

THE IMPACT OF A SUMMER EDUCATION PROGRAM ON THE ENVIRONMENTAL ATTITUDES AND AWARENESS OF MINORITY CHILDREN

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Abstract.—The environmental education (EE) of America's youth is a high priority, but the effect of EE on children's environmental attitudes and awareness remains uncertain. This study used a pretest, post-test approach to investigate the impact of a 1-week EE summer program on children from different age groups and ethnic backgrounds. A survey instrument designed to measure children's views of nature was created and validated through a multi-step process, revealing three primary components of attitudes and awareness: eco-affinity, eco-awareness, and content knowledge. Potential EE program effects were examined by comparing subscale scores of participants in a treatment and control group at the beginning and end of a 1-week period. Results suggested that EE programs may benefit older children's eco-affinity and African American children's eco-awareness. This study could be used to generate support for EE programs in underserved populations.

1.0 INTRODUCTION

According to the National Environmental Education and Training Foundation, few American citizens are adequately prepared to face the complex environmental issues of the future (Coyle 2005). This problem is especially evident in children, who increasingly succumb to an affliction known as "nature-deficit disorder" (Louv 2005). Indirect and

vicarious exposure to nature, often achieved through school and the media, are inadequate substitutes for direct encounters with native ecosystems (Kellert 2005). Environmental education (EE) may help correct nature-deficit disorder. Programs that influence the development of environmental attitudes and awareness may help children learn more effectively and build environmental stewardship values from an early age (Evans et al. 2007). Although EE has been hailed as a panacea for many environmental problems, few studies have demonstrated quantifiable impacts of an EE program on children's affective development (Eagles and Demare 1999, Leeming et al. 1993). Additional research is needed to investigate these ambiguous impacts of EE programs on children's environmental attitudes and awareness.

The absence of data regarding EE program effects on minority children, who represent a rapidly growing segment of the U.S. population, is a present concern. Minority children often come from urban neighborhoods where encounters with nature are limited, and this dearth of experience may have a negative impact on their environmental attitudes (Bullard 2006). Additionally, many common assumptions regarding the environmental attitudes and awareness of minorities may be inaccurate (Jones 2002). The development of a reliable method for assessing affective growth sparked by EE might help generate more financial support for programs that enable minority children of low socioeconomic status to experience nature and develop positive environmental values.

In an effort to address growing concerns regarding the role of EE in children's environmental orientation, this study focused on three primary objectives: (1) the development of a reliable and valid survey instrument to measure the environmental attitudes and awareness of children; (2) a comparison of the baseline environmental attitudes and awareness of children from different age and ethnic groups;

and (3) an evaluation of EE program impacts on the environmental attitudes and awareness of children from different age and ethnic groups. An empirical evaluation of EE program effects might yield important information about the formation and development of children's attitudes toward the environment. Furthermore, results could affect the design and scope of future EE programs, especially those focused on underserved populations.

2.0 METHODS

This study involved 190 children participating in summer EE programs and after-school programs in the Athens, GA, area. Data for children in the EE treatment groups were collected from June 18 through August 10, 2007. Data for children in the after-school control groups (ASP) were collected from December 2007 through March 2008. Ages ranged from 6 to 13, but a majority of the participants were between the ages of 8 and 11 (mean age = 9.5 ± 1.44). Children were placed in age group categories (6- and 7-, 8- and 9-, 10- and 11-, and 12- and 13-year-olds) to mitigate unequal sample sizes and developmental differences. Gender and ethnic (African American and white) ratios were approximately equal. A very small number of Hispanic students enrolled in ASP also participated in the study.

