed to investigate SEEP's effects on the variables of environmental knowledge, affect, skills, and behavior—the components that make up environmental literacy. The sample of this study consisted of 45 students from the 4th to the 8th grade. A total of 25 males and 20 females completed the standardized testing measures given before and after SEEP. The results of this study showed a positive gain in environmental literacy after SEEP.

### ***Limitations of Prior Research***

Although the studies above each examined different variables, used different measures, and studied few subjects in depth to many persons at a more surface level, all studies came to a common conclusion: exposure to nature shows positive gains during childhood and may be related to some positive later adult attitudes toward nature and involvement in nature. Most research to this point has also been observational in nature or based upon interviews—it has been rare to have any experimental variation in plans or procedures related to environmental education programs.

### ***Narrative Writing***

An innovative variable that can be examined is the use of narrative writing. Bringing nature knowledge to writing is a subject that has not yet been investigated. For the first time, in the present research we examine not only questionnaire data but also the quality of narratives concerning nature in terms of factual knowledge, mentions of environmental stewardship, causal relationships, and length.

### ***Present Study***

The goal of this research study will be to determine the effects of a four-day environmental education program conducted in a camp in a nature-rich context (Penn State Outdoor School). It is predicted that significant gains on both questionnaire and narrative measures will be shown in the variables of connection to nature, environmental stewardship, and knowledge of nature.

## **Methods**

### ***Participants***

The study participants included 177 fifth grade campers between the ages of 9 to 11 from various elementary schools in Huntingdon and Mifflin Counties who have chosen to attend Penn State's Outdoor School in the fall of their school year. There were 76 male campers and 96 female campers and 1 camper identifying as Other who participated in the pre- and post-tests. The approximate ethnic distribution of the sample was 6.2% American Indian/Alaska Native, 4.0% Asian, 1.1% Black/African American, 0.6% Native Hawaiian/Other Pacific Islander, 0.6% Hispanic, and 87.6% White/Caucasian.

### ***Data Collection Procedure***

A repeated measures design was implemented in the form of a pre-tests and post-tests. One week prior to attending the environmental education program, the measure was administered by the Primary Investigator to the fifth-grade campers in their typical classroom environment in order to establish a baseline. Upon the conclusion of the environmental education program, the campers were administered the same set of measures and the changes in response were analyzed. The complete pre- and post-assessment package of measures included four blocks: the Connection to Nature Index; specific knowledge questions; a Self-Efficacy scale for perceptions of actions towards nature; and two narrative writing samples that were analyzed for connection to, knowledge of, and orientation toward nature.

### ***Connection to Nature***

As previously mentioned, an individual's connection to nature can be defined as the extent to which an individual identifies with nature and considers nature as a part of their daily life. The first section of the measure was taken from the previously mentioned CNI (Bragg et al., 2013), a sixteen-item questionnaire rated on a seven-point scale of Strongly Agree to Strongly Disagree. The sixteen items are based on four dimensions: (a) enjoyment of nature, (b) empathy for creatures, (c) sense of oneness, and (d) sense of responsibility (Bragg et al., 2013). By taking an average of all the items on the CNI, a score out of 5 is provided for each participant (5 being extremely connected to nature and 1 being extremely disconnected from nature).

### ***Environmental Stewardship***

An individual's environmental stewardship or orientation toward nature refers to the actions or behaviors an individual takes in order to preserve the environment. Environmental stewardship was measured using Bandura's (2006) self-efficacy scale with adapted components to examine an individual's level of nature efficacy. The Self Efficacy scale was adapted from Bandura's (2006) study by creating questions using information from Chawla's (2009) synthesis of research instead of using questions about an individual's own efficacy (confidence in one's own actions). These questions covered the efficacy of doing actions of environmental stewardship, for example an individual's perception of being able to eat all meals for one day with zero food waste or being able to tell a friend to recycle instead of throwing away a water bottle. Participants rated their confidence in their ability to do these actions on a scale of 1-100 (100 being very confident, 1 being not confident at all). This measure examines an individual's perception of their own ability to act rather than their thoughts and feelings on issues of stewardship in the environment.

