ENVIRONMENTAL EDUCATION AND ETHNICITY:

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

by

LINCOLN R. LARSON

(Under the Direction of Gary T. Green and Steven B. Castleberry)

ABSTRACT

The environmental education (EE) of America's youth is a high priority, but the effects of EE on the environmental attitudes and awareness of children remain uncertain. Assessment strategies are needed to measure the influence of EE programs on the beliefs, attitudes, and awareness of children from different backgrounds. This study used a mixed-method, quasi-experimental approach to investigate the impact of a one-week EE summer camp program on the environmental attitudes and awareness of children from different ethnic groups. A survey instrument designed to measure children's views of nature was created, refined, and validated through two pilot tests. The survey instrument revealed three primary components of attitudes and awareness: eco-affinity, eco-awareness, and content knowledge. A pre-test, post-test approach was used to assess program effects. Baseline data showed declining eco-affinity in older children and low levels of eco-awareness and content knowledge in African-Americans. The EE treatment produced a significant increase in eco-affinity for all children, particularly those in the older age group (10 to 13 year-olds). The treatment also led to higher content knowledge scores for all children, with the greatest increase evident in African-Americans. The summer EE program had little effect on eco-awareness. Results suggest that: (1) the EE influences different aspects of environmental attitudes to different degrees; and (2) the EE programs may be especially beneficial for children that are older and/or African-American. This study may help to generate future support for education and outreach programs for underserved populations.

INDEX WORDS: Children, Environmental attitudes, Environmental awareness, Environmental education, Minority, Nature

ENVIRONMENTAL EDUCATION AND ETHNICITY:

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

by

LINCOLN R. LARSON

B.S., Duke University, 2003

A Thesis Submitted to the Graduate Faculty of The University of Georgia

in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2008

ENVIRONMENTAL EDUCATION AND ETHNICITY:

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

by

LINCOLN R. LARSON

Major Professors:	Gary T. Green Steven B. Castleberry
Committee:	Craig A. Miller Kris Irwin

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2008

ACKNOWLEDGEMENTS

This study was made possible through the collaborative effort of multiple individuals and organizations in the Athens community. I would like to thank the State Botanical Garden of Georgia, the Boys & Girls Club of Athens, the Oconee County 4-H Center, and the Athens-Clarke County Leisure Services Department for their help organizing and operating all of the EE summer programs. I would also like to thank the Barrow Elementary and Gaines Elementary After-School Programs for accommodating a number of requests and incorporating opportunities for assessment into their daily schedule.

Program activities and evaluations were administered by a number of staff and volunteers who provided immeasurable support throughout the entire process, and I deeply appreciate the help of the following EE enthusiasts for their assistance with the study: Cora Keber, Joe Milanovich, Debbie Mitchell, Amanda Price, Alina Ruiz, Rachel Small, Julie Strack, Kim Sutherland, Emily Warburg, and Luke Worsham. I must also thank Anne Shenk, the Director of Education at the State Botanical Garden, for developing a wonderful EE framework and providing access to multiple resources and materials to help guide children on the path to enlightenment. Special thanks should also be extended to my co-advisors, Gary Green and Steven Castleberry, and committee members, Craig Miller and Kris Irwin, for their constant supply of guidance, constructive criticism, and infinite statistical wisdom throughout the past two years. Finally, I would like to thank all of the kids who participated in this project. With their unparalleled energy and excitement, the future is promising.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

Introduction

According to the National Environmental Education & Training Foundation (NEETF), 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 are increasingly affected by a condition described as "nature-deficit disorder" (Louv, 2005). Though the natural environment has played an integral role in human development for thousands of years, children today have fewer opportunities for outdoor exploration (Kahn & Kellert, 2002; 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; Pergams & Zaradic, 2006; Taylor, Kuo, & Sullivan, 1998). A decline in authentic outdoor experiences alters the way a child perceives the natural world, producing profoundly negative developmental consequences (Kellert, 2005). However, environmental education (EE) represents a potential way to counter the effects of this 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; Lieberman & Hoody, 1998; National EE Advisory Council, 2005).

Environmental education programs have been hailed as a panacea for many environmental problems, but improvements in the quality, delivery, and objectives of current programs are necessary to achieve the long-term goal of an environmentally-literate population (Braus, 1995; Coyle, 2005; Palmer, 1998; Smyth, 1995). Research has

shown that EE within public schools improves children's science achievement, but this achievement is usually measured with standardized test scores that only reflect cognitive gains (Coyle, 2005). Affective development measures are often better indicators of conservation behavior and could be incorporated into more program evaluations (Iozzi, 1989; Kruse & Card, 2004; Stern, 2000). Few empirical studies have attempted to measure the effect of an EE program on the attitudes and awareness of children, and this limited body of research has indicated that EE influences environmental attitudes, knowledge, and stewardship behavior to different degrees (American Institutes for Research, 2005; Leeming, Dwyer, Porter, & Cobern, 1993; Smith-Sebasto & Cavern, 2006). Some studies have shown that EE had a positive impact on attitudes and awareness (Bogner, 1998; Dresner & Gill, 1994; Mittlestaedt, Sanker, & VanderVeer, 1999), while others revealed no significant attitude changes (Eagles & Demare, 1999; Kostka, 1976; Legault & Pelletier, 2000; Shepard & Speelman, 1985). Programs that produced substantial knowledge gains did not always impose attitude change (Keen, 1991), and programs that resulted in more positive attitudes did not always increase knowledge (Leeming, Porter, Dwyer, Cobern, & Oliver, 1997). Additional research is needed to investigate the relationship between environmental attitudes, awareness, and knowledge in children and to empirically assess the impact of EE on children's affective development.

The current absence of environmental attitude and awareness data for minority children, who represent a rapidly growing segment of the U.S. population, is a particular concern (Capps et al., 2005). Minority children often come from urban neighborhoods where encounters with nature are limited, and this dearth of experience may have a

negative impact on environmental attitudes (Bullard, 2006; Flannery & Whiting, 2003). Additionally, many common assumptions regarding the environmental attitudes and awareness of minorities may be inaccurate (Jones, 2002). Given an opportunity to interact with nature and participate in outdoor activities, minorities have displayed an ability to build positive environmental attitudes and awareness (Gollnick & Chinn, 2002; Marouli, 2002; Wendling, Wuensch, & Christiano, 1989). The development of a reliable method for assessing affective growth sparked by EE might help generate more support for programs that enable minority children of low socioeconomic status to experience nature and develop positive environmental values.

Problem Statement

An overview of existing research reveals several important problems that must be addressed to improve the depth and scope of EE programs. These problems are:

1. A lack of valid and reliable instruments for measuring affective development presents a major obstacle in the EE evaluation process.

2. An insufficient understanding of existing environmental attitudes and awareness in diverse groups of children compromises effective EE program design.

3. The effect of EE programs on different aspects of children's environmental attitudes and awareness remains unknown.

4. Despite changing demographics, the influence of EE on children from different ethnic backgrounds has not been adequately investigated.

Out-of-school summer EE programs represent an appealing alternative to in-class science education because they can (a) provide students with a unique opportunity to experience complete outdoor immersion and (b) have a more profound impact on

affective development (Falk, 2001a). Unfortunately, many summer EE programs are constrained by lack of funding and staff. The development of a reliable method for assessing the affective components of EE might help generate more support for programs that enable children from all backgrounds to experience nature and develop positive environmental values.

Statement of Purpose and Research Objectives

The objective of this study was to investigate the effect of an EE program on the environmental attitudes and awareness of children in a three-step process. This process involved: (1) the development of a reliable and valid metric to quantify the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups; (2) the examination of baseline differences in the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups; and (3) the examination of the effect of a one-week EE summer camp on the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups.

Research Justification

The future of global conservation may well depend on the quality and delivery of education programs that generate positive environmental attitudes in children. Resources for EE programs are often allocated to those that demonstrate quantifiable results, and research is necessary to identify "proven" results and "promising" strategies for EE (National EE Advisory Council, 2005). Summer programs represent an important vehicle for environmental education, but their impact is often overlooked. This study will assess the value of a summer camp as an environmental education tool.

Environmental education often has targeted homogenous school groups, but limited focus becomes problematic as America's population grows more ethnically diverse. By 2050, the European-American proportion of the U.S. population will decline from the current 70% to 50% as the Latino and African-American proportions rise (Cordell, Betz, & Green, 2002; U.S. Census Bureau, 2006). Environmental education efforts should be adapted to respond to these population changes. The summer programs in Athens, Georgia, provided a unique opportunity to study the environmental attitudes and awareness of a diverse population near an urban area in the southern United States, a region with low environmental literacy rates relative to the rest of the country (Coyle, 2005). One out of every four Athens-Clarke County children lives in poverty, and suboptimal socioeconomic situations prevent many African-American families from accessing nature-based recreation opportunities in and around Athens (Partners for a Prosperous Athens, 2006). Summer EE programs expose children to unfamiliar environmental objects and concepts in an exciting context, which may induce attitude shifts in children regardless of their ethnic, economic, or cultural barriers.

Evaluation strategies that assess goals, objectives, and program impacts on children from all backgrounds should be implemented as the field of environmental education progresses. This study represents an important step in that process. The EE summer program could confer immediate benefits to participating children. An empirical evaluation of any program effects could also yield important information about the formation and development of children's attitudes toward the environment. Furthermore, the results may affect the design and scope of future EE programs, especially those focused on underserved populations.

CHAPTER II

Literature Review

The effect of an EE program on the environmental attitudes and awareness of children was assessed in a three-step process that involved: (1) the development of a reliable and valid metric to quantify the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups; (2) the examination of baseline differences in the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups; and (3) the examination of the impact of a one-week EE summer camp on the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups. Literature related to this study is reviewed in this chapter. Relevant research includes an overview of environmental attitudes and awareness, attempts to measure children's environmental attitudes and awareness, factors that influence environmental attitudes and awareness, and efforts to measure the effect of EE on children's attitudes and awareness.

Environmental Attitudes and Awareness

Heberlein (1981) summarized early environmental attitude research when he acknowledged that environmental attitudes are "fundamentally important, widely discussed, frequently measured, and poorly understood" (p. 1). Since then, a rapidly expanding body of literature has revealed important patterns in the environmental attitudes, awareness, and behavior of adults (Dunlap, Van Liere, Mertig, & Jones, 2000; Gardner & Stern, 2002; Gifford, 2002; Milfont & Duckitt, 2004; Schultz, 2001; Snelgar, 2006). In the 1970s, an innovative model called the New Environmental Paradigm (NEP)

transformed the field of environmental sociology and stimulated abundant research on the topic of public environmental concern (Dunlap & Van Liere, 1978). The model suggested that humans were shifting from an anthropocentric worldview, characterized by a human exemptionalist attitude, to an ecocentric worldview more respectful of nature. Recent studies, including a revised version of the NEP, renamed the New Ecological Paradigm, continue to emphasize a conceptual continuum related to these two distinct value orientations (Dunlap et al., 2000; Vaske & Donnelly, 1999). The anthropocentric mindset favors utilization of natural resources. People with anthropocentric environmental attitudes value nature because of the material or physical benefits it can provide for humans (Milfont & Duckitt, 2004; Snelgar, 2006; Thompson & Barton, 1994; Wiseman & Bogner, 2003). On the opposite end of the environmental concern spectrum, the biocentric or ecocentric approach endorses environmental preservation where nature is valued for its own sake – not for human use or consumption (Kellert, 2005; Thompson & Barton, 1994; Wiseman & Bogner, 2003). However, these two views of nature need not be mutually exclusive (Castro, 2006). Humans are constantly balancing resource use and preservation, and the formation of environmental attitudes may be a complex dialectical process.

Conventional wisdom regarding the relationship between attitudes and behavior, best articulated in the Theory of Planned Behavior (Ajzen, 1991; Fishbein & Ajzen, 1975), suggests that a pro-ecological attitude orientation should be closely linked to pro-environmental behavior. However, the attitude-behavior consistency has been cautiously interpreted in a conservation context (Gardner & Stern, 1996; Guagnano, Stern, & Dietz, 1995; Hines et al., 1986; Hungerford & Volk, 1990). A positive attitude and expressed

intention to act does not always result in overt behavior. Several factors, including time constraints, financial limitations, moral obligations, and perceived lack of control influence personal actions related to environmental issues. When these factors are controlled, a positive correlation between pro-environmental attitudes and behavior can emerge (Evans et al., 2007; Heberlein & Black, 1981; Kaiser, Oerke, & Bogner, 2007; Weigel & Weigel, 1978). However, much of this confounding variation is absent in children. If the ultimate goal is changing behavior, attitudes may be a more appropriate proxy for children than adults. Subsequently, a tool used to measure children's attitudes and awareness might serve as an effective indicator of a child's potential behavioral response to EE programming (Gotch & Hall, 2004).

Measuring Children's Environmental Attitudes and Awareness

Despite extensive research documenting cognitive gains associated with EE programs (American Institutes for Research, 2005; Coyle, 2005; Gilchrist, 2002), the effects of EE on children's attitudes toward and awareness of the environment remain largely unknown (Leeming et al., 1993; Leeming et al., 1997; Smith-Sebasto & Cavern, 2006). This ambiguous relationship between EE, environmental attitudes, and behavior persists for two primary reasons: (1) a paucity of information regarding children's environmental orientation; and (2) the difficulty of quantifying children's beliefs, attitudes, and values. Many researchers who have attempted to quantify children's environmental attitudes and knowledge used a project-based questionnaire often relevant to only one specific program (Gray, Borden, & Weigel, 1985; Leeming et al., 1993). Utilization of a standardized, reliable, and psychometrically valid scale could greatly

enhance the capacity for EE evaluation and allow for comparisons across different programs (Gray et al., 1985; Manoli, Johnson, & Dunlap, 2007).

Several attempts have been made to create such a scale (Appendix A). The *Children's Environmental Response Inventory* (CERI) consists of eight subscales designed to measure various components of environmental concern across broad age ranges (Bunting & Cousins, 1983). Although elements of the CERI scale have been employed in some studies (Salmivalli, 1998; Smith-Sebasto & Cavern, 2006), the large number of items and the complex question structure were generally inappropriate for younger audiences. The *Children's Environmental Attitude and Knowledge Scale* (CHEAKS) also attempted to evaluate the science knowledge and environmental attitudes of children in first through seventh grade (Leeming et al., 1995). The CHEAKS scale was based on an earlier metric created for adults and attempts to evaluate three components of environmental attitudes: verbal commitment, actual commitment, and affect (Maloney, Ward, & Braucht, 1975). The reliability and validity of CHEAKS were consistently high, but the authors admit that the knowledge subscale content could have been too difficult for younger children (Leeming et al., 1995). Another tool, the *Children's Attitudes Toward the Environment Scale* (CATES) was simple and relatively quick to administer, score and interpret. The CATES consists of 25 items created to measure beliefs and behaviors that fall within the volitional control of eight to twelve year old children (Musser & Malkus, 1994). The CATES items were generic and easy to read, but the age-appropriate format could have been compromised by asymmetrical, polarized response choices.

Evans et al. (2007) abandoned the verbally intensive semantic questionnaire, which raised concerns about attention and the authenticity of responses, and devised an alternative evaluation strategy based on interactive games suitable for young children (mean age = 6.8 years). Unlike earlier attempts, the items in this scale were based on the NEP's extensively-researched conceptual model of environmental attitudes and values. However, the unique format could have been developmentally inappropriate for children over the age of eight. Evans et al. (2007) also acknowledged sampling limitations. For instance, their study population consisted almost exclusively of white, upper middle-class children, and the collection of data from a more heterogeneous sample could yield more informative results.

An adapted written version of the revised NEP scale for adults may be the most efficient and effective tool for evaluating children's attitudes toward the environment (Manoli et al., 2007). Manoli et al. (2007) revised the question wording and structure of original NEP items to construct and validate a scale suitable for use with children. The final result, the *NEP Scale for Children*, consisted of ten items that measured three interrelated dimensions of the New Ecological Paradigm: Rights of Nature (or humans role in natural ecosystems), Eco-Crisis (or environmental sustainability), and Human Exemptionalism (or humans' ability to transcend nature through ingenuity). The scale was tested on a diverse group of students across several states, and appears to be an appropriate measure of environmental worldview for ten to twelve year-olds. Although the *NEP Scale for Children* reliably measures three constructs, a field test demonstrated that program-mediated shifts in ecological worldview were primarily due to one factor: human exemptionalism (Manoli et al., 2007). In other words, the nascent environmental

attitudes of children may be one dimensional, centered on a child's egoistical viewpoints. A simple scale that distinguished between personal environmental attitudes and general environmental awareness could help to illustrate how children of different ages think and feel about environmental issues.