Children's environmental attitudes and awareness were measured using a survey consisting of 21 total items: 16 statements with Likert-type responses, four multiple-choice questions, and one open-ended response item. The Environmental Attitude and Awareness Survey (EAAS) instrument was created and modified through a multi-step process that included an in-depth literature review, initial scale construction, pilot testing, scale revision and reduction, and additional refinement. Items from existing scales were adapted to cover general concepts and specific facts related to the environmental education curriculum, creating an efficient and effective modified evaluation tool suitable for children (Leeming et al. 1995, Manoli et al. 2007). The Likert-type attitude scale ranged from "strongly disagree" to "strongly agree" (with numerical response values of one to five for each item). Four multiple choice questions and one open-

ended response item were included to test content knowledge directly addressed by activities in the EE program and to investigate potential links between program-specific knowledge gains and general environmental attitudes. The complete EAAS was intentionally simplified and limited to 21 items to minimize the time burden for survey participants. Surveys were administered in small groups (4 to 10 individuals) and read aloud to improve comprehension and increase the accuracy of responses. Approximately 15 minutes was needed to complete the EAAS.

The reliability and validity of the survey instrument was analyzed using SPSS Version 15. Reliability estimates of internal consistency were measured for the overall population and subgroups using Cronbach's alpha. An exploratory factor analysis (EFA) with oblique rotation was used to identify constructs embedded in the 16-item attitude scale. The validity of the extracted factors was then examined using item analysis, bivariate correlations, and regression procedures. The EFA and validity assessments revealed two underlying constructs for the 16 Likert-type items: eco-affinity and eco-awareness. Using these two components and the content knowledge subscale, we deemed the EAAS ready to measure pretest environmental attitude and awareness score differences between diverse age and ethnic groups. Due to slight deviations from the normal data distribution, pretest scores were compared using nonparametric procedures. A Kruskal Wallis test was used to compare pretest eco-affinity, eco-awareness, and content knowledge scores for children in different age and ethnic groups. Following the pretest, children in the treatment group were exposed to the 1-week EE summer program. An identical post-test was administered on the final day of the program 5 days later. Children in the control group received no EE enrichment during the 1-week period between the pretest and post-test.

The environmental education "treatment" selected for the study was designed by educators at the State Botanical Garden of Georgia and was part of the institution's Garden Earth Naturalist (GEN) curriculum. The GEN program has been used in

summer programs and after-school clubs, and has received positive reviews from both teachers and students. The program helps children identify valuable ecological services provided by “Garden Earth” and understand the importance of these free services by studying, exploring, and enhancing natural habitats on their school sites and in surrounding communities.

Two-way analyses of covariance (ANCOVA) were used to evaluate adjusted mean post-test scores after controlling for initial pretest differences. Separate tests were conducted with post-test scores on each of the different subscales (eco-affinity, eco-awareness, and content knowledge) as the dependent variable and pretest scores on respective subscales as the covariate. Independent variables were the EE treatment (EE program or no EE program) and the potential moderator variables age and ethnicity. Hispanic children were omitted from this analysis because no Hispanics participated in the summer EE program. Preliminary checks were conducted to ensure that the assumptions of reliable covariate measurement, normality, linearity, homogeneity of variances, and homogeneity of regression slopes were not violated. The use of ANCOVA with intact, nonrandomized groups can interfere with statistical inferences, but a comparison of pretest scores between the treatment and control groups confirmed that covariate scores were approximately equal and independent of assigned treatments prior to experimentation. Statistically significant effects were graphically compared using pre-post score changes and adjusted post-test means on the various subscales.

3.0 RESULTS

This section presents the results for each distinct project phase in the following chronological order: constructing the survey instrument, measuring children’s environmental attitudes and awareness, and measuring an EE program’s impact on children’s environmental attitudes and awareness.