### **Knowledge of Nature**

Specific knowledge of nature can be defined as the level of information an individual understands surrounding topics about plant life, animal life, and species interactions. The third block of the measure included specific knowledge questions about animals and the environment. Therefore, knowledge of nature was measured using seven multiple choice questions created by the authors pertaining to the Outdoor School curriculum. These seven questions were multiple choice and included knowledge such as knowing the term for animals that only come out at night. These questions were pilot tested as a part of pre-research in an Online Survey created on Qualtrics. The specific knowledge score was calculated as the number of correct answers out of the seven.

### **Narrative Writing Samples**

The final block of the measure included two samples of writing covering two questions, “Tell me about one kind of wild animal living in nature that you find extremely interesting” and “How have some people have helped the health and survival of one kind of wild animal living in nature?”. The individual was given five minutes to write openly and the measure was coded for variables of word count, causal linkages in sentences, mentions of environmental stewardship, and inclusion of factual knowledge. These coded measures thus provided another way of measuring, beyond the survey measures, multiple aspects of nature attitudes and knowledge.

### **Results**

Measures of connection to nature, environmental stewardship, and knowledge of nature, including scored narratives were submitted to Paired Samples *t*-Tests. All means, standard deviations, and *t* values can be found in Table 1. Significant gains from pre-tests to post-tests were shown in the variables of connection to nature ( $M = .186$ ,  $SD = .35$ ,  $t = 6.912$ ,  $p < .001$ ), environmental stewardship ( $M = 10.836$ ,  $SD = 20.42$ ,  $t = 6.918$ ,  $p < .001$ ), and knowledge of nature ( $M = 27.764$ ,  $SD = 23.28$ ,  $t = 15.866$ ,  $p < .001$ ).

Within the narratives, gains in factual knowledge in the Health and Survival narrative showed a significant increase ( $M_{H\&S} = .145$ ,  $SD = .90$ ,  $t = 2.078$ ,  $p < .05$ ) while word count in both narratives showed a significant decrease ( $M_W = -6.604$ ,  $SD = 17.36$ ,  $t = 4.945$ ,  $p < .001$ ;  $M_{H\&S} = 7.090$ ,  $SD = 16.94$ ,  $t = 5.391$ ,  $p < .001$ ). A marginally significant trend was found as an increase in factual knowledge for the Wild Animal narrative ( $M_W = .214$ ,  $SD = 2.09$ ,  $t = 1.330$ ,  $p < .10$ ).

**Table 1.** Paired Samples t Test of Campers' Changes: Post-Mean minus Pre-Mean

<i>Measure</i>	<i>M Differences</i>	<i>SD</i>	<i>t</i>	<i>Cohen's d</i>	<i>Sig. (1-tailed)</i>
<b>CNI</b>	.186	.35	6.912	0.53	.000
<b>ES</b>	10.836	20.42	6.918	0.53	.000
<b>Knowledge</b>	27.764	23.28	15.866	1.19	.000
<b>WordsW</b>	-6.604	17.36	4.945	0.38	.000
<b>WordsH&amp;S</b>	-7.090	16.94	5.391	0.42	.000
<b>MentionW</b>	.006	.21	.377	0.03	.354
<b>MentionHS</b>	-.134	1.73	.994	0.08	.161
<b>Causal W</b>	-.047	1.12	.548	0.04	.292
<b>Causal H&amp;S</b>	.012	1.57	.099	0.01	.461
<b>FactsW</b>	.214	2.09	1.330	0.10	.093
<b>FactsH&amp;S</b>	.145	.90	2.078	0.16	.020

**Note:** CNI = Connection to Nature Index; ES = Environmental Stewardship; W = Narrative about Wild Animal, H&S = Narrative about Health and Survival

## Discussion

### Summary

The purpose of this study was to examine the effects of Penn State's Outdoor School, a residential environmental education program conducted in a camp in a nature-rich Pennsylvania woods context. Using an innovative approach with narrative writing, this study also expected to investigate if the results from the first-time use of this measure would also demonstrate pretest-to-posttests gains concerning nature. There were positive and substantial gains by the fifth-grade campers in all areas of connection to nature, environmental stewardship, and knowledge of nature. After participation in the Outdoor School program, children felt nature to be more a part of their lives, were more conscious of how their actions impacted the environment, were more likely to take action to protect the environment, and were more knowledgeable about nature.