Factors that Influence Environmental Attitudes and Awareness

Religion, income, education and age have been suggested as variables that contribute to individual variation in adult's environmental values, but the correlations between each of these variables and environmental concern are weak and inconclusive (Guth, Green, Kellstedt, & Smidt, 1995; Hines et al., 1986; Kellert & Westervelt, 1983; Vaske, Donnelly, Whittaker, Segura, & Bowler, 2005; Williams, & Jonker, 2001). Religious preferences often correlated with environmental attitudes, as more secular individuals tend to display more of a pro-environmental affiliation (Guth et al., 1995). A positive relationship between income, education, and measures of environmental worldview and global environmental knowledge also has been observed (Arcury & Christianson, 1993; Coyle, 2005). In a national survey, higher income urban residents displayed an ecocentric perspective on the NEP scale, whereas lower income rural citizens generally favored the anthropocentric or utilization mindset (Cordell et al., 2002). On a local scale, however, the relationship between income, education, and environmental concern may be inverted. Mohai and Bryant (1998) showed that African-Americans from lower socioeconomic neighborhoods demonstrated more concern for pollution and other local environmental issues than wealthy, educated whites. Vaske et al. (2001) suggested that income and education may not be the most appropriate indicators when attempting to explain environmentalism, and recommended future investigations of

other potential predictors of attitude and value orientations, such as age, gender, and ethnicity.

Younger age groups typically are more pro-environment (Jones & Dunlap, 1992; Van Liere & Dunlap, 1980), but this pattern may be changing. Whittaker et al. (2005) observed a decline in the willingness of young adults to self-identify as environmentalists – a trend that could have negative repercussions for conservation efforts. The limited body of research on children's environmental attitudes showed that a child's age may dictate levels of environmental concern. A temporal shift is best described by Kellert's typology of values (Kahn & Kellert, 2002). For instance, children in early childhood seem to express a utilitarian and dominionistic view of nature. These values are consistent with the anthropocentric, or egoistic, environmental attitudes in adults. Hence, Kellert (1985) suggested that educational programs for early learners might best focus on affective components and emotional concern for animals and nature. In middle childhood, children develop an emotional attachment to the environment. The new appeal of nature for aesthetic, symbolic, or moralistic reasons may precipitate a shift in late childhood to ecological appreciation, which can translate into ecocentric and preservationist environmental attitudes in adults (Kahn & Kellert, 2002; Kellert, 2005). These transitions were supported by studies that identified an increase in overall environmental concern once children reached ten or eleven years of age (Eagles & Demare, 1999; Kahn, 1999; Kellert, 1985). Though general measures of environmental concern and factual knowledge increase as children approach adolescence, specific indicators of environmental attitudes and behavioral intentions are typically higher for younger individuals (Hines et al., 1986; Leeming et al., 1995). The implications of these

conflicting results are difficult to determine, especially in the context of EE programming. An accurate and functional assessment strategy that separates distinct constructs (i.e. attitudes, awareness, knowledge, etc.) and provides an opportunity for age comparisons would help identify an optimal range of emphasis for EE efforts.

A number of studies have addressed gender differences in environmental orientations. Research suggests that women are more inclined to support preservation of nature, often expressed as concern for environmental issues and intention to engage in pro-environmental behavior (Milfont & Duckitt, 2004; Mohai & Bryant, 1998; Vaske et al., 2001; Zelezny, 2000). Females also were more likely to show support for EE (Fernandez-Manzanal, Rodriguez-Barreiro, & Carrasquer, 2007). Despite a female affinity for environmental preservation, many studies have revealed an environmental "gender gap" that shows women are generally less knowledgeable about environmental issues than males (Coyle, 2005; NEETF & Roper Starch Worldwide, 2001). Women also were slightly less interested in participating in outdoor activities (Busser, Hyams, & Carruthers, 1996). Other studies that show no relationship between gender and pro-environmental behaviors, such as recycling, have called into question the presumed impact of gender on environmental attitudes and knowledge (Hines et al., 1986; Schultz, Oskamp, & Mainieri, 1995).

Research on environmental attitudes typically has reflected the views and concerns of the white majority, but the impact of ethnic and socioeconomic differences on environmental attitudes may be important as the U.S. population continues to diversify (Johnson, Bowker, & Cordell, 2004; Jones, 2002; Zimmermann, 1996). A growing body of international research has challenged the widely-held belief that environmental

concern is only expressed by the wealthy, elite members of society (Schultz & Zelezny, 1999). In fact, a pro-ecological mindset actually may be more prevalent in less-developed countries like Brazil, where natural and cultural elements are integrated and the human exemptionist viewpoint is less pronounced (Bechtel, Corral-Verdugo, & de Queiroz Pinheiro, 1999; Vikan, Camino, Biaggio, & Nordvik, 2007). Students in Zimbabwe, however, showed a strong anthropocentric preference in the NEP construct "man over nature" (Van Petegem & Blieck, 2006). These results revealed the prominent influence of cultural factors in environmental attitudes and values.

A central tenet in this cultural debate has been the controversial assessment of the environmental attitudes and behavior of African-Americans. For many years, it was suggested that African-Americans were less interested in the environment than Euro-Americans (Hershey & Hill, 1978; Jones & Carter, 1994; Kellert, 1984). These assumptions were altered by the environmental justice movement of the early 1990s. Research began to reveal that blacks were not only exposed to a disproportionate amount of pollution (Adeola, 1994; Bullard, 2001), but they were more concerned with local environmental health on a local scale than whites, who tended to focus on global nature preservation (Jones & Rainey, 2006; Mohai & Bryant, 1998). Some evidence now suggests that African-Americans actually may be more concerned about environmental issues than whites, but economic and cultural barriers limit participation in positive environmental behaviors within the African-American community (Jones & Carter, 1994; Jones & Rainey, 2006; Parker & McDonough, 1999). Nearly 25% of African-Americans and Latinos in the United States are below the poverty line, compared to 11% of whites (U.S. Census Bureau, 2006). Minority groups represent the fastest-growing segment of

the U.S. population, yet many uncertainties persist regarding environmental interactions and perceptions within these various ethnic groups (Johnson et al., 2004).

The expansion of EE outreach efforts could place a stronger emphasis on African-American children. The greatest socioeconomic gap in the U.S. occurs in children under the age of 18. Almost 35% of African-American children live below the poverty line, compared to 14% of white children (U.S. Census Bureau, 2006), and these social circumstances may influence environmental attitudes and awareness. Nevertheless, little empirical work has addressed the construction and solidification of environmental attitudes in African-American children (Kahn & Friedman, 1995; Kellert, 1985; Wendling et al., 1989). Kellert (1985) and Flannery & Whiting (2003) showed that African-American children exhibited more negative attitudes towards wildlife than white children, but these studies did not encompass other aspects of nature. Kahn & Friedman (1995) found that African-American children living in an impoverished inner city community displayed a rich appreciation for nature and moral responsiveness to its preservation, but their study involved no controls. Wendling et al. (1989) discovered that, although white children initially had more positive attitudes toward the environment than non-whites, hands-on outdoor activities could potentially eliminate pre-treatment racial differences in attitude scores. Research comparing children from areas of varying socioeconomic status showed that environmental awareness decreased in poorer neighborhoods, possibly because children had fewer opportunities to safely access natural resources (Barraza & Cuaron, 2004; Bullard, 2006). With little chance for positive reinforcement of ecological concepts and ideas, children from low-income neighborhoods may be less inclined to change their perspective on environmental issues (Fisman, 2005).

Overall, research that has investigated links between ethnicity, socioeconomic status (SES), and environmental orientation has yielded two major findings. First, despite conventional assumptions, people from all backgrounds may express equally positive environmental attitudes and comparable levels of environmental concern. Second, a well-designed EE program that crosses cultural borders and accounts for demographic diversity may confer more benefits to minority children of low socioeconomic status (Capps et al., 2005; Gollnick & Chinn, 2002; Marouli, 2002). A summer EE program could provide a rare opportunity for minority children to enjoy the outdoors and develop positive environmental attitudes and awareness.

Environmental Education

Education was first recognized as an important conservation strategy in the 1970s when the United Nations Educational, Scientific, and Cultural Organization made global environmental education a high priority. According to the Belgrade Charter:

> The goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO, 1975).

In the 1977 Tbilisi Declaration that followed, the United Nations called for programs to foster environmental awareness, provide opportunities and skills for environmental protection, and create new patterns of behavior (UNESCO, 1977). The Declaration's primary objectives – increasing awareness, building knowledge, changing attitudes, and encouraging participation in pro-environmental behaviors – remain

important goals of environmental education efforts around the world. The 1990 National Environmental Education Act emphasized the need for environmental programs within the American educational system (EPA, 1990). Traditional reforms have since targeted science knowledge through in-class activities, but classroom instruction rarely induces students to change their attitudes and ideas about the environment (Mahadeva, 1989).

A new educational approach that builds on social constructivist theory and uses the environment as an integrated context for learning has been found to be more beneficial to young learners (Castro, 2006; Kahn, 1999; Kellert, 2005; Lieberman & Hoody, 1998). Out-of-school experiences that supplement in-class curricula increase positive exposure to natural environments and help children assimilate new ideas into their existing base of knowledge (Ausubel, Novak, & Hanesian, 1978; Hellden, 1998; Kellert, 2005; Stranix, 1975). These out-of-school experiences also increase the capacity for affective development (Stone & Glascott, 1998). A hands-on learning approach raises interest and awareness of environmental issues for many children, and may have a significant effect on environmental attitudes (Ramey-Gassert, 1997; Uitto, Juuti, Lavonen, & Meisalo, 2006; Waliczek, Logan, & Zajicek, 2003). Therefore, a greater emphasis should be placed on non-school activities that integrate ecological concepts into educational structures (Falk, 2001b). Summer programs, for example, provide an ideal opportunity for environmental education in an interactive context. However, the extent to which these programs impact the environmental attitudes and behavior of young children remains largely unknown. Thus, there is a strong need for research that assesses the effect of informal EE on children's environmental attitudes, awareness, and behavior. This is especially true as national support for EE initiatives, manifested by legislative measures

such as the proposed No Child Left Inside Act, continues to grow (Braus, 1995; Smith-Sebasto & Cavern, 2006; Walsh-Daneshmandi & MacLachlan, 2006). The EE programs that foster positive environmental attitudes likely will enhance the efficacy of future conservation efforts. A thorough understanding of the formation and evolution of environmental attitudes and awareness is necessary to devise an effective strategy for measuring and improving EE quality and for generating funding for future EE programs.

CHAPTER III

Methods

Statement of Purpose, Research Objectives, and Hypotheses

The goal of this study was to investigate the effect of an EE program on the environmental attitudes and awareness of children in a three-step process. The study design was guided by the following objectives and corresponding hypotheses.

Objective 1

The purpose of this objective is to develop a reliable and valid survey instrument to measure the environmental attitudes and awareness of children (named the *Environmental Attitude and Awareness Survey*, or EAAS).

Null Hypothesis (H_{10}). Statistical analyses will fail to provide evidence that data from the EAAS reveals statistically significantly reliable and valid responses for children of all gender, age, and ethnic groups.

Alternate Hypothesis (H_1). All statistical analyses will provide evidence that data from the EAAS reveals statistically significantly reliable and valid responses for children of all gender, age, and ethnic groups.

Objective 2

The purpose of this objective is to compare baseline environmental attitudes and awareness of children across different gender, age, and ethnic groups.

Null Hypothesis (H_{2a0}). No statistically significant differences will exist between the EAAS pre-test scores of boys and girls.

Alternate Hypothesis (H_{2a}). Statistically significant differences will exist between the EAAS pre-test scores of boys and girls.

Null Hypothesis (H_{2b0}). Older children will fail to exhibit statistically significantly higher EAAS pre-test scores than younger children.

Alternate Hypothesis (H_{2b}). Older children will exhibit statistically significantly higher EAAS pre-test scores than younger children.

Null Hypothesis (H_{2c0}). No statistically significant differences will exist between the EAAS pre-test scores of African-American, Hispanic, and white children.

Alternate Hypothesis (H_{2c}). Statistically significant differences will exist between the EAAS pre-test scores of African-American, Hispanic, and white children.

Objective 3

The purpose of this objective is to evaluate the effect of a one-week EE treatment relative to a control on the environmental attitudes and awareness of children from different gender, age, and ethnic groups.

Null Hypothesis (H_{3a0}). Children in the EE treatment group will fail to exhibit statistically significantly higher EAAS post-test scores than children in the control group.

Alternate Hypothesis (H_{3a}). Children in the EE treatment group will exhibit statistically significantly higher EAAS post-test scores than children in the control group.

Null Hypothesis (H_{3b0}). Boys and girls in the treatment group will fail to exhibit statistically significantly higher EAAS post-test scores than boys and girls in the control group.

Alternate Hypothesis (H_{3b}). Boys and girls in the treatment group will exhibit statistically significantly higher EAAS post-test scores than boys and girls in the control group.

Null Hypothesis (H_{3c0}). Children in different age groups in the treatment group will fail to exhibit statistically significantly higher EAAS post-test scores relative to children in different age groups in the control group.

Alternate Hypothesis (H_{3c}). Children in different age groups in the treatment group will exhibit statistically significantly higher EAAS post-test scores than children in different age groups in the control group.

Null Hypothesis (H_{3d0}). Children of different ethnicities in the treatment group will fail to exhibit statistically significantly higher EAAS scores than children of different ethnicities in the control group.

Alternate Hypothesis (H_{3d}). Children of different ethnicities in the treatment group will exhibit statistically significantly higher EAAS post-test scores than children of different ethnicities in the control group.

Study Context

This study employed a mixed-method, quasi-experimental approach involving a treatment group (children who participated in a one-week EE summer camp) and a control group (children who attended an after-school program with no EE emphasis). Other variables of interest within those groups included gender, age (6 & 7, 8 & 9, 10 & 11, or 12 & 13 year-olds), and ethnicity (African-American, Hispanic, or white). Ages were pooled into two-year groupings due to the limited sample size. Age groupings were based on the age-related expression of environmental attitudes and awareness observed in

past studies and were limited to two years because larger intervals reflect substantial differences in the intellectual and social development of children (Kahn & Kellert, 2002; Piaget, 1969). Data were collected from a population of six to thirteen year-old children in two counties surrounding Athens, Georgia. Clarke County is an urban county (estimated 2006 population density = 933.7 people per square mile) with a median household income $14,583 below the 2004 national average of $44,334 (U.S. Census Bureau, 2008). Oconee County is a suburban/rural county (estimated 2006 population density = 166.2 people per square mile) with a median household income $17,632 above the national average. The Athens-Clarke County area was selected because of its diverse population and proximity to EE programs offered through the State Botanical Garden of Georgia.

Participants

The project involved two pilot tests, an EE treatment group, and a control group of students in local after-school programs (ASP). The first pilot test was conducted with a group of ethnically diverse third graders from Hall County, GA (n = 37), on a field trip to the State Botanical Garden of Georgia from 9 A.M. to 11 A.M. on May 15, 2007. The second pilot test was completed by third and fourth grade students at the Athens Montessori School in Athens, GA (n = 25), throughout the day on June 2, 2007. After survey revisions based on the pilot test responses, a purposive sample frame of 190 six to thirteen year-old children was selected to address the study's research objectives (Mean age = 9.45, SD = 1.44). The sample population consisted of children participating in EE summer programs sponsored by the State Botanical Garden of Georgia from June 18 through August 10, 2007 (n = 85), and children enrolled in after-school programs in two

Clarke County Schools during the 2007-08 academic year (n = 105). Random allocation of subjects to the treatment (EE summer programs) and control group (ASP programs) was not possible because both camp and ASP enrollment was pre-determined. A survey was administered to all 190 children who participated in either the treatment or control groups (Table 1 for demographic distribution data). The survey population was characterized by a relatively equal gender split (Figure 1). A majority of the survey participants were upper elementary school students between the ages of eight and eleven (Figure 2). The number of African-American and white students was approximately equal. A small number of Hispanic students enrolled in ASP took the survey as part of the control group (Figure 3). No Hispanic students attended the non-formal EE program.