3.1 Constructing the Survey Instrument

The overall reliability coefficients for the 16 Likert-type items on the EAAS were high (Cronbach’s alpha

$\geq .749$) across all gender, age, and ethnic subgroups for both the first (pretest) and second (post-test) survey administration. The EFA scree plot indicated that a two-component solution was optimal. On the pretest, the two-factor solution accounted for 44.9 percent of the total scale variance and rotations converged in six iterations. Factor one had an eigenvalue of 5.12 (31.9 percent of the variance) and factor two had an eigenvalue of 2.08 (13.0 percent of the variance). On the post-test, the two-factor solution accounted for 49.2 percent of the total variance and rotations converged in five iterations. Factor one had an eigenvalue of 5.83 (36.4 percent of the variance) and factor two had an eigenvalue of 2.04 (12.8 percent of the variance). Based on item content, the factors extracted in the EFA were named eco-affinity and eco-awareness. Eight items loaded strongly (≥ 0.4) on factor one, while four items loaded strongly (≥ 0.4) on factor two (Table 1). Items with weak loadings were retained for construct validity assessment to ensure that variables were not inaccurately discarded from the analysis.

The convergent and discriminant validity of each factor was confirmed through a bivariate correlation item analysis. Correlations were calculated to measure the strength of the relationship between each item with its own scale (after removing the focal item) and with the other subscale. As expected, items that loaded strongly on the eco-affinity subscale were more closely correlated with other items on the eco-affinity scale; items on the eco-awareness subscale generally converged with other items on the eco-awareness scale. The content validity of the two component model was also verified, as items within each factor were meaningful, logical, and interpretable. Validity analysis suggested that eco-affinity and eco-awareness represented two distinct constructs. The content knowledge section of the survey, featuring four multiple choice and one open-ended question, was also retained as a separate subscale. Overall, the EAAS appears to be a reliable and valid instrument for measuring three dimensions of children’s environmental attitudes: eco-affinity, eco-awareness, and content knowledge.

Table 1. - Rotated pretest EFA loadings for two subscales (n=177; only values > 0.3 are reported)

Item	Factor 1	Factor 2
Eco-Affinity $\alpha=0.852^a$		
I like to learn about nature.	0.790	
I like to read about plants and animals.	0.751	
I would spend time after school working to fix problems in nature.	0.702	
I like to learn about plants and animals.	0.639	
I am interested in learning new ways to help protect plants and animals.	0.636	
I would give some of my own money to help save wild plants and animals.	0.598	
I like to spend time in places that have plants and animals.	0.561	
I would help to clean up green areas in my neighborhood.	0.457	
Eco-Awareness $\alpha=0.720^b$		
My life would change if there were no plants and animals.		0.698
My life would change if there were no trees.		0.673
Plants and animals are important to people.		0.528
It makes me sad to see homes built where plants and animals used to be.		0.415
People need plants to live.		0.359
Nature is easily harmed or hurt by people.		0.354
Plants and animals are easily harmed or hurt by people.		0.335
We need to take better care of plants and animals.	0.328	

^a Cronbach's alpha for eight eco-affinity items

^b Cronbach's alpha for eight eco-awareness items

3.2 Measuring Environmental Attitudes and Awareness

Kruskal Wallis tests indicated significant eco-affinity ($\chi^2_{3,N=180} = 24.6, p \leq 0.000, \eta^2=0.14$) and content knowledge ($\chi^2_{3,N=185} = 11.2, p \leq 0.01, \eta^2=0.06$) differences among children in distinct age groups. Follow-up tests were conducted using Mann Whitney U tests with Holm's sequential Bonferroni corrections to evaluate pairwise differences among the age categories. In general, eco-affinity decreased as children got older (Fig. 1). Content knowledge was lower in the 6- and 7-year-old children compared to the 8- and 9-year-olds ($z=-2.64, p=0.008$) or 10- and 11-year-olds ($z=-3.48, p=0.001$). The extreme variability associated with mean scores for 12- and 13-year-old children was likely a function of the small sample size.