In the narratives, factual knowledge of nature was found to increase significantly from pre-test to post-test on one measure and marginally so on another. Considering together all the narrative measures, it appears that children's knowledge is better integrated and expressed through their writing. In essence, increases in knowledge but conveyed in shorter word counts for narratives illustrates that children are better able to concisely convey information through their writing about nature after the completion of the Outdoor School program.

The following excerpts from the post-test narratives about Health and Survival illustrate the kinds of specific knowledge about nature the children were able to remember and express through a brief writing sample:

*The people can grow flower so butterfly can drink nectar. We can grow different kinds of flowers or winterberry shrubs or milkweeds. So animals can stay health can clean.*

*People have helped the creatures living in the water by keeping water non-polluted. They do this by not throwing garbage into the water and not putting oil in the water either. The way to know if the water is polluted or non-polluted is to check what animals live in the water. Say, if there was a salamander in the water, it's non-polluted. If there's a crayfish, there might be pollution. All you have to do is see what animals are in the water.*

*People helped owls because owl were almost extinct. Since people helped owls the owls keeps the mice population low. People help the health and survival of owl from taking owls out of one part of the country when there was a disease risk for owls. Owls are now a helping part of the community thanks to people.*

*People have helped the health of deer in nature by making safe areas for them, but have hunting season so deer don't over populate then all due to lack of resources. The safe areas for deer can range from actual non-hunting zone, to cover of night, to even other animals. Hunting season encourages deer to be shot, and that helps keep deer from overpopulating and all dying out.*

*People have helped the health and survival of many species such as the Bald Eagle. The bald Eagle is a very special species. It is so special because it is endangered. The Bald Eagle is a very big bird. This means that there is not many left in the world. We have made laws to protect the Bald Eagle. This law says that we are not allowed to shoot, injure or kill them.*

### **Comparisons to Prior Research with Children at Nature Camps**

Previous research demonstrated modest gains due to exposure to nature in the areas of cognitive functioning such as attentional capacity, adult environmentalism, ecological knowledge, connection to nature, outdoor play behavior, environmental stewardship behavior, and environmental literacy (Wells, 2000; Wells, 2006; Andrejewski, 2013; Erdoğan, 2015). The present study takes a similar design to the most recent prior study in the literature by



Erdog an (2015), however, it specifically focuses on connection to nature, environmental stewardship, and knowledge of nature. Using a pre- and post-test, repeated measures design for an environmental education program, both studies clearly show significant effects on planned behavior towards the environment which is a part of environmental stewardship. There are also significant effects in both studies on positive affect towards the environment which is part of connection to the outdoors. Finally, there are significant effects in both studies in relation to knowledge of the environment. Together, Erdog an (2015) defines these three areas as components of environmental literacy. The present study used a larger sample and showed similar effect sizes as the study by Erdog an (2015). Erdog an (2015) showed small to medium effect sizes for Environmental Affect sub-scales ( $d = .41$ ;  $d = .64$ ;  $d = .56$ ) and medium effect sizes for Environmental Behavior sub-scales ( $d = .52$ ;  $d = .59$ ;  $d = .7$ ) while the present study showed a medium effect size for Connection to Nature ( $d = .53$ ) and a medium effect size for Environmental Stewardship ( $d = .53$ ). In addition, the present study showed more robust gains on Knowledge of Nature. Erdog an (2015) displayed a small effect size for Environmental Knowledge ( $d = .31$ ), while the results of the present study showed a large effect size for Knowledge of Nature ( $d = 1.19$ ).