Table 1

Number of Study Participants by Gender, Age, and Ethnicity in Both the Treatment and Control Groups During the 2007-2008 Final Survey Administration (n = 190)

Variable	**Treatment Group**			**Control Group**		
	African-American	White	Hispanic	African-American	White	Hispanic
Gender						
Boy	24	21	0	26	27	5
Girl	22	18	0	25	21	1
Age						
6 & 7 year-olds	8	3	0	3	1	1
8 & 9 year-olds	15	19	0	18	25	0
10 & 11 year-olds	17	16	0	29	22	4
12 & 13 year-olds	6	1	0	1	0	1
TOTAL	46	39	0	51	48	6

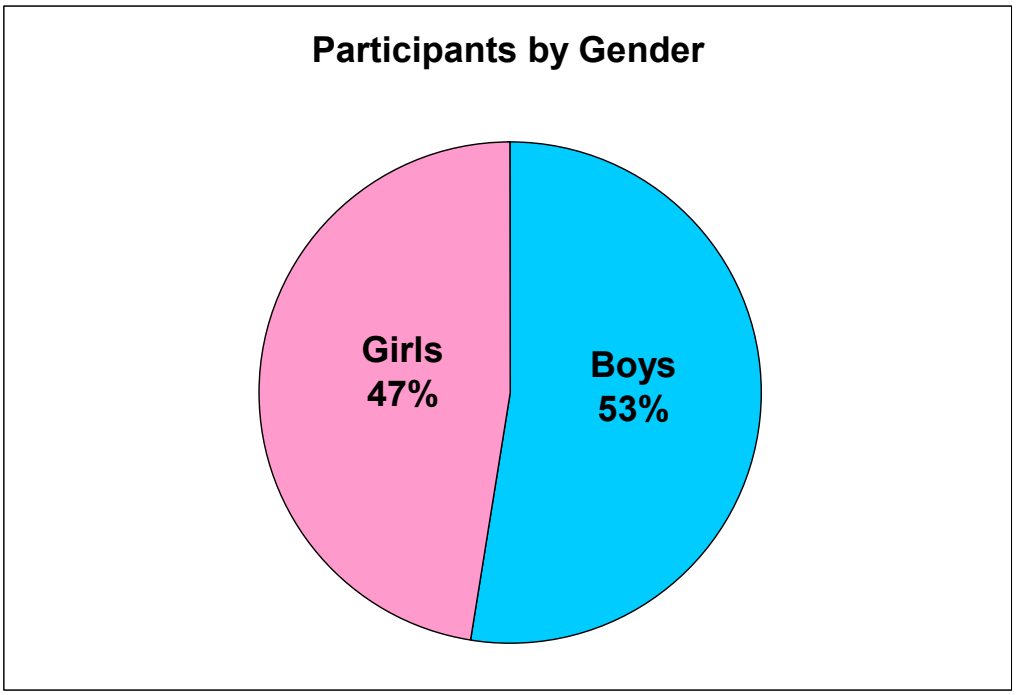


Figure 1. Final Survey Administration Sample Distribution by Gender (n = 190).

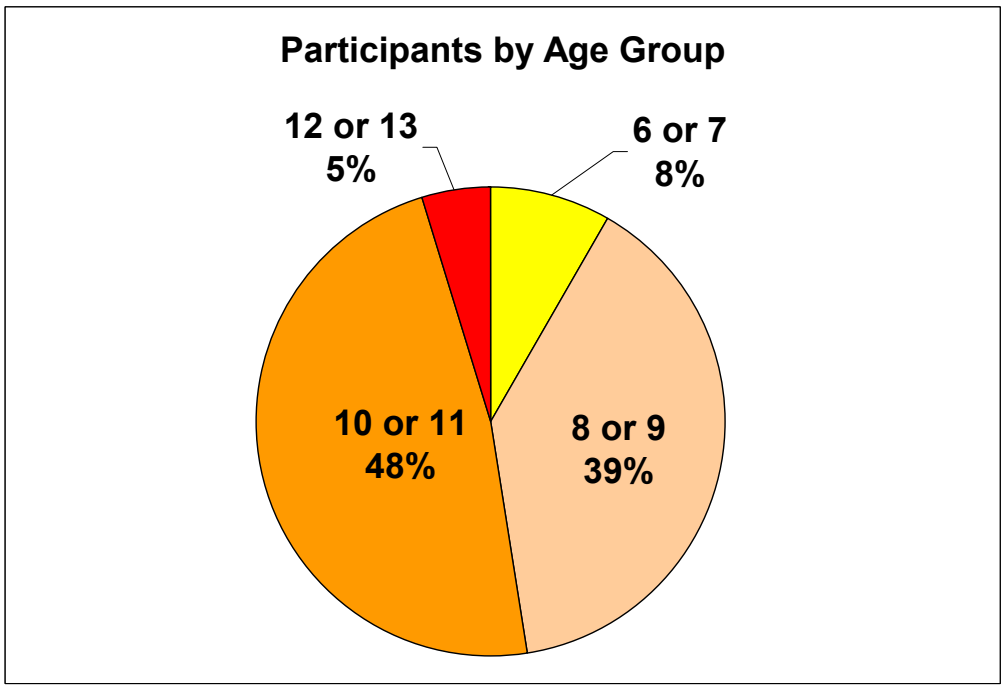


Figure 2. Final Survey Administration Sample Distribution by Age Group (n = 190).

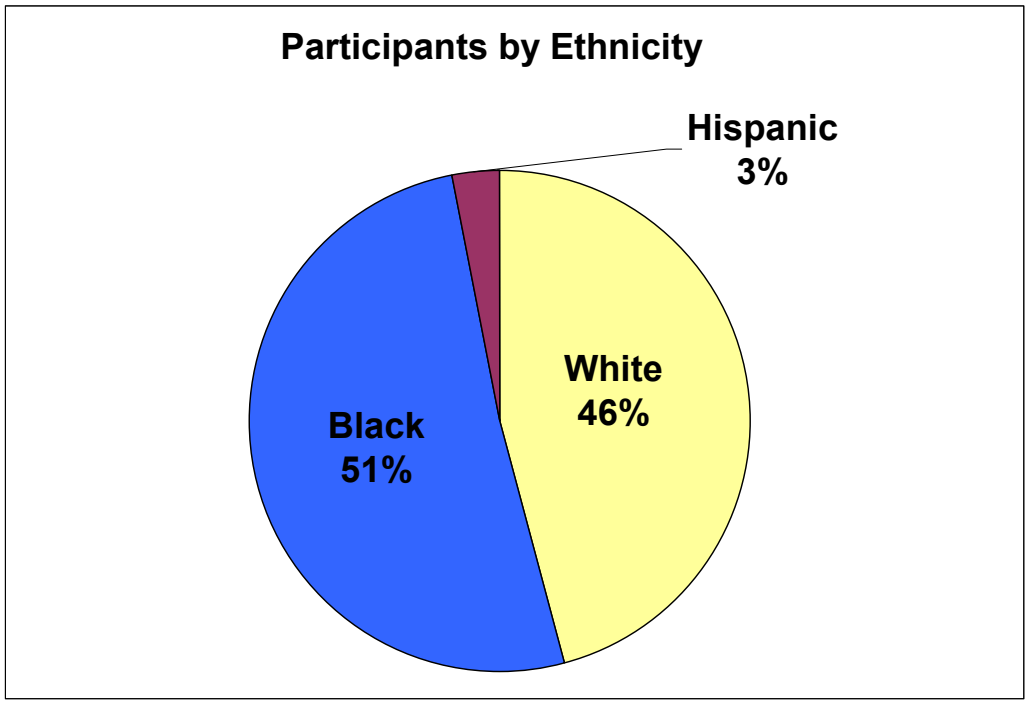


Figure 3. Final Survey Administration Sample Distribution by Ethnicity (n = 190).

Constructing the Survey Instrument

Environmental attitudes and awareness of children were measured using a survey consisting of 21 total items: sixteen statements with five-point Likert-type responses, four multiple-choice questions, and one open-ended response item (Appendix B). The EAAS instrument was created and modified through a multi-step process that included an in-depth literature review, initial scale construction, scale revision and reduction, pre-testing, and refinement. Items from existing scales were adapted to cover general concepts and specific facts related to the environmental education curriculum, creating a modified evaluation tool suitable for children (Bunting & Cousins, 1983; Dunlap et al., 2000; Leeming et al., 1995; Manoli et al., 2007; Musser & Malkus, 1994). Though each of the original scales has proven to be a reliable measure of children's environmental orientation, the instruments had limited applicability in the education sector due to broad

scope, lengthy time requirements and complex question structure. An instrument like the EAAS that simplifies elements of existing scales and emphasizes nature in an individual context may be a more useful predictor of children's environmental attitudes and awareness.

Likert-type response items were designed to measure several important components of environmental attitudes including interest in nature, perception of ecological importance and vulnerability, and intention to behave an environmentally-responsible manner. Based on prior research and scale-specific item content, four common factors related to attitudinal components were expected to emerge (Manoli et al., 2007). These factors were interest in nature, importance of nature, endangered ecosystems, and environmental stewardship. Sixteen survey items were chosen to meet the minimum recommendation of four variables for each anticipated factor (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Statements related to each distinct component were randomly arranged, and children were asked to indicate the extent to which they disagreed or agreed with a statement by circling the appropriate word and symbol. The Likert-type attitude scale ranged from one = "strongly disagree" to five = "strongly agree." A familiar image, the "thumbs up" symbol, was included with the attitude scale to provide a visual cue to increase the potential for response accuracy (Appendix B; Dillman, 2007). The intermediate option, "not sure" (numerical value of three), was symbolically represented by a question mark. Four multiple choice questions and one open-ended response item were employed to test content knowledge directly addressed by activities in the EE program. These topics included anthropogenic impacts, decomposition, ecosystem energy flow, human uses of plants, and pollination. Each

multiple choice question consisted of a statement with four potential answers. One point was awarded for correct answers. One-third of one point was awarded for each correct answer on the open-ended response (the fractional point value for correct answers on the open-ended question was determined by assigning the median value - a total of three acceptable responses - one full point). Content items were incorporated to investigate potential links between program-specific knowledge gains and general environmental attitudes. The complete EAAS was intentionally limited to 21 items to minimize burden time for survey participants.

Pilot tests of the EAAS were conducted with 2^{nd}-5^{th} grade classes from local schools selected to match the demographic characteristics of the larger population of interest. In the first pilot test, the survey was read aloud by the experimenter to the entire group (n = 37). Problematic items were identified and modified based on observations, participant questions, and Cronbach's Alpha reliability estimates. A revised survey was produced prior to the second pilot test. In the second test, surveys (n = 25) were administered by the classroom teacher. Problematic items were again identified and modified based on observations, participant questions, and Cronbach's alpha reliability estimates. A final survey version was produced prior to application of the EE treatment. Because some of the study subjects would have had difficulty reading and writing during the pilot tests, the surveys were read aloud in small groups of five to ten individuals to improve comprehension and increase the accuracy of responses (Musser & Malkus, 1994). The ASP surveys were conducted in slightly larger groups (eight to twenty-five individuals) to comply with rigid time constraints. Surveys were administered by several trained assistants in addition to the lead instructor to reduce possible experimenter

expectancy bias. After each question was read out loud twice, children were given time to respond and ask for clarification if necessary. Approximately fifteen minutes was needed to complete the EAAS. Children younger than six and older than thirteen were invited to participate, but their scores were not included in the analysis.

Reliability and Validity Analysis

Reliability estimates of internal consistency were measured for the overall population and subgroups using the Cronbach's alpha coefficient. An exploratory factor analysis (EFA) was used to identify constructs embedded within the 16-item attitude survey. Although principal components analysis (PCA) is often specified as the default data reduction technique in many statistical programs, it can produce inflated values of the variance accounted for by separate components (Costello & Osborne, 2005; Fabrigar et al., 1999). In this study, EFA with the principal axis factoring extraction method was employed because the data violated the assumption of multivariate normality (Costello & Osborne, 2005). An oblique rotation helped to clarify the data structure and preserve any correlations that might exist among the factors. The oblique rotation was selected because the multiple components of environmental attitudes and awareness were likely related to one another. The validity of the extracted factors was then examined using item analysis, bivariate correlations, and regression procedures. All tests were conducted using SPSS (SPSS, Inc., Version 15.0). The EFA and validity assessments revealed two underlying constructs for the sixteen Likert-type items: eco-affinity and eco-awareness (For more information see *Results: Constructing the Survey Instrument*).

Measuring Children's Environmental Attitudes and Awareness

Before the summer EE program effects could be measured, baseline environmental attitudes and awareness of the participants had to be established. These baseline values were measured on the first day of a one week program or school period using the survey administration procedure outlined above. Data from the first experimental survey administration (i.e. pre-test) were used to: (a) examine potential pre-existing differences in the summer program treatment group and the ASP control groups; and (b) compare scores of children in different gender, age (6 & 7, 8 & 9, 10 & 11, or 12 & 13 year-olds) and ethnic groups (African-American, Hispanic, or white). The dependent variables in the initial analysis were pre-test scores on the eco-affinity, eco-awareness, and content knowledge subscales

A statistical significance threshold of alpha = .05 was set for all data analysis procedures. Due to slight deviations from a normal data distribution, pre-test scores were compared using nonparametric procedures. The Mann-Whitney *U* test was used to compare scores from factors with two levels (i.e. gender). Kruskal-Wallis tests were used to compare scores from factors with more than two levels (age and ethnicity). Pairwise tests of significant differences were conducted using Mann-Whitney *U* tests with Holm's sequential Bonferroni adjustments, which controlled type I error across tests by evaluating each paired comparison at a different alpha level. The Holm's Bonferroni correction formula appears below:

$$\text{\# of pairwise comparions} = \frac{\text{\# of groups} * (\text{\# of groups} - 1)}{2}$$

$$\alpha^1 = \alpha_{\text{family}} / \text{\# of pairwise comparisons}$$

$$\alpha^2 = \alpha_{\text{family}} / \text{\# of pairwise comparisons} - 1, \text{ etc.}$$

Holm's sequential Bonferroni method is preferable to the traditional Bonferroni method for evaluating hypotheses because it is less conservative and has greater power (Green & Salkind, 2003). The Eta squared statistic (η^2), which represents the proportion of the variability in the ranked dependent variable accounted for by the different factor levels, was also calculated for each test using the formula: $\eta^2 = \chi^2/(N-1)$.

Measuring EE Program Effects on Children's Environmental Attitudes and Awareness

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" (Garden Earth Naturalist Brochure, 2007, front cover). The GEN framework consists of eight curricular modules, or topics, that address important ecological life support services (Appendix C). The program incorporates a variety of activities such as puppet shows, crafts, hikes, outdoor games, field trips, and animal encounters designed to teach children about ecological processes and environmental stewardship. Although the one-week timeframe did not allow for a full integration of all GEN themes and activities, the program was designed around the GEN curriculum's guiding principles.

The EE treatment was applied during six different five-day summer sessions from June 18 through August 10 of 2007. Each program day lasted approximately six hours (9

A.M. to 3 P.M.) for a total of 30 instructional hours per session. The same instructor conducted each program session using the same materials to reduce variation associated with different teaching styles and techniques. Paid counselors and volunteers provided programming assistance. Though day-to-day activities varied slightly, each child was exposed to the same ideas and concepts throughout the course of the program.

Children attended programs sponsored by the State Botanical Garden at one of six locations (Appendix D). Random sampling was not feasible for the treatment groups given the program's structure and relatively small size (ten to twenty children per session), so each registered participant who completed the one-week program was included in the study. Programs at the State Botanical Garden and Oconee 4-H Center were predominantly composed of white children from affluent backgrounds. The cost of the Botanical Garden programs was $100 per child per week. One African-American child received a free scholarship to a Botanical Garden program. The cost of the 4-H session was $30 per child per week. The EE programs at the East Athens Community Center ($5/week), Rock Springs Community Center ($5/week) and Boys & Girls Club (free) were 100% African-American, and a majority of these children came from low-income urban communities. Socioeconomic factors can impact environmental attitudes (Bullard, 2006; Fisman, 2005), so control groups were selected from comparable neighborhoods to reduce potential variation associated with socioeconomic status.

The control groups consisted of 2nd, 3rd, 4th and 5th grade students enrolled in the after-school program (ASP) at two Clarke County public schools: Barrow Elementary and Gaines Elementary (Appendix D). The Clarke County School District (Athens, GA) was selected as a control because of its diverse population and proximity to the various

summer program sites. Barrow Elementary is predominantly white, while Gaines is predominantly African-American (Figures 4 & 5). Both schools have a relatively small Hispanic population. The after-school programs at each school reflected these overall demographic patterns, with a mix of African-American (n = 51), white (n = 48), and Hispanic children (n = 6). Several of the children in the EE treatment groups also attended Barrow or Gaines Elementary, but these students were not involved with ASP and did not participate in the control group. Because Asian-Americans typically demonstrate environmental beliefs similar to white, non-Hispanic Americans (Johnson et al., 2004), the limited number of Asian participants (n = 3) were grouped with white children in this study.