Children's ethnicity appeared to have a significant effect on eco-awareness ($\chi^2_{2,N=182} = 16.9, p \leq 0.000, \eta^2=0.09$) and content knowledge ($\chi^2_{2,N=185} = 43.2, p \leq 0.000, \eta^2=0.24$), but no significant differences were observed in eco-affinity scores ($\chi^2_{2,N=180} = 1.14,$

$p=0.566$). The eco-awareness of white children was significantly higher than African American or Hispanic children (Fig. 2). Environmental content knowledge score ranks were also higher for white children than African American or Hispanic children (Fig. 3). The ranked scores for children in both minority groups, African American and Hispanic, revealed no significant differences on any of the survey variables. The extreme variability for Hispanic children was likely a function of the small sample size.

3.3 Measuring EE Program Impacts on Environmental Attitudes and Awareness

The ANCOVA results suggested that the EE treatment led to a statistically significant positive increase in eco-affinity scores for children regardless of age and ethnicity. The treatment effects on eco-affinity were more pronounced, however, when accounting for age differences ($F_{1,130} = 6.62, p=0.011, \text{partial } \eta^2=0.05$). Participation in the EE program appeared to have the most statistically significant positive impact on the eco-affinity of older children (Fig. 4).

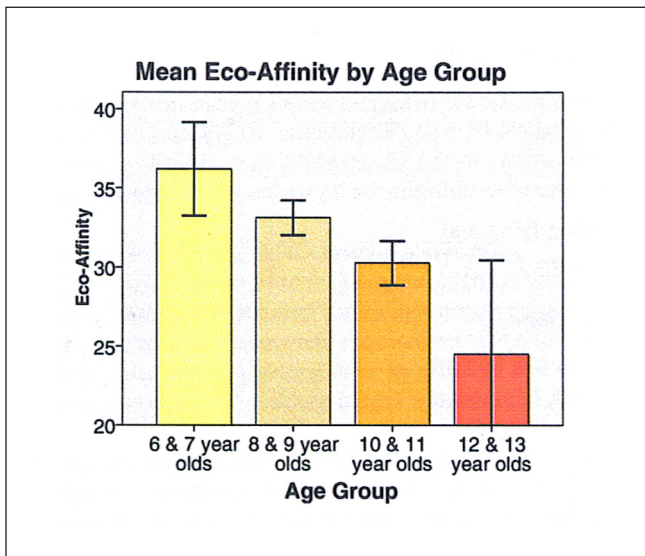


Figure 1.—Mean pretest eco-affinity scores by age group with 95% CI (n=180).

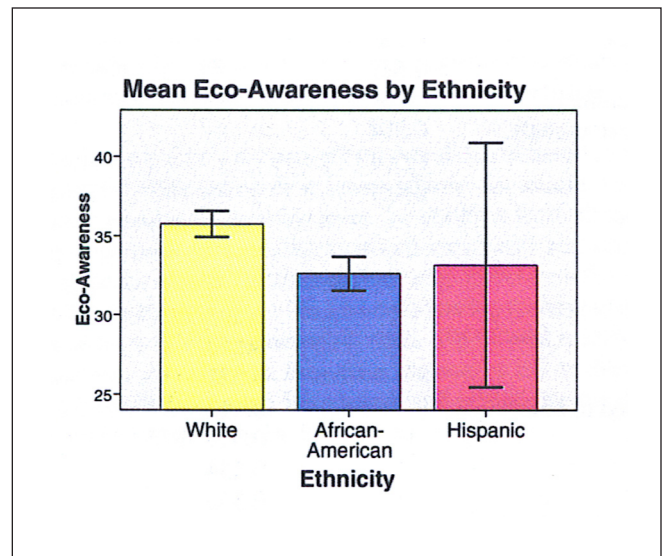


Figure 2.—Mean pretest eco-awareness scores by ethnic group with 95% CI (n=182).