The study by Erdog an (2015) took place in Turkey, showing that the similar positive changes for the children and the similar effect sizes found in the present study are generalizable across cultures. In essence, despite any cultural differences between Europe and the United States, participation in summer environmental education programs in Turkey and participation in Outdoor School in Pennsylvania result in very similar effects on environmental affect and behaviors.

It is important to make clear that the present study is broader in scope of measures and with a larger sample size of children than most prior studies. It shows similar directions of findings to those in prior literature exemplified through similar questionnaire measures, but the present study gains on these measures generally are stronger than those in prior intervention studies with children. Moreover, there are significant gains shown using innovative narrative measures.

### ***Implications for Teaching Children***

The results of this study indicate that a four-day program for fifth graders at an outdoor nature camp led to substantial changes in multiple aspects of their knowledge of and attitudes and beliefs concerning nature. In education, these intervention programs could be worked into curricula that include direct experiences in natural settings or encourage a reform of the current classroom teaching techniques. A future study comparing the effects of a standard school to a school teaching nature education with more exposure within the school day would be beneficial. The results of this potential study could show if nature exposure on a daily level would help children in a significant way that justifies the curriculum changes. Future research studies in psychology and education

could capitalize on the implications and test the efficacy of the potential changes in curriculum to see if they are improving the same variables in the normal classroom area.

Other studies of intervention programs that could take place without changing curricula could be creating initiatives for schools to have their students play and explore outside more in nature. A beneficial study could examine the effectiveness of extra-curricular clubs created to study nature, after school programs that include outdoor play, or even a school-wide challenge event for tracking new knowledge learned about nature or how much time was spent outside discovering nature. The study's results would show if these initiatives would increase the desire for children to go outdoors and become more connected to nature.

Research in this area of development also could encourage parents to interact with their children in nature to try and foster a connection to the environment. Due to the increasing usage of technology in the modern era, parents might be more inclined to let their children stay indoors and occupy themselves with many different types of screens. However, research like this study could motivate parents to change the direction of their children's hobbies and promote outdoor activities in their children's daily lives, if possible, or at least find ways to get support for their children to periodically visit natural areas through special summer camps or other programs.

### ***Limitations***

The sample of participants in this study was predominately Caucasian. Lack of a diverse sample could limit the generalizability of the results found in this study. Nevertheless, the sample studied demonstrated that substantial gains were found in connection to and orientation toward nature and nature stewardship as well as in knowledge of nature.

### ***Future Research***

Future studies should strive to obtain a more heterogeneous sample in order to collect new narratives as well as survey and questionnaire instruments from a more diverse population. Using written narratives as an innovative measure would require further research into the collection and interpretation of the narratives to confirm the reliability of the coding measure. The potential for narratives is high for assessing the integrated knowledge and attitudes and action commitments shown by individuals participating in the environmental education program.

In addition, it would be valuable to focus future studies on more intensive interventions to see if a more intense program results in higher effect sizes and evidence of lasting changes. Future research might address as well whether directly training narrative complexity for nature topics could profit from prior research on training narrative skills overall in children (Khan, Nelson, & Whyte, 2013; Nelson & Arkenberg, 2008).

## Conclusion

Overall, this study expands upon a fairly small set of previous studies and findings regarding exposure to nature through direct experience for children in nature camps or similar settings. The present study employed a broader set of measures and a larger sample size within a pre-test/intervention/post-test design than any prior study. Strong gains were demonstrated on multiple measures in this investigation: orientation toward nature, knowledge of nature, and levels of factual knowledge in both narrative and questionnaire measures. In addition, the present results converge with the few prior pre-test/intervention/post-test studies in showing gains on the measure of connection to nature used most commonly across the studies. Relative to the most germane prior studies, the level of gains made in this study are similar in kind but stronger. The level of gains made in this study also reflect these gains in a broader scope from just the questionnaire measures through the results of the innovative use of the narrative measures. These new narrative measures include word count, mentions of environmental stewardship, inclusion of causal relationships, and reporting of factual knowledge.

## Disclosure statement

The Authors reported that no competing financial interest.

## Notes on contributors

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