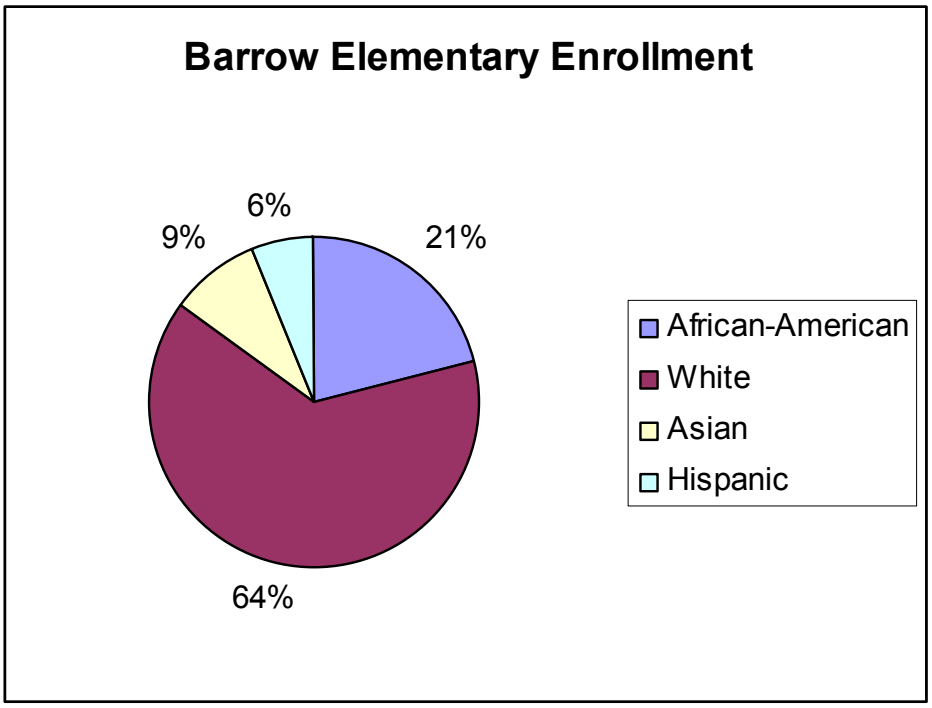


Figure 4. Total Student Population at Barrow Elementary (Grades K-5) in 2005-2006 by Ethnicity (Source: National Center for Education Statistics, 2005).

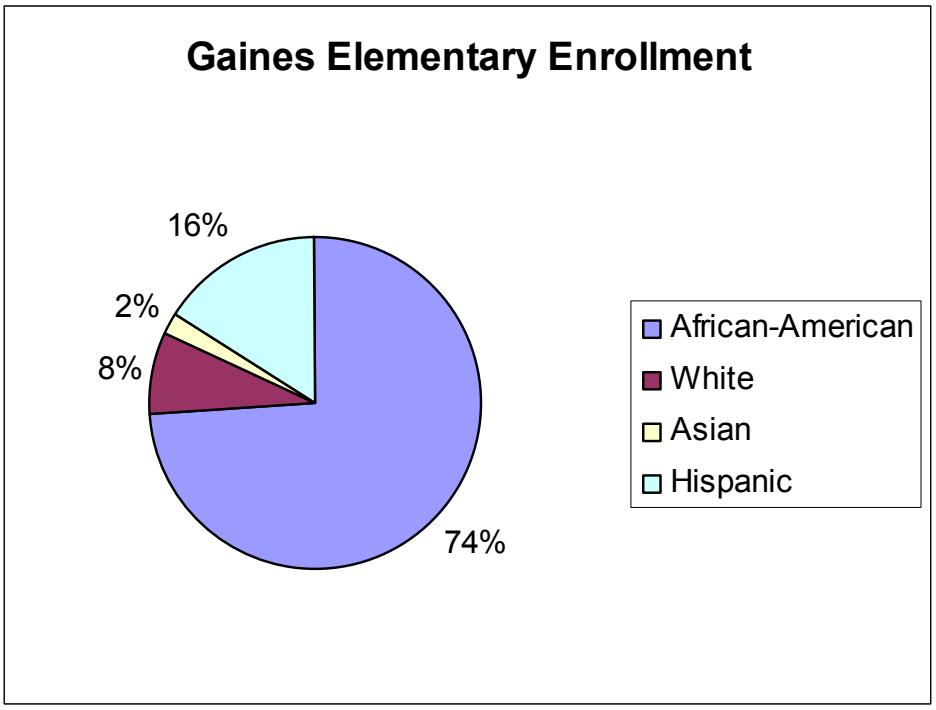


Figure 5. Total Student Population at Gaines Elementary (Grades K-5) in 2005-2006 by Ethnicity (Source: National Center for Education Statistics, 2005).

Effects of the EE program on children's eco-affinity, eco-awareness, and content knowledge was assessed using a pre-test, post-test approach. Initial differences in environmental attitude and awareness scores for children in the treatment and control groups were examined. After controlling for pre-test score differences, data from the second experimental survey administration (i.e. post-test) were used to: (a) examine pre-test, post-test score changes on all attitudes and awareness subscales for children in the treatment and control groups; and (b) investigate the EE treatment response of children by gender, age (6 & 7, 8 & 9, 10 & 11, or 12 & 13 year-olds) and ethnic group (African-American, or white). Hispanic students were omitted from the EE treatment analysis because no Hispanic students participated in the EE summer programs. Of the 190 participants in the EE treatment and ASP control groups, 146 completed the pre-test and

post-test EAAS at the beginning and end of a one-week period. Pre and post survey versions contained identical Likert-type items. Order of multiple choice answers was randomly altered to discourage memorization. All surveys were administered between 2 and 4 P.M. with the exception of the treatment group pre-tests, which were conducted between 9 and 11 A.M. on Monday morning. Precautions were taken to minimize potential disturbances associated with afternoon survey sessions, such as post-lunch and early pick-up time periods. If a child in the treatment group was absent for more than one day of the program, his/her post-test scores were not included in the analysis.

Program Impact Analysis

Pre-test score differences between children in the treatment and control groups were assessed using a nonparametric Mann-Whitney *U* test because of non-normal data distribution. Two-way analyses of covariance (ANCOVA) were used to evaluate program-mediated effects on post-test score means after controlling for initial pre-test differences. 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. Because all of the necessary assumptions were met, ANCOVA could control extraneous variation and increase the power of the statistical test (Huck & Cormier, 1996). Separate tests were run with post-test scores on each of the different subscales (eco-affinity, eco-awareness, and content knowledge) as the dependent variable. Pre-test scores on respective subscales served as the covariate. Independent variables were the EE treatment (EE program or no EE program) and the potential moderator variables gender, age (6 & 7, 8 & 9, 10 & 11, or 12 & 13 year-olds), and ethnicity (African-American or white).

Hierarchical multiple regression was used to supplement the ANCOVA results and assess the proportional influence of the EE treatment, gender, age, ethnicity, and pre-test scores on post-test eco-affinity, eco-awareness, and content-knowledge. Only children who completed both the pre-test and post-test were included in the analysis. Preliminary tests were conducted to ensure the assumptions of multicollinearity, linearity, normality, and homoscedasticity were not violated. A statistically significant score increase over the one week period for students in the treatment group would suggest that the GEN summer camp program had a positive impact on environmental attitudes and awareness.

Qualitative Data Collection

Quantitative survey data provides a solid foundation for assessment, but qualitative analysis often yields a more comprehensive, holistic picture of children's thoughts and ideas (Patton, 1990; Waliczek et al., 2003). Therefore, additional data regarding summer program activity preferences and program-related changes in environmental attitudes and awareness were obtained through one-page evaluations and short personal interviews. The written program evaluation was attached to the post-test EAAS of students in the treatment group (Appendix E). Brief personal interviews also were conducted by the principal investigator and trained volunteers to supplement EAAS data and provide an opportunity for criterion-based validity analysis of the survey constructs. Children who obtained parental consent (n = 68) were asked eight questions designed to provide a more detailed look at individual interaction with nature (Appendix F). Interviews occurred at the beginning and end of the one-week summer program and lasted approximately five minutes each (minimum = 2:26, maximum = 9:54). Due to time

constraints, no interviews were conducted with children in the control group. An inductive analysis was used to identify emerging patterns and classify responses into a set of ordered categories that could be used to supplement and support trends in the quantitative data (For more information regarding qualitative data analysis, see Dey, 1993; Patton, 1990). The inclusion of these components helped to highlight the EE program elements and activities that were most effective and enjoyable for all participants. Results from the qualitative analysis that were relevant to the research objectives are incorporated into the final chapter of this document, *Discussion and Implications*.

Limitations

Population-level inferences based on the sample statistics should be cautiously interpreted. Data were collected from a relatively small sample of participants (n=190) in two Georgia counties, Clarke and Oconee, and survey responses from children in other geographical regions may vary. Random selection of participants was not possible because groups were intact prior to the experimental intervention, and inherent bias associated with self-selected, non-random group structure may impact generalizations (Huck & Cormier, 1996; Leeming et al., 1993). Non-randomized allocation of treatments to groups is not uncommon in social science research; however, pre-existing differences in subjects can be somewhat mitigated and controlled through statistical procedures (Tabachnick & Fidell, 2001). Study groups were intentionally selected to examine variations associated with participant ethnicity and socio-economic status when assessing treatment effects, but the specific impacts of a child's ethnicity and socio-economic status on environmental attitudes could not be separately measured. Although the same

instructor facilitated all of the EE camps, different camp assistants helped administer the surveys. Despite training focused on the standardized survey administration process, some score differences could be attributed to facilitator effects. Pre and post surveys were distributed at different times of the day due to logistical constraints imposed by program activities, and some variation in responses could have been a function of administration time. Finally, all survey scores were self-reported with the expectation that every child answered each item honestly and without external influences. A substantial effort was made to recognize these limitations and reduce confounding variation as much as possible.

CHAPTER IV

Results

The results of the data analysis associated with each research objective and corresponding hypotheses are described in this chapter. Results for each distinct project phase (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) are presented in chronological order.

Constructing the Survey Instrument

In the exploratory factor analysis of the sixteen Likert-type items on the pilot tests, seven components had an eigenvalue greater than one and four factors accounted for 51.1% of the total variance. An attempt to extract the factors terminated after 25 iterations. Cronbach's Alpha coefficients were especially low for males, minority students, and seven to nine year-old pilot test participants (Table 2). Though these low values were partially attributed to the small sample size, general trends suggested revisions were necessary. Multiple items were altered to reduce confusion, promote redundancy, and improve the internal consistency of responses on the version of the survey used in the empirical investigation.

Table 2

Reliability Analysis for Subgroups on Two Pilot Tests Conducted Spring 2007

Test	n	Cronbach's Alpha
Pilot Test 1 TOTAL[1]	37	0.595
Males	18	0.430
Minority Students	27	0.379
7-9 year-olds	37	0.595
Pilot Test 2 TOTAL[2]	25	0.515
Males	14	0.269
Minority Students	0	-
7-9 year-olds	9	0.258

[1] The first pilot test was conducted with a third grade school group from Hall County, GA, on a field trip at the State Botanical Garden of Georgia.
[2] The second pilot test was conducted with fourth and fifth grade students at the Athens Montessori School in Clarke County, GA. No minority students were enrolled in either class.

Table 3

Reliability Analysis for Subgroups Within the Overall Sample (Treatment and Control Groups) on the EAAS Pre-test and Post-test Conducted 2007-2008

Test	n	Cronbach's Alpha
Pre-test TOTAL	**177**[1]	**0.840**
Boys	94	0.854
Girls	83	0.818
Minority children	94	0.840
White children	83	0.854
6-9 year-olds	85	0.749
10-13 year-olds	92	0.879
Post-test TOTAL	**146**[2]	**0.874**
Boys	69	0.893
Girls	77	0.848
Minority children	78	0.868
White children	68	0.881
6-9 year-olds	72	0.804
10-13 year-olds	74	0.912

[1] 13 of the 190 surveys were omitted because responses were incomplete.
[2] 44 of the 190 surveys were omitted because responses were incomplete.

The overall reliability coefficients for the revised 16-item survey were high ($\geq$ 0.749) across all subgroups for both the first (pre-test) and second (post-test) administration (Table 3). Acceptable scores on the Bartlett's test of sphericity ($p \leq 0.001$) and the Kaiser-Meyer-Olkin measure of sampling adequacy (pre-test = 0.812, post-test = 0.844) showed that an exploratory factor analysis was appropriate (Pallant, 2007). The EFA scree plot indicated an optimal two-factor solution (Figure 6). On the pre-test, the two-factor solution accounted for 44.9% of the total scale variance and rotations converged in six iterations. Factor one had an eigenvalue of 5.12 (31.9% of the variance) and factor two had an eigenvalue of 2.08 (13.0% of the variance). On the post-test, the two-factor solution accounted for 49.2% of the total variance and rotations converged in

five iterations. Factor one had an eigenvalue of 5.83 (36.4% of the variance) and factor two had an eigenvalue of 2.04 (12.8% of the variance). Based on item content, the factors extracted in the EFA were named Eco-affinity and Eco-awareness.

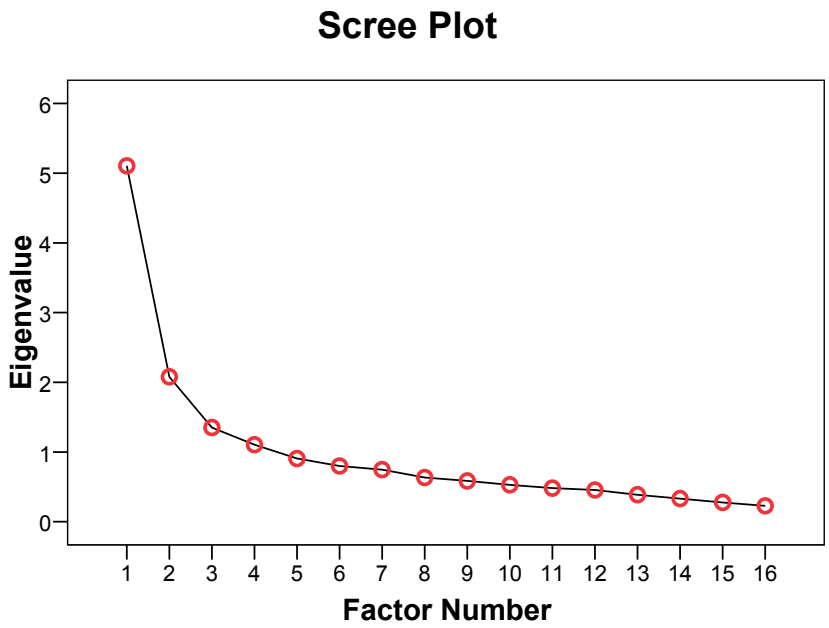


Figure 6. EFA Scree Plot With Extracted Factors and Corresponding Eigenvalues for 16-item Pre-test.

Only factor loadings over the commonly accepted minimum value of 0.32 are reported in Tables 4 and 5 (Tabachnick & Fidell, 2001). Eight items loaded strongly (≥0.4) on factor one for both the pre and post-test. Four items loaded strongly (≥0.4) on factor two for both the pre and post-test. The smaller loadings and cross-loadings that are more evident on the post-test may have been due to program-mediated effects on the reduced post-test sample. Subject to item ratios for the pre-test (11:1) and post-test (9:1) were comparable to other studies, but samples of this size still allow for the emergence of an incorrect factor structure 40% of the time (Costello & Osborne, 2005). To ensure that

variables were not inaccurately discarded from the analysis, items with weak loadings were retained for construct validity assessment.

Table 4

Rotated Pre-test EFA Loadings for Two Subscales (Only Values ≥ 0.32 are Reported; n = 177)

Item	Factor 1	Factor 2
Eco-Affinity α=.852[1]		
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 α=.720[2]		
My life would change if there were no plants and animals.		0.698
My life would change if there were no trees.		0.683
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[3]	

[1] Cronbach's Alpha for eight eco-affinity items.
[2] Cronbach's Alpha for eight eco-awareness items.
[3] Item loaded weakly on both scales, grouped with other eco-awareness items due to item content (see text for explanation).

Table 5

Rotated Post-test EFA Loadings for Two Subscales (Only Values ≥ 0.32 are Reported; n=146)

Item	Factor 1	Factor 2
Eco-Affinity α=.877[1]		
I like to learn about nature.	0.827	
I am interested in learning new ways to help protect plants and animals.	0.731	
I would give some of my own money to help save wild plants and animals.	0.728	
I like to learn about plants and animals.	0.695	
I would spend time after school working to fix problems in nature.	0.684	
I like to read about plants and animals.	0.677	
I would help to clean up green areas in my neighborhood.	0.660	
I like to spend time in places that have plants and animals.	0.507	0.383[3]
Eco-Awareness α=.760[2]		
My life would change if there were no plants and animals.		0.887
My life would change if there were no trees.		0.698
Nature is easily harmed or hurt by people.		0.541
Plants and animals are easily harmed or hurt by people.		0.485
People need plants to live.		0.419
Plants and animals are important to people.		0.326
We need to take better care of plants and animals.	0.392[4]	
It makes me sad to see homes built where plants and animals used to be.	0.353[4]	

[1] Cronbach's alpha for 8 eco-affinity items.
[2] Cronbach's alpha for 8 eco-awareness items.
[3] Item cross-loading potentially due to program mediated effects (see text for explanation).
[4] Item loaded weakly on both scales, grouped with other eco-awareness items due to item content (see text for explanation).

The convergent and discriminant validity of each factor was confirmed through a bivariate correlation item analysis (Green & Salkind, 2003). 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 subscales. As expected, items that loaded strongly on the eco-affinity subscale were more closely correlated with other items on that scale than items on the eco-awareness subscale (Tables 6 & 7). Items on the eco-awareness subscale also tended to converge with other items on the same scale. Only one

item, “We need to take better care of plants and animals,” was correlated with both subscales on the pre-test and post-test. The same item also cross-loaded on both factors in the EFA. Removing the variable added more ambiguity to the two-factor structure, however, so the item was retained. The content validity of the two component model was verified, as items within each factor were meaningful, logical, and interpretable. As expected, the oblique rotation of the two-factor model also indicated some degree of correlation between the eco-affinity and eco-awareness factors in both the pre-test ($r = 0.329$) and the post-test ($r = 0.442$).