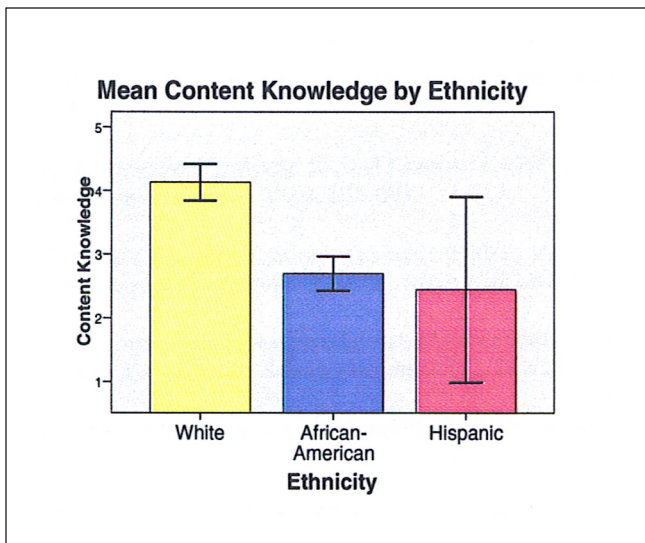


Figure 3.—Mean pretest content knowledge scores by ethnic group with 95% CI (n=185).

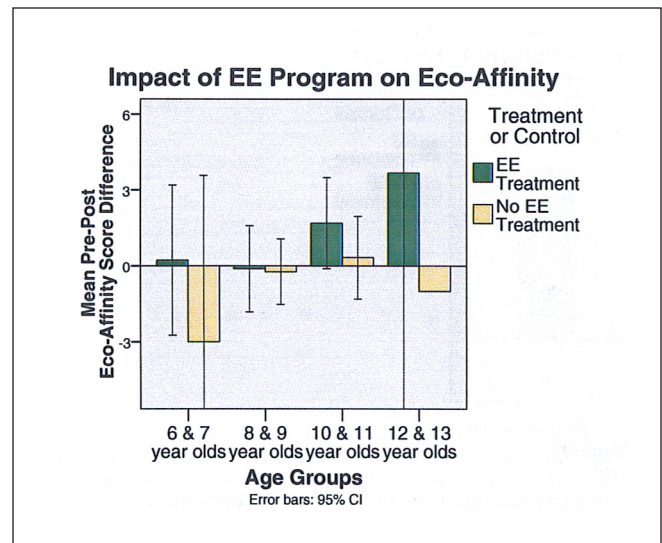


Figure 4.—Mean pre-post eco-affinity score differences for children in treatment and control groups by age (n=139).

The EE treatment had no statistically significant effect on eco-awareness. The interaction term (treatment X ethnicity) also showed no significant differences, but a comparison of adjusted post-test means for African American and white children revealed an interesting trend (Fig. 5). Although the adjusted post-test scores of white children in the treatment and control groups were approximately equal, African American children displayed elevated eco-awareness following exposure to EE.

Content knowledge scores increased for all children after the EE program. The treatment effects were more obvious when accounting for ethnicity ($F_{1,142} = 30.50$, $p \leq 0.000$, partial $\eta^2 = 0.18$). White children continued to score higher than African American children on the content knowledge scale after exposure to EE, but the difference was less pronounced. African American children showed the largest relative score increases (Fig. 6).

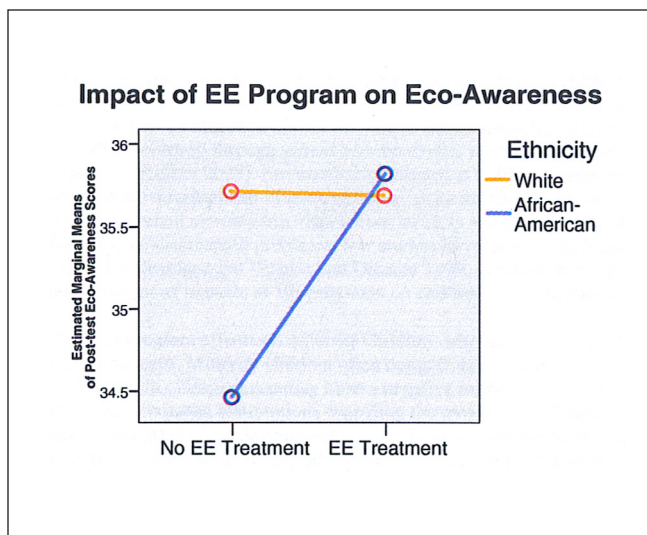


Figure 5.—Estimated marginal means for post-test eco-awareness scores by ethnicity (n=143).