Table 6

Pearson Correlation Coefficients of Pre-test Item Scores with Total Scores on Both Subscales (Only Values > 0.3 are Reported)

Item	Eco-Affinity[1]	Eco-Awareness[2]
Eco-Affinity		
I like to learn about nature.	0.722	
I like to learn about plants and animals.	0.642	0.365
I am interested in learning new ways to help protect plants and animals.	0.631	0.326
I like to read about plants and animals.	0.628	
I like to spend time in places that have plants and animals.	0.587	0.437
I would give some of my own money to help save wild plants and animals.	0.582	0.322
I would spend time after school working to fix problems in nature.	0.578	
I would help to clean up green areas in my neighborhood.	0.378	
Eco-Awareness		
		0.484
Plants and animals are important to people.	0.462	0.466
It makes me sad to see homes built where plants and animals used to be.		0.463
My life would change if there were no plants and animals.		0.427
My life would change if there were no trees.	0.379	0.398
People need plants to live.	0.415	0.383
We need to take better care of plants and animals.		0.378
Plants and animals are easily harmed or hurt by people.		0.343
Nature is easily harmed or hurt by people.		

[1]Correlations of each eco-affinity item with other items on the eco-affinity scale were calculated after removing the focal item.
[2]Correlations of each eco-awareness item with other items on the eco-awareness scale were calculated after removing the focal item.

Table 7

Pearson Correlation Coefficients of Post-test Individual Item Scores with Total Scores on Both Subscales (Only Values > 0.3 are Reported)

Item	Eco-Affinity[1]	Eco-Awareness[2]
Eco-Affinity		
I like to learn about nature.	0.726	0.346
I like to learn about plants and animals.	0.672	0.387
I am interested in learning new ways to help protect plants and animals.	0.661	0.363
I would give some of my own money to help save wild plants and animals.	0.649	0.340
I like to read about plants and animals.	0.619	0.334
I like to spend time in places that have plants and animals.	0.618	0.565
I would spend time after school working to fix problems in nature.	0.609	
I would help to clean up green areas in my neighborhood.	0.586	
Eco-Awareness		
My life would change if there were no plants and animals.		0.645
Nature is easily harmed or hurt by people.	0.310	0.531
My life would change if there were no trees.		0.499
Plants and animals are easily harmed or hurt by people.		0.467
People need plants to live.		0.424
We need to take better care of plants and animals.	0.480	0.420
Plants and animals are important to people.	0.352	0.391
It makes me sad to see homes built where plants and animals used to be.	0.422	0.351

[1]Correlations of each eco-affinity item with other items on the eco-affinity scale were calculated after removing the focal item.
[2]Correlations of each eco-awareness item with other items on the eco-awareness scale were calculated after removing the focal item.

The criterion-based validity for the overall survey and each distinct construct was assessed using interview data from summer program participants (n = 68). Children who reported spending more after school time outside than inside scored higher on both subscales, especially eco-awareness. Children who claimed to enjoy spending time outside scored higher on both subscales, with the greatest difference again observed in eco-awareness items. Eco-affinity scores were higher in campers that expressed more

positive thoughts when asked to describe their views of nature (Table 8). Due to the small interview sample, none of these differences were statistically significant.

Table 8

Comparison of EAAS Subscale Scores and Pro-environmental Responses to Interview Questions

Interview Question Response	n	Eco-Affinity Scores (Mean ± SD)	Eco-Awareness Scores (Mean ± SD)
After-school activity location			
• **Outside**	**19**	**33.63 ± 4.0**	**35.74 ± 4.4**
• Inside	13	32.62 ± 5.6	33.77 ± 3.6
Outdoor preference			
• **Enjoys outdoors**	**54**	**33.37 ± 5.2**	**35.30 ± 3.4**
• Does not enjoy outdoors	3	32.67 ± 6.8	33.33 ± 3.1
Thoughts about nature			
• **Positive**	**11**	**34.36 ± 5.3**	**35.27 ± 3.6**
• No opinion	50	32.50 ± 5.6	34.38 ± 4.6

Note: No significant difference at $\alpha<.05$

An ordinary least squares regression analysis was conducted to determine the relationship between the eco-affinity and eco-awareness subscales and third component of the EAAS, content knowledge (Figures 7 & 8). Eco-awareness and content knowledge were closely associated ($R^2 = 0.25$, F change$_{1,179} = 59.05$, beta = 0.498, $p \leq 0.001$). No correlation between eco-affinity and content knowledge scores was evident ($R^2 = 0.05$, F change$_{1,177} = 0.32$, beta = 0.043, $p = 0.571$). The validity analysis suggested that eco-affinity and eco-awareness represented two distinct constructs that accurately reflected what they were purported to measure. 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 appeared to measure three dimensions of children's environmental attitudes: eco-affinity, eco-awareness, and content knowledge. Statistical analyses provided evidence that the EAAS revealed statistically significantly reliable and

valid responses for children of all gender, age, and ethnic groups. Hence, null hypothesis H_{10} was rejected.

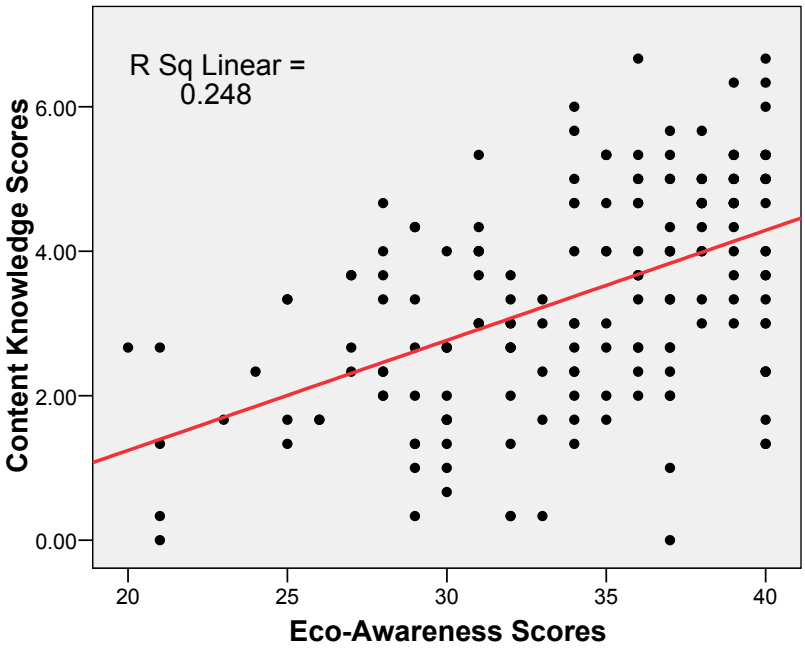


Figure 7. Scatterplot Comparing Eco-awareness and Content Knowledge Scores.

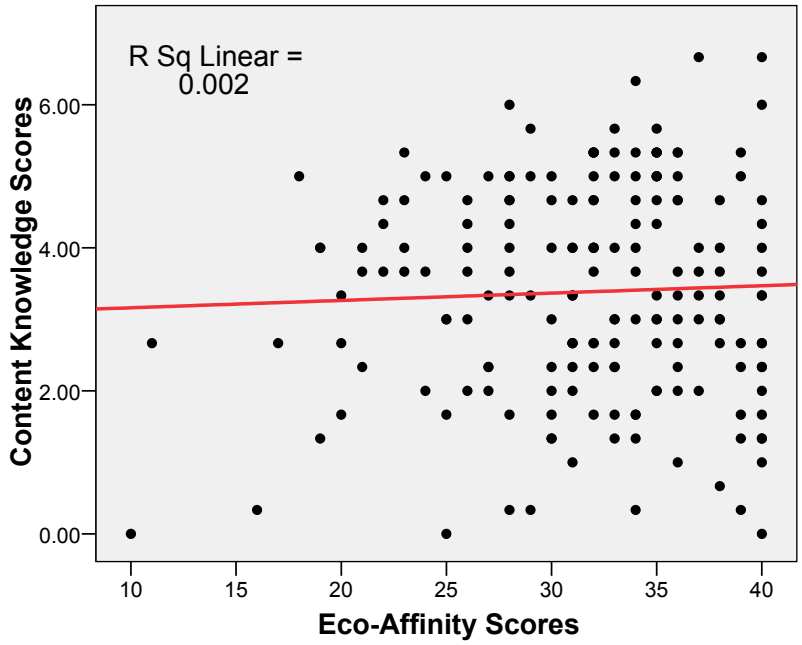


Figure 8. Scatterplot Comparing Eco-affinity and Content Knowledge Scores.

Measuring Children's Environmental Attitudes and Awareness

Prior to the EE treatment, a Mann-Whitney *U* test revealed no significant gender differences in terms of eco-affinity ($z = -0.751$, $p = 0.453$), eco-awareness ($z = 0.000$, $p = 1.00$), or content knowledge ($z = -1.34$, $p = 0.181$). Differences in eco-affinity ($\chi^2_{3,N=180} = 24.6$, $p \leq 0.001$) and content knowledge ($\chi^2_{3,N=185} = 11.2$, $p \leq 0.01$) were evident among the different age groups. No significant differences were observed in eco-awareness scores ($\chi^2_{3,N=182} = 1.94$, $p = 0.586$). The Eta squared statistic for eco-affinity (0.14) and content knowledge (0.06) suggested a moderate to strong relationship between age groups and ranked scores (Green & Salkind, 2003). Follow-up tests were conducted using Mann Whitney *U* tests to evaluate pairwise differences among the different age groups.

In general, eco-affinity decreased as children got older (Figure 9). The eco-affinity of 6 & 7 year-old children was significantly higher than either 8 & 9 ($z = -2.40$, $p = 0.016$), 10 & 11 ($z = -3.63$, $p \leq 0.001$), and 12 & 13 year-olds ($z = -3.26$, $p \leq 0.001$). The 8 & 9 year-old children also showed higher eco-affinity than their 10 & 11 ($z = -2.53$, $p = 0.011$) and 12 & 13 year-old classmates ($z = -3.39$, $p \leq 0.001$). Eco-affinity scores were higher in 10 & 11 year-olds than 12 & 13 year-olds ($z = -2.21$, $p = 0.027$). Content knowledge was lower in the 6 & 7 year-old children compared to the 8 & 9 ($z = -2.64$, $p = 0.008$) or 10 & 11 year-olds ($z = -3.48$, $p \leq 0.001$; Figure 10). The high variability associated with mean scores for 12 & 13 year-old children was likely due to the small sample size.

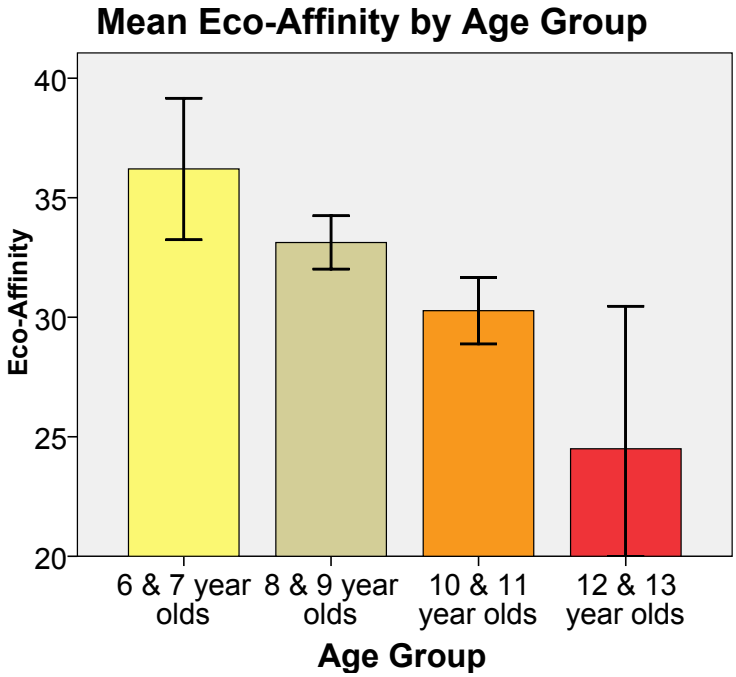


Figure 9. Mean Pre-test Eco-affinity Scores by Age Group with 95% CI (n = 180).

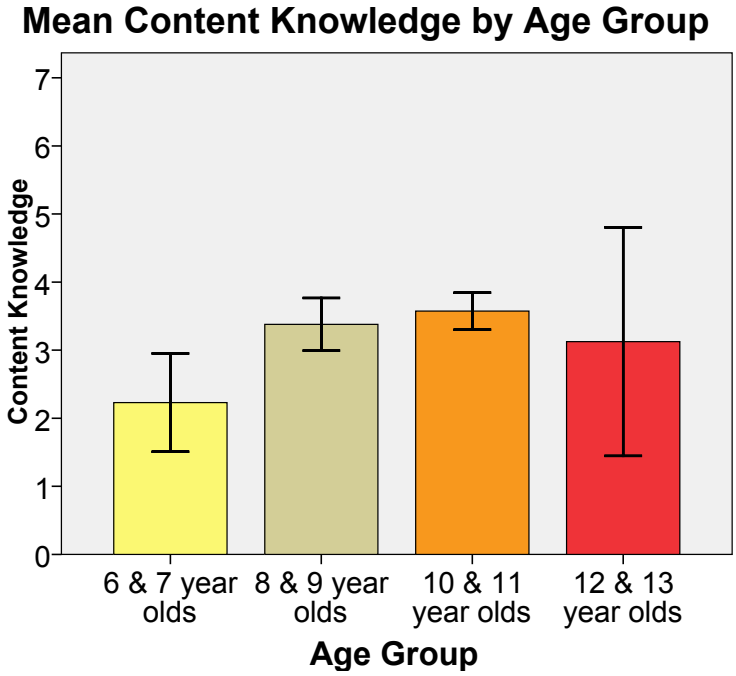


Figure 10. Mean Pre-test Content Knowledge Scores by Age Group with 95% CI (n = 185).

Differences in eco-awareness ($\chi^2_{2,N=182} = 16.9$, $p \leq 0.001$) and content knowledge ($\chi^2_{2,N=185} = 43.2$, $p \leq 0.001$) were identified among the different ethnic groups. No significant differences were observed in eco-affinity scores ($\chi^2_{2,N=180} = 1.14$, $p = 0.566$). The Eta squared values for eco-awareness (0.09) and content knowledge (0.24) suggest a moderate to strong relationship between ethnic groups and ranked scores (Green & Salkind, 2003).

Follow-up tests were conducted using Mann Whitney *U* tests to evaluate pairwise differences among the ethnic groups. The eco-awareness of white children was significantly higher than African-American children ($z = -4.14$, $p \leq 0.001$; Figure 11). Environmental content knowledge score ranks also were higher for white children than African-American children ($z = -6.39$, $p \leq 0.001$; Figure 12). The ranked scores for children in both minority groups, African-American and Hispanic, revealed no statistically significant differences on any of the survey variables. The high variability for Hispanic children was likely due to the small sample size.

In summary, statistically significant differences existed in the pre-test scores of children from different age and ethnic groups. Therefore, null hypotheses H_{2b0} and H_{2c0} were rejected. However, no significant differences were evident in the pre-test EAAS scores of boys and girls. Hence, insufficient evidence was found to reject null hypothesis H_{2a0}.

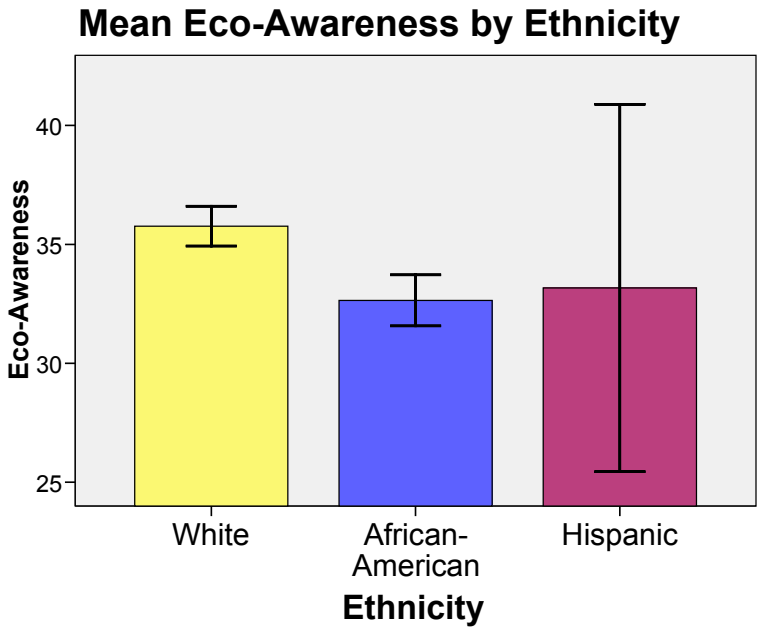


Figure 11. Mean Pre-test Eco-awareness Scores by Ethnic Group with 95% CI (n = 182).