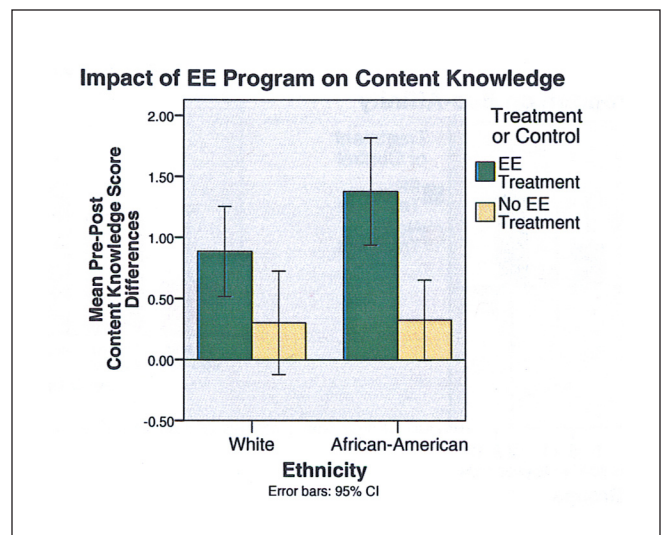


Figure 6.—Mean pre-post content knowledge score differences for children in treatment and control groups by ethnicity (n=149).

4.0 DISCUSSION AND IMPLICATIONS

The EAAS appeared to be a psychometrically sound evaluation tool for use with 6- to 13-year-old children, and may help to meet the demand for an instrument capable of measuring the affective impacts of EE programs. The EAAS contained fewer items and required less time to administer than instruments used in earlier studies. Furthermore, the new instrument appeared to be an efficient and effective method for accurately measuring the environmental attitudes and awareness of children across a substantial demographic range.

Results highlighted two major concerns. Children displayed high levels of eco-affinity before the age of 10, but after age 10 eco-affinity began to decline. A decreased emphasis on outdoor science activities in upper elementary grades may be related to children's diminishing preference for nature (Coyle 2005). Despite research that has revealed equivalent and occasionally elevated levels of environmental concern in adults from minority populations (Mohai and Bryant 1998), this study revealed an eco-awareness and environmental content knowledge gap between African American and white children. Flannery and

Whiting (2003) also noted that wildlife knowledge and attitude scores of fifth-grade students in Texas were significantly greater for white children compared to Hispanics or African Americans. Reduced access to safe, nature-based activities and limited opportunities for positive outdoor experience may constrain the development of eco-awareness in minority children from low socioeconomic status families (Bullard 2006). A 1-week EE summer program could provide a potential solution to both of these problems.

The EE summer program had a positive impact on the eco-affinity of all participants, and seemed to be especially effective for older children who appeared to be losing their innate affinity for nature without positive reinforcement. The EE program also led to significant content knowledge gains for children from all age and ethnic groups. African American children, in particular, showed noticeable increases in eco-awareness and knowledge following the EE program. Based on these results, it appears that all children derive some direct benefits from environmental education. EE programs that promote interactions with nature in a fun and entertaining context may strengthen a child's eco-affinity and build a strong

foundation for a future conservation ethos. Additional research is needed to confirm the utility of the EAAS as an assessment tool, examine the long-term impacts of EE on the environmental attitudes and awareness of children from all backgrounds (including Hispanics), and investigate the relationship between EE program involvement and positive stewardship behavior in children.

5.0 CITATIONS

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