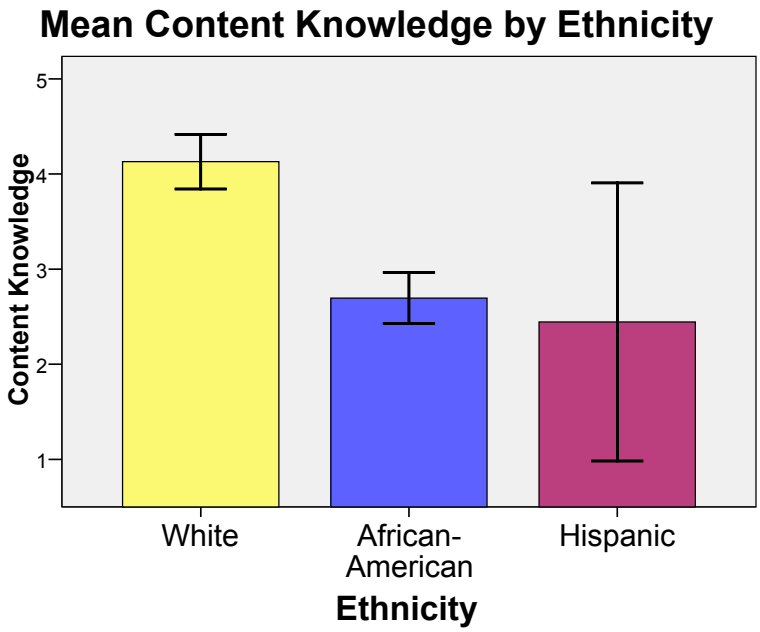


Figure 12. Mean Pre-test Content Knowledge Scores by Ethnic Group with 95% CI (n = 185).

Measuring EE Program Effects on Children's Environmental Attitudes and Awareness

The use of ANCOVA with intact, nonrandomized groups often interferes with statistical inferences (Pallant, 2007; Tabachnick & Fidell, 2001), but a comparison of pre-test scores between the treatment and control groups confirmed that covariate scores were approximately equal and independent of assigned treatments prior to experimentation. The Mann-Whitney *U* test comparing median pre-test scores in treatment and control groups showed no significant differences in terms of eco-affinity ($z = -1.446$, $p = 0.148$), eco-awareness ($z = -0.209$, $p = 0.834$), or content knowledge ($z = -0.902$, $p = 0.367$). Although some of the post-test score distributions for different gender and ethnic groups were skewed with unequal variances, analysis of variance is reasonably robust to violations of this assumption when group size is sufficiently large and approximately equal (Pallant, 2007). The within-group relationship between the covariate and the dependent variable was linear for each level of the independent factors ($R^2 \geq 0.4$). No significant interactions occurred between the covariate and treatment groups in the various tests, so the homogeneity of regression slopes assumption was also satisfied.

High tolerance values (≥ 0.676) and low variance inflation factors (≤ 1.480) for variables in the different subscale models indicated low correlation levels with other variables, a necessary assumption for hierarchical multiple regression tests. An examination of the normal probability plot and scatterplot of the standardized residuals using criteria outlined in Tabachnick & Fidell (2001) showed the data also satisfied the requirements of linearity, normality and homoscedasticity. The minimum case to variable ratio of 27.8 was below the 40 to 1 ratio recommended for stepwise regression but above

the ideal 20 to 1 ratio accepted for most regression procedures (Tabachnick & Fidell, 2001).

After adjusting for pre-test scores, the ANCOVA revealed a significant treatment effect on the overall EAAS scores ($F_{1,131} = 4.84$, $p = 0.03$, partial eta squared = 0.036). Significant score differences between children in the treatment and control groups were evident for some, but not all, of the subscales. A comparison of pre and post-test scores for specific EAAS items appears in Appendix G.

Eco-Affinity and the EE Program

The EE treatment had the greatest impact on eco-affinity (Table 9). The treatment effects on eco-affinity were more pronounced when accounting for age differences ($F_{1,130} = 6.62$, $p = 0.011$, partial eta squared = 0.048), but significant post-program improvements were also evident controlling for gender ($F_{1,134} = 5.20$, $p = 0.024$, partial eta squared = 0.037) and ethnicity ($F_{1,134} = 5.16$, $p = 0.025$, partial eta squared = 0.037). In all cases, the effect size or strength of relationship between the treatment and eco-affinity was relatively weak ($\eta^2 = 0.037 - 0.048$). A strong relationship existed between pre-test and post-test eco-affinity scores ($\eta^2 = 0.505 - 0.569$). None of the interactions associated with gender, age, or ethnicity and the treatment group were statistically significant. The results suggested that the EE treatment led to a statistically significant positive increase in eco-affinity scores for children regardless of gender, age, and ethnicity. Despite the non-significant interaction between age and treatment ($F_{3,130} = 1.32$, $p = 0.269$), data trends indicated that participation in the EE program appeared to have a particularly strong impact on the eco-affinity scores for older children (Figure 13).

Table 9

Pre and Post-test Eco-Affinity Scores for Treatment and Control Groups

Group	Pre-test			Post-test		
	N	Mean	SD	N	Mean	SD
Treatment	67	32.94	5.34	67	33.82	5.38
Control	72	30.82	6.91	72	30.72	6.50

Note: The eco-affinity scale consisted of eight Likert-type items rated on a scale of one (strongly disagree) to five (strongly agree).

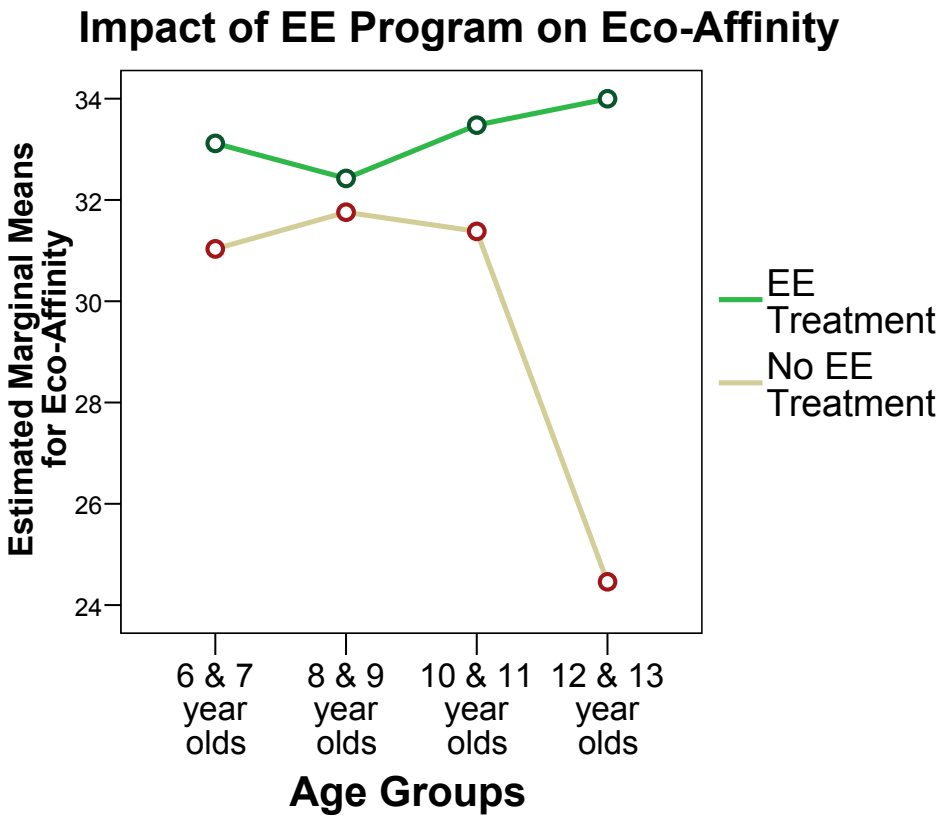


Figure 13. Estimated Marginal Means for Post-test Eco-Affinity Scores by Age Group (n = 139).

Pre-test scores were entered in step one of the hierarchical regression, explaining 58.0% of the total variance. The demographic variables gender, age, and ethnicity only accounted for an additional 0.01% of the variance in eco-affinity scores after controlling for pre-test scores. The EE treatment variable was then added to explain another 2.5% of

the variance after controlling for all other variables (F change $_{1,133}$ = 8.69, p = 0.004). In the final model, only two variables made a unique contribution to post-test eco-affinity scores: pre-test eco-affinity scores (beta = 0.746, p ≤ 0.001) and EE treatment (beta = -0.160, p = 0.004; Table 12).

Eco-Awareness and the EE Program

After adjusting for pre-test scores, the ANCOVA revealed no significant differences in mean-post test eco-awareness scores between the treatment and control groups when accounting for gender ($F_{1,138}$ = 2.09, p = 0.151, partial eta squared = 0.015) and ethnicity ($F_{1,138}$ = 1.74, p = 0.190, partial eta squared = 0.012; Table 10). Eco-awareness score were significantly different when age was included in the model ($F_{1,134}$ = 5.06, p = 0.026), but not when the oldest age group (n = 4) was removed ($F_{1,131}$ = 1.16, p = 0.283). A strong relationship existed between pre-test and post-test eco-awareness scores (η^2 = 0.559 - 0.598). None of the interactions associated with gender, age, or ethnicity and the treatment group were statistically significant. Despite the non-significant interactions of the EE treatment with gender ($F_{1,138}$ = 1.24, p = 0.267) and ethnicity ($F_{1,138}$ = 1.87, p = 0.174), data revealed some interesting trends. The gap between the treatment and control eco-awareness scores for boys and African-Americans was larger than the gap between treatment and control scores for girls and white children (Figures 14 & 15).

Table 10

Pre and Post-test Eco-Awareness Scores for Treatment and Control Groups

Group	Pre-test			Post-test		
	N	Mean	SD	N	Mean	SD
Treatment	69	34.52	4.53	69	35.93	4.25
Control	74	34.08	4.97	74	34.88	5.23

Note: The eco-awareness scale consisted of eight Likert-type items rated on a scale of one (strongly disagree) to five (strongly agree).

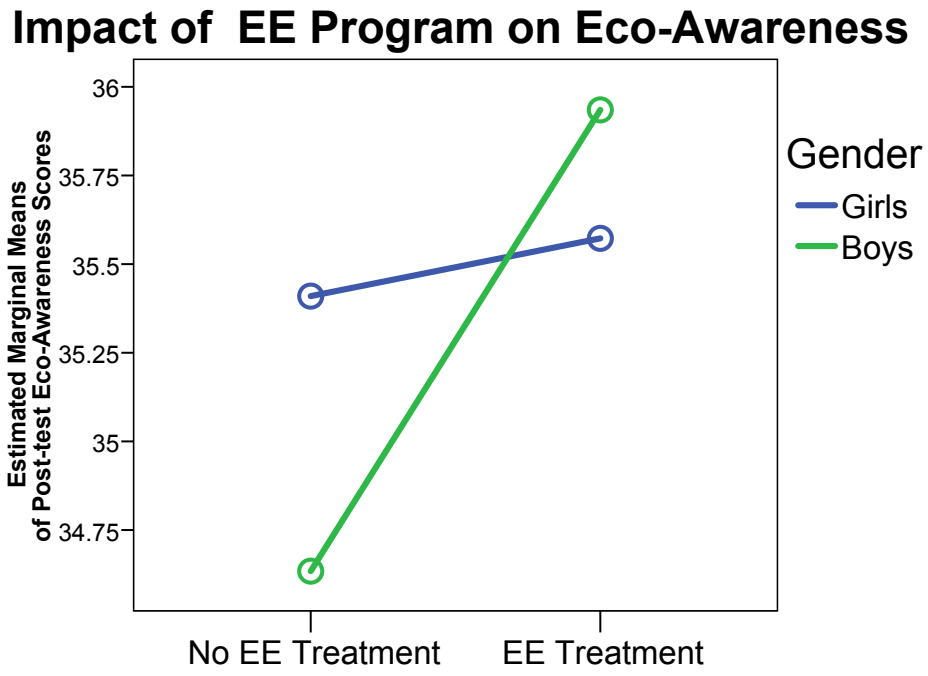


Figure 14. Estimated Marginal Means for Post-test Eco-Awareness Scores by Gender (n = 143).

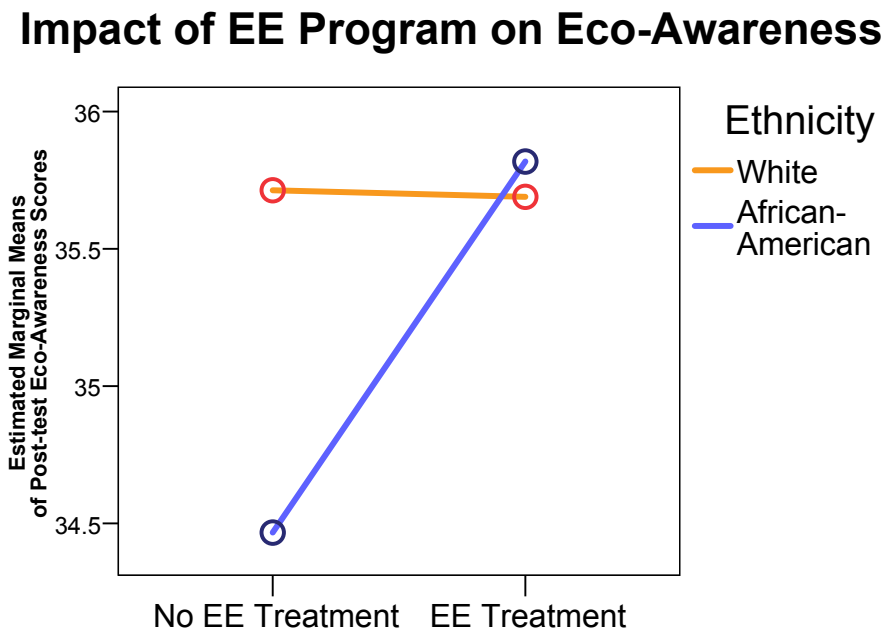


Figure 15. Estimated Marginal Means for Post-test Eco-Awareness Scores by Ethnicity (n = 143).

Pre-test scores were entered in step one of the hierarchical multiple regression model, explaining 60.2% of the total variance. After controlling for pre-test scores, the demographic variables gender, age, and ethnicity only accounted for an additional 0.01% of the variance in eco-awareness. The EE treatment variable was then added to explain another 0.01% of the variance after controlling for all other variables (F change$_{1,137}$ = 2.90, p = 0.091). In the final model, only pre-test eco-awareness scores (beta = 0.742, p $\leq$ 0.001) made a unique contribution to post-test eco-awareness scores (Table 12).

Content Knowledge and the EE Program

After adjusting for pre-test scores, the ANCOVA revealed significant differences in mean-post test content knowledge scores between the treatment and control groups (Table 11). Treatment effects were most pronounced when accounting for ethnic ($F_{1,142}$ =

30.50, $p \leq 0.001$, partial eta squared = 0.177) and gender differences ($F_{1,142} = 29.93$, $p \leq 0.001$, partial eta squared = 0.174), but significant post-program improvements also were evident controlling for age ($F_{1,138} = 12.32$, $p \leq 0.001$ partial eta squared = 0.082). In all cases, the strength of relationship between the treatment and content knowledge was relatively strong ($\eta^2 = 0.082 - 0.177$). The main effect of ethnicity on adjusted post-test scores also was significant ($F_{1,142} = 4.71$, $p = 0.034$, partial eta squared = 0.031). A strong relationship existed between pre-test and post-test content knowledge scores ($\eta^2 = 0.354 - 0.461$). Interactions associated with gender, age, ethnicity and the EE treatment were not statistically significant. Results suggested that the EE program led to a statistically significant positive increase in content knowledge scores for children regardless of gender or age. Although no statistically significant interaction between the EE treatment and ethnicity was evident ($F_{1,142} = 1.11$, $p = 0.295$), the magnitude of a child's adjusted post-test content knowledge score seemed to be related to ethnicity. African-Americans showed the largest score increases following the EE treatment (Figure 16). White children continued to score higher than African-American on the content knowledge scale after the EE program, but that difference was less pronounced.

Table 11

Pre and Post-test Content Knowledge Scores for Treatment and Control Groups

Group	**Pre-test**			**Post-test**		
	N	Mean	SD	N	Mean	SD
Treatment	72	3.53	1.57	72	4.67	1.42
Control	77	3.23	1.49	75	3.55	1.39

Note: The content knowledge scale consisted of four multiple choice items (0 = incorrect answers, 1 = correct answer) and one open-ended question (0.33 for each acceptable response).

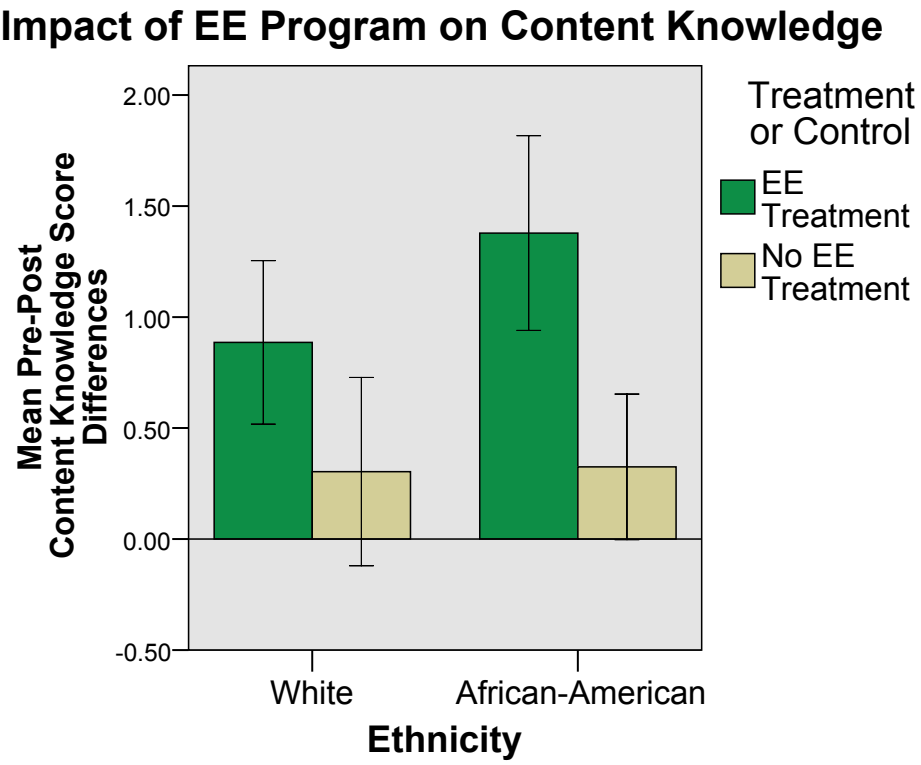


Figure 16. Mean Pre-test, Post-test Content Knowledge Score Change by Ethnicity (n = 149).

The hierarchical multiple regression model evaluated the influence of separate independent variables on post-test content knowledge scores. Pre-test scores were entered in step one, explaining 44.9% of the total variance. The demographic variables gender, age, and ethnicity accounted for an additional 2.8% of the variance in content knowledge scores after controlling for pre-test scores. The EE treatment variable was then added to explain another 10.9% of the variance after controlling for all other variables ($F\ change_{1,141} = 37.17$, $p \leq 0.001$). In the final model, several variables made a unique contribution to post-test content knowledge scores: pre-test content knowledge scores (beta = 0.548, $p \leq 0.001$), EE treatment (beta = -.331, $p \leq 0.001$), ethnicity (beta = -0.179, $p = 0.005$), and gender (beta = -0.114, $p = 0.039$; Table 12).

Table 12

Hierarchical Regression Model Standardized Coefficients (With Significance) for Post-test Scores on Three Subscales

Subscale	**Pre-test**	**Ethnicity**	**Gender**	**Age**	**EE Treatment**
Eco-Affinity	.746**	-.098	.014	-.003	-.160**
Eco-Awareness	.742**	-.098	-.036	.022	-.090
Content Knowledge	.548**	-.179**	-.114*	.031	-.331**

*$p \leq 0.05$, **$p \leq 0.01$

Overall, children in the treatment group exhibited significantly higher post-test scores than children in the control group after controlling for gender, age, and ethnicity. Thus, the null hypotheses H_{3a0}, H_{3b0}, H_{3c0}, and H_{3d0} were rejected. The EE program appeared to have the most significant effect on children's eco-affinity and content knowledge. Furthermore, the magnitude of EE treatment effects varied slightly as a function of gender, age, and ethnicity.

CHAPTER V

Discussion and Implications

This study was designed to investigate the effect of an EE program on the environmental attitudes and awareness of children in a three-step process that involved: (1) development of a reliable and valid metric to quantify the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups; (2) examination of baseline differences in the environmental attitude and awareness of children from diverse gender, age, and ethnic groups; and (3) examination of the effect of a one-week EE summer camp on the environmental attitudes and awareness of children from diverse gender, age, and ethnic groups. A discussion of results and implications of future research for each stage of the project are described in this chapter. Interview excerpts have also been incorporated to illuminate important issues and trends.

Constructing the Survey Instrument

Scales that evaluate program-mediated impacts on environmental attitudes and values have been used for years, but critical elements of scale construction such as reliability and validity are often overlooked (Gray et al., 1985). A standardized scale would enable comparisons across programs and various demographic groups, but reliable methods for measuring the environmental attitudes and awareness of children have not been adequately developed. In this study, young children (six to nine year-olds) had a particularly difficult time understanding concepts like “environment” and “natural resources” in pilot tests and may have equal difficulty comprehending more complex items on scales such as Manoli et al.’s revised NEP for children (2007). Males and

minority students also seemed to struggle with response consistency and comprehension on the pilot surveys. After revisions, however, results indicated that the EAAS appeared to be a psychometrically sound scale suitable for use with six to thirteen year-old children. The EAAS contained fewer items and required less time to administer than instruments used in earlier studies (Leeming et al., 1995; Musser & Malkus, 1994). Furthermore, the new instrument appeared to be an efficient and effective method for accurately measuring the environmental attitudes and awareness of children across a demographic range.

Analysis of EAAS pre-test data showed statistically significant reliability and validity across all subgroups and subscales. The Likert-type EAAS items appeared to measure two important components of a child's environmental orientation: eco-affinity and eco-awareness. Eco-affinity items reflected personal interest in nature and intentions to engage in pro-environmental behavior. Eco-awareness items reflected a cognitive grasp of environmental issues related to the general importance and sustainability of natural ecosystems. Construct validity is an important consideration in survey design, and multiple validation methods should be considered when working with children. In this study, personal interviews supplemented the quantitative data and supported the two-factor structure. Together, eco-affinity and eco-awareness items encompassed elements of attitudes addressed in earlier research, such as ecological appreciation and environmental concern (Eagles & Demare, 1999; Kellert, 1985, 2002). Overall, the items grouped under the eco-affinity and eco-awareness categories seemed to represent distinct components of children's environmental attitudes.

A short, program-specific content knowledge component was used to investigate the link between the cognitive and affective components of environmental attitudes. Instruments that incorporate lengthy knowledge-based sections, such as the CHEAKS scale (Leeming et al., 1995), can be cumbersome for participants difficult to implement in a short time frame. However, if more time is available, a longer, more general measure of environmental literacy might be more relevant to conservation knowledge than content-specific questions such as those utilized in this study. In any case, cognitive metrics are necessary to examine the foundation and associations of knowledge, attitudes, and behavior. Content knowledge and eco-awareness were closely connected, but eco-affinity did not appear to be tied to the other subscale scores. This result suggested that a child's preference for nature may not be determined by how much he/she knows about environmental issues. Future research with more complex knowledge scales is necessary to validate this conclusion.

Administration of the EAAS presented several logistical problems. The survey was administered in groups of various sizes (ranging from one to twenty-five), and the impact of group size on the instrument's reliability and validity was a concern. Reliability estimates were higher for students in large groups of more than ten individuals (Cronbach's alpha = 0.892, n = 73) than the small groups (Cronbach's alpha = 0.762, n = 104). However, the 16-item survey seemed to maintain its two-component structure better in smaller groups. The data suggested an optimal group size of six to ten individuals – though larger groups produced more efficient data collection, they also were characterized by insufficient response validity.

Experimenter expectancy effects should be considered when (a) an instrument is administered immediately following an intervention or (b) the instrument is administered by the same person who presented the intervention (Leeming et al., 1993). In the current study, children who completed post-camp surveys administered by EE program personnel could potentially score higher on pro-environmental metrics in an effort to please their instructors. This possible bias was examined through a comparison of scores from post-test surveys administered by different people, and the analysis revealed no statistically significant evidence of expectancy bias. Although more children responded to all of the 16 items in the instructor-administered surveys (94.7%) than those administered by the trained volunteers (78.9%), Cronbach's Alpha coefficients for the instructor-administered surveys (alpha = 0.764, n = 54) and the volunteer-administered surveys (alpha = 0.784, n = 45) were similar. In both cases, the underlying factors were consistent with the EFA for the overall survey data. Each volunteer was trained with strict guidelines to follow prior to survey and interview administration (Appendices H & I), and the emphasis on a standardized survey administration process may have eliminated potential instructor-induced effects on survey scores.

Techniques used to recruit subjects can also interfere with population level inferences beyond the survey sample (Dillman, 2007). The summer EE programs were advertised at multiple locations in the community, and participation in the programs was strictly voluntary. Children who registered for the Eco-Camps may have possessed a predisposition for environmentally-oriented programs, creating the possibility of self-selection bias (Leeming et al., 1993). Though the pre-test scores for children participating in the EE programs were slightly higher across all subscales, these initial score

differences were not statistically significantly different. The potential eco-friendly predisposition of children in the EE programs did not appear to have a major impact on this study.

A better understanding of environmental attitudes may lead to improved EE programs, but education must translate into action. A notable shortcoming of the EAAS is its inability to directly measure stewardship behavior. Researchers have devoted a great deal of attention to the links between values, beliefs, attitudes, norms, and behavioral intentions in a conservation context (Hungerford & Volk, 1990; Kaiser, Hubner, & Bogner, 2005; Kruse & Card, 2004; Stern, 2000). Due to various unpredictable external conditions such as time constraints, financial constraints, moral obligations, or lack of personal control, many argue that attitudes are not always effective predictors of actual behaviors (Gardner & Stern, 1996; Guagnano et al., 1995; Hines et al., 1986). Many factors undoubtedly influence human conservation behavior, but a positive correlation between pro-environmental attitudes and behavior has been confirmed by numerous studies (Evans et al., 2007; Heberlein & Black, 1981; Kaiser et al., 2007; Weigel & Weigel, 1978). The attitude-behavior consistency may be even stronger in children (Gotch & Hall, 2004; Kaiser et al., 2007). Thus, a tool used to measure children's attitudes, especially one that includes behavior intentions such as the EAAS, may help forecast a child's likelihood to engage in environmental stewardship actions. Hungerford & Volk (1990) postulated that stewardship behavior can only be influenced when environmental sensitivity and awareness are coupled with a sense of ownership and empowerment – variables that were not included in the EAAS due to logistical constraints such as time restrictions and limited staff. More research is needed to reach

beyond attitude and value orientations to evaluate the EAAS's capacity to predict environmental behaviors.

Results suggest that the EAAS is a valid and reliable instrument that can be used to assess environmental attitudes and awareness in young children. This instrument is a preliminary attempt to create a short survey specifically designed for young audiences, and continued efforts to refine and revise the evaluation tool will enhance its utility. For example, the incorporation of reverse-scaled questions, which were initially omitted to reduce complexity, might increase survey reliability. The five-point scale also could be extended to seven or nine categories – an adjustment that would increase variation in the response variables and alter the negatively skewed distribution. However, added complexity could also exacerbate comprehension issues in young children. Future use of the EAAS will continue to generate feedback and revisions, casting more light on the validity of survey constructs. Data obtained from this new evaluation tool could be used to improve EE and outdoor education programs for a variety of young audiences, and may help instructors determine cognitive and affective aspects of their programming that need improvement.

Measuring Children's Environmental Attitudes and Awareness

A synthesis of prior research suggests an ambiguous relationship between gender, age, ethnicity, and environmental attitudes (Eagles & Demare, 1999; Flannery & Whiting, 2003; Hines et al., 1986; Kahn & Kellert, 2002; Shepard & Speelman, 1985; Whittaker et al., 2005). In this study, pre-test survey scores revealed several interesting trends. No statistically significant differences emerged in the pre-test scores of boys and girls. Contrary to other research that reveals different views of wildlife and nature among

boys and girls (Flannery & Whiting, 2003), gender did not appear to have a major effect on eco-affinity, eco-awareness, or content-knowledge in this study. Age effects were significant, as younger children scored higher than older children on some subscales. Content knowledge, as expected, generally increased as children got older. Contrary to the hypotheses, however, these cognitive gains were not associated with higher eco-affinity and eco-awareness levels in older children. Older children actually reported equal levels of eco-awareness and lower eco-affinity than the younger children, a result that was somewhat surprising considering previous observations of heightened environmental concern in older children (Eagles & Demare, 1999; Kellert, 1985, 2002). High levels of specific indicators associated with eco-affinity have been documented before in young children (Hines et al., 1986; Leeming et al., 1995), and may be a residual effect of "biophilia," or an inherent passion for the natural world that all humans share from early age (Kellert & Wilson, 1993; Wilson, 1984). Without positive reinforcement, however, children may begin to lose this innate eco-affinity as they enter upper elementary school.

Ethnicity also seemed to play a role in the development of certain environmental attitude components. The relationship between ethnicity and environmental attitudes has been debated for some time. Early work showed lower levels of environmental concern in African-Americans (Hershey & Hill, 1978; Jones & Carter, 1994), but ethnic differences associated with ecological orientations may be smaller than initially suspected. Eco-affinity levels in this study were almost identical for both African-American and white children – a result consistent with recent research regarding race and concern for the environment (Jones & Rainey, 2006; Kahn, 1999; Mohai & Bryant, 1998). Significant differences emerged in the eco-awareness of white and minority students. Minority

students also scored lower on the content knowledge portion of the EAAS. Although African-Americans and other minority students in this study clearly cared about nature, they were less aware of issues related to ecological importance and sustainability than white children.

The close correlation between ethnicity and socioeconomic status in this study cannot be overlooked. Despite a historically weak relationship between SES and concern for environmental quality (Van Liere & Dunlap, 1980), economic discrepancies have been shown to influence specific environmental attitudes (Fisman, 2005; Johnson et al., 2004). When basic survival needs are not fulfilled on a regular basis, many impoverished children are not motivated to care about broader issues like resource conservation (Maslow, 1943; Mohai & Bryant, 1998). With fewer opportunities to explore nature within the security of a safe neighborhood, low SES children may be less inclined to nurture pro-ecological tendencies (Fisman, 2005). This study featured sharp ethnic and socioeconomic contrasts in the treatment and control groups. Most of the white participants attended either a summer program with a substantial weekly cost ($35 to $110) or a high-performing local school (Barrow Elementary). Most of the African-American and Hispanic participants attended either a summer program with little to no weekly cost ($0 to $5) or a low-performing local school (Gaines Elementary).

Interview responses from children in the treatment group provided evidence to support the theory that children from different ethnic and socioeconomic backgrounds were exposed to nature in different ways. Two out of every three children who claimed to spend a majority of outdoor time in their own private backyard were white. The children who said they went somewhere to play outside, such as a friend's or relative's house,

were predominantly African-American (83%). White children also were more likely to engage in solitary nature-based activities (58%) than African-Americans (21%), who preferred a social outdoor experience. One ten year-old African-American boy summed up his experience with the following statement:

> I don't go outside at my house because it's like a bad, you know, environment to go out in. So my mom takes me to the park and we go play basketball, go on the swings, slide down the slide, and sometimes we walk.

Many of the white children clearly had a different perspective. "I go in my backyard woods," one ten year-old girl said. "I have trails back there. It goes back to this field thingy. I have lots of places to explore." An eleven-year old boy was in a similar situation:

> I like to invite people over and go down in the woods and work on a fort that we have. It's actually bigger than this room. It has a treehouse, tunnel, fireplace, and seats. We haven't finished it yet. There are spiders and leaves in there. We're going to add another layer to the treehouse and we'll probably add a zipline.

The quotes highlight some significant differences in the outdoor experiences of children prior to the EE program. Whether or not those differences were caused by ethnicity, SES, or an interaction of the two remained unclear, but there appeared to be a positive correlation between direct contact with nature, free play, and eco-awareness (Chawla, 2006). Thus, an absence of free exploration opportunities and authentic natural experiences in poor areas should be a major concern (Chawla, 2006; P. H. Kahn, 2002; Louv, 2005), and could be a reason for lower eco-awareness and content knowledge

scores associated with minority students and children of lower SES in the Athens, GA, area.

Differences in the eco-affinity of six to thirteen year-old children from distinct gender and ethnic groups appear to be negligible, but the inverse relationship between age and eco-affinity demands more attention. The No Child Left Behind Act has placed a growing emphasis on testing associated with reading, writing, and mathematics, and environmental education is often regarded as a lower priority. A 2000 study by the North American Association for Environmental Education and the Environmental Literacy Council showed that although 61% of public school teachers claim to include environmental topics in their curricula, most devote fewer than 50 hours to it throughout the course of an entire year (Coyle, 2005). Without opportunities to learn about environmental issues and engage in direct experiences with nature, a child's eco-affinity may be less likely to persist as he/she gets older. Research that tracks eco-affinity and similar measures as children transition from upper elementary to middle school might help illuminate strategies for preserving pro-environmental orientations. An investigation of the links between eco-affinity and environmental literacy also may help educators develop strategies to mitigate the declining interest in the natural world that is characteristic of many older children.

Despite research that has revealed equivalent and occasionally elevated levels of environmental concern in adults from minority populations (Jones & Rainey, 2006; Mohai & Bryant, 1998), this study showed that African-American children's eco-awareness and environmental content knowledge were substantially lower than white children's. Awareness and content knowledge do not necessarily equate to concern, but

these two factors may have a significant impact on environmental literacy. One plausible reason for this discrepancy is limited social support for nature-based activities, which seems to discourage many minority children from developing interest in environmental careers (Chawla, 2006). Without positive mentors, children may have trouble building environmental awareness and knowledge. In this study, for example, half of the African-American children interviewed (17 of 34) said they never talked to their parents about nature, compared to 26% of white children (9 of 34). Access to outdoor activities and direct experience with nature are also limited for many children from low socio-economic status families. The current study did not distinguish between ethnicity-related and SES-related effects on environmental attitudes, but links between attitude and awareness subscales, ethnicity, and SES warrant further investigation.

The persistence of an awareness and knowledge gap in minority children is a major concern, and efforts should be made to increase social support for environmental activities and identify cultural and economic barriers that influence eco-awareness and knowledge in different populations. Several U.S. cities have derived social and health benefits from growth that emphasizes urban "greening" and environmental restoration in low SES neighborhoods (Taylor et al., 1998). Similar projects may provide a unique opportunity to influence the environmental awareness and stewardship behavior of underserved minority populations, and research is needed to investigate the link between urban green space and children's environmental attitudes on a larger geographical scale.

Schools in the U.S. will become more diverse as the Hispanic proportion of the population continues to grow. Hispanic children's views of nature likely will play an important role in future conservation efforts. Although this study revealed roughly

equivalent levels of environmental attitudes and awareness for Hispanic and African-American children, generalizations could not be made due to the small sample size (n=6). Other studies investigating minority perceptions of environmental issues have found increasing levels of environmental awareness in Latinos (Whittaker et al., 2005). Research that focuses on the environmental attitudes and awareness of Hispanic children would help educators redesign and reevaluate EE programs to benefit minority students from all backgrounds.

Measuring EE Program Effects on Children's Environmental Attitudes and Awareness

Authorities have issued a call for rigorous EE programs and curricula that help children reconnect with nature (Coyle, 2005; Louv, 2005; Pergams & Zaradic, 2006), stimulating a push for program evaluation and assessment. Many of these evaluation tools focus on cognitive gains, but affective components are equally important if the ultimate goal is pro-environmental behavior. This study addressed the affective side of EE instruction by attempting to answer the following question: Does exposure to an EE program alter young children's environmental attitudes, awareness, and knowledge? Data analysis indicated that participation in the EE program affected different aspects of environmental attitudes and awareness to different degrees. Baseline eco-affinity, eco-awareness and content knowledge for children in the treatment and control groups were approximately equal, but the EE treatment effects related to gender, age, and ethnicity varied from one subscale to another. The summer EE program had a significantly positive impact on eco-affinity and content knowledge scores, and relatively little influence on eco-awareness.

Universal benefits of EE on the content knowledge scale were obvious for children in all groups, including African-Americans. This result was not surprising considering the number of other EE programs that have been shown to foster cognitive growth in children (Bogner, 1998; Laing, 2004; American Institutes for Research, 2005). The EE mediated-knowledge gains were encouraging because knowledge is a critical component of environmental literacy (Coyle, 2005). However, attitudes and awareness have a more direct impact on behavior. Thus, the study's primary emphasis was on the affective impacts of environmental education.

Participation in the EE treatment precipitated a substantial rise in eco-affinity scores. The EE-mediated increase in eco-affinity was consistent for children across demographic variables, but especially noticeable in children between the ages of ten and thirteen. Older children, who displayed the lowest eco-affinity levels on the pre-test, scored the highest on the eco-affinity subscale following the EE treatment. This pattern seemed to contradict earlier research that showed no significant changes in environmental attitude scores for older children following an EE intervention (Eagles & Demare, 1999; Keen, 1991; Shepard & Speelman, 1985). Eagles and Demare (1999) noted that previous experience with EE programs led to moderate baseline levels of ecologistic and moralistic concern that were difficult to alter. This study suggests that, regardless of initial eco-affinity, EE can increase interest in nature and environmental preferences for a diverse population of children.

The strong effect of EE on children's eco-affinity was likely tied to the nature of the summer program activities. Though the day-to-day programming featured a mix of activities ranging from inactive (sedentary observation games, writing, arts and crafts,

etc.) to very active (ecosystem tag games, relay races, etc.), the children showed an overwhelming preference for activities that involved at least some degree of activity. A majority of the children who attended the EE program said they would definitely return (79%). When asked "Why would you like to go this program again?" the most common response was "to have fun" (73%). Learning interesting facts about plants and animals may have been an added bonus, but most children who participated in the summer EE program remembered one thing about their experience – it was fun! A program that features a different instructional format may produce different results.

Although the EE program raised the eco-affinity of children, it had little effect on eco-awareness. Several explanations are plausible. Pre-test scores were the best predictor of post-test eco-awareness scores. Pre-test eco-awareness scores that were clustered around the high end of the scale may have limited variability and decreased the potential to observe treatment effects (Dresner & Gill, 1994). An expanded scale with a broader range of response options might help to alleviate this problem. Another possibility is that high eco-awareness scores on the initial survey could reflect the modern preponderance of vicarious experiences with nature through the media (Kahn & Kellert, 2002). Indirect exposure to nature may permit children to build some awareness of environmental issues without developing an appreciation or affinity for the natural world. Finally, although one week may be sufficient to help children reactivate their inherent passion for nature, more time is likely necessary to help them understand the concepts of ecosystem importance and sustainability.

Despite an absence of significant differences in eco-awareness scores between the treatment and control groups, the data revealed some interesting trends that warrant

further analysis. The EE program appeared to have a positive impact on the post-test eco-awareness of boys. Boys typically have shown less concern for conservation (Milfont & Duckitt, 2004; Vaske et al., 2001; Zelezny, 2000), but they adopted a more positive attitude after exposure to this EE program, which reinforced stewardship values. The same may be true for African-Americans, who also showed a marked increase in eco-awareness following this EE program. The EE activities may have been especially beneficial for children with lower baseline levels of eco-awareness. These children likely had little or no previous exposure to nature, and the EE program may have altered their perception of the environment.

An effective EE program could enhance environmental awareness and knowledge, but this study indicated that the greatest asset of EE may be its potential for increasing eco-affinity in children of all ages. Although no previous environmental attitude and awareness data existed for the older children in this sample, it is likely that the ten to thirteen year-old children in the study once held beliefs similar to their six to nine year-old colleagues. Personal and academic priorities begin to shift over time, and older children may have fewer opportunities to interact with nature. A short intervention, such as a one-week summer program, can help ten to thirteen year-olds rekindle and even build upon a previous pro-environmental orientation.

Both white and African-American children claimed the EE program changed the way they felt about nature to some degree (78%). A seven year-old white boy admitted, “At first I don’t often go outside. Now I want to go out there because it is more fun than I thought it would be.” A ten year-old black boy echoed those sentiments, stating, “At first I wasn’t really interested in nature, but when I started coming to Eco-Camp I started

liking nature a lot more than I used too." The comments and research results were consistent with other studies refuting the basic assumption that environmentalism is a strictly white phenomenon (Johnson et al., 2004; Kahn, 1999; Whittaker et al., 2005). Even without exposure to EE, African-American and white children display comparable levels of eco-affinity. Given a forum to interact with nature, such as a summer EE program, African-American children may be able to improve eco-awareness and environmental knowledge as well. Results present hope for EE outreach in underserved communities. The EE program seemed to work equally well for all audiences, and efforts that build on the intrinsic eco-affinity of African-American children may help to bridge existing eco-awareness and content knowledge gaps and create a more environmentally-literate society.

Although the immediate positive influence of education on environmental attitudes is encouraging, long-lasting effects of the EE treatment could not be measured because the study was limited to a one-week period. A delayed post, longitudinal-type study would have provided insight into long-term program effects. Additional research is needed to understand the long-term effects of increased eco-affinity, eco-awareness, and content knowledge on the values, ethical beliefs, and environmental behavior of children from all backgrounds.

Finally, results suggest that EE programs should focus on learning through games and activities that help keep children engaged. A heavy emphasis on information content and cognitive gains may overshadow more exciting aspects of EE that have a stronger influence on environmental attitudes. The true value of effective EE may lie in entertaining and exciting programming, a delivery style that is not always applicable in a

formal school setting. Out-of-school experiences can catalyze an interest in nature and environmental issues (Uitto et al., 2006). Thus, the summer EE approach may be a critical method for reconnecting kids with nature and promoting positive environmental attitudes. A comparative study of the effects of formal and informal approaches to EE on environmental attitudes, awareness, and conservation behavior would help to direct EE efforts, refine implementation strategies, and recognize critical stages for affecting a pro-environmental ethos in younger children.

Summary

If EE programs are going to play an important role in the development of an environmentally-literate global society, an evaluation of EE program impacts on children's environmental attitudes and awareness will be critical. This study built on existing research to describe the development of an efficient, reliable, and valid survey instrument that measured three important components of a child's environmental orientation: eco-affinity, eco-awareness, and content knowledge. Two important trends were evident in baseline measurements of environmental attitudes. Children displayed high levels of eco-affinity before the age of ten, but by upper elementary school eco-affinity began to decline. African-American and white children showed the similar levels of eco-affinity, but the eco-awareness and environmental content knowledge of African-Americans was significantly lower. A one-week EE summer program had a positive impact on the eco-affinity of all participants, and appeared to be particularly effective for older children. The EE program also led to significant content knowledge gains for children from all gender, age, and ethnic groups. Surprisingly, eco-awareness was only marginally impacted by the EE treatment. Overall, African-American children showed

the most noticeable increases in eco-awareness and knowledge following the summer EE program. Based on these results, it appears that all children derive some direct benefits from environmental education. Environmental education programs that promote positive interactions with nature strengthen children's eco-affinity and may incite a deeper appreciation of the natural world. Research is needed to identify additional factors that effect children's environmental orientations and to determine strategies for improving access to EE programs for all audiences.

REFERENCES

Adeola, F. O. (1994). Environmental hazards, health, and racial inequity in hazardous waste distribution. *Environment and Behavior, 26*, 99-126.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.

American Institutes for Research. (2005). *Effects of outdoor education programs for children in California*. Sacremento, CA: The California Department of Education.

Arcury, T. A., & Christianson, E. H. (1993). Rural-urban differences in environmental knowledge and actions. *Journal of Environmental Education, 25*(1), 19-25.

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). *Educational psychology: A cognitive view* (2nd ed.). New York, NY: Rinehart and Winston.

Barraza, L., & Cuaron, A. D. (2004). How values in education affect children's environmental knowledge. *Journal of Biological Education, 39*(1), 18-23.

Bechtel, R. B., Corral-Verdugo, V., & de Queiroz Pinheiro, J. (1999). Environmental belief systems: United States, Brazil, and Mexico. *Journal of Cross-Cultural Psychology, 30*(1), 122-128.

Bogner, F. X. (1998). The influence of short-term outdoor ecology education on long-term variables of environmental perspective. *Journal of Environmental Education, 29*(4), 17-29.

Braus, J. (1995). Environmental education. *BioScience, 45* (Supplement: Science and Biodiversity Policy), S45-S51.

Bullard, R. D. (2006). Anatomy of environmental racism and the environmental justice movement. In R. D. Bullard (Ed.), *Confronting environmental racism: Voices from the grassroots*. Boston, MA: South End Press.

Bullard, R. D. (2001). Dumping in Dixie: Race, class, and environmental quality. Boulder, CO: Westview Press.

Bunting, T. E., & Cousins, L. R. (1983). Development and application of the Children's Environmental Response Inventory. *Journal of Environmental Education, 15*(1), 3-10.

Busser, J. A., Hyams, A. L., & Carruthers, C. P. (1996). Differences in adolescent activity participation by gender, grade and ethnicity. *Journal of Park and Recreation Administration, 14*(4), 1-20.

Capps, R., Fix, M., Murray, J., Ost, J., Passel, J. S., & Herwantoro, S. (2005). *The new demography of America's schools: Immigration and the No Child Left Behind Act*. Retrieved November 30, 2006, from http://www.urban.org/publications/311230.html

Castro, P. (2006). Applying social psychology to the study of environmental concern and environmental worldviews: Contributions from the social representations approach. *Journal of Community & Applied Social Psychology, 16*, 247-266.

Chawla, L. (2006). Learning to love the natural world enought to protect it. *Barn, nr. 2*, 57-78.

Cordell, H. K., Betz, C. J., & Green, G. T. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences, 24*, 13-41.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1-9.

Coyle, K. (2005). *Environmental literacy in America: What ten years of NEETF/Roper research and related studies say about environmental literacy in the U.S.* Washington, DC: The National Environmental Education & Training Foundation.

Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. London: Routledge.

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Dresner, M., & Gill, M. (1994). Environmental education at summer nature camp. *Journal of Environmental Education, 25*(3), 35-41.

Dunlap, R. E., & Van Liere, K. D. (1978). The "New Environmental Paradigm": A proposed measuring instrument and preliminary results. *Journal of Environmental Education, 9*(4), 10-19.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues 56*(3), 425-442.

Eagles, P. F. J., & Demare, R. (1999). Factors influencing children's environmental attitudes. *Journal of Environmental Education, 30*(4), 33-37.

Environmental Protection Agency. (1990). *National Environmental Education Act of 1990*. Retrieved. from http://www.epa.gov/enviroed/whatis.html.

Evans, G. W., Brauchle, G., Haq, A., Stecker, R., Wong, K., & Shapiro, E. (2007). Young children's environmental attitudes and behaviors. *Environment and Behavior, 39*(5), 635-659.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*(3), 272-299.

Falk, J. H. (2001a). Free-choice science education: How we learn science outside of school. In R. Duschl (Ed.), *Ways of knowing in science and mathematics*. New York, NY: Teachers College Press.

Falk, J. H. (2001b). Free-choice science learning: Framing the discussion. In J. H. Falk (Ed.), *Free-choice science education: How we learn science outside of school*. New York, NY: Teachers College Press.

Fernandez-Manzanal, R., Rodriguez-Barreiro, L., & Carrasquer, J. (2007). Evaluation of environmental attitudes: Analysis and results of a scale applied to university students. *Science Education, 91*(6), 988-1009.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley Publishing Company.

Fisman, L. (2005). The effects of local learning on environmental awareness in children: An empirical investigation. *Journal of Environmental Education, 36*(3), 39-50.

Flannery, K., & Whiting, R. M. (2003). Children's attitudes towards wildlife: A comparison by ethnicity and community size. *Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies, 57*, 280-290.

Garden Earth Naturalist Brochure. (2007). Garden Earth Naturalist After Schoool Clubs Brochure. In the State Botanical Garden of Georgia (Ed.).

Gardner, G.T., & Stern, P. C. (2002). *Environmental problems and human behavior* (2nd ed.). Boston: Allyn & Bacon.

Gardner, G. T., & Stern, P. C. (1996). *Environmental problems and human behavior*. Boston, MA: Allyn and Bacon.

Gifford, R. (2002). *Environmental psychology: Principles and practice* (3rd ed.). Colville, WA: Optimal Books.

Gilchrist, S. C. (2002). *The effects of Project Wild on fourth grade students in Wisconsin: Results of a statewide study, 1989-90*. Madison, WI: Department of Natural Resources.

Gollnick, D. M., & Chinn, P. C. (2002). *Multicultural education in a pluralistic society* (6th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Gotch, C., & Hall, T. (2004). Understanding nature-related behaviors among children through a Theory of Reasoned Action approach. *Environmental Education Research, 10*(2), 157-177.

Gray, D. B., Borden, R. J., & Weigel, R. H. (1985). *Ecological beliefs and behaviors: Assessment and change*. Westport, CT: Greenwood Press.

Green, S. B., & Salkind, N. J. (2003). *Using SPSS for Windows and Macintosh: Analyzing and understanding data.* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior, 27*, 699-718.

Guth, J. L., Green, J. C., Kellstedt, L. A., & Smidt, C. E. (1995). Faith and the environment: Religious beliefs and attitudes on environmental policy. *American Journal of Political Science, 39*(2), 364-382.

Heberlein, T. A. (1981). Environmental attitudes (Publication. Retrieved December 20, 2007, from ZfU: http://www.drs.wisc.edu/heberlein/_documents/_public/EnvironmentalAttitudes.pdf)

Heberlein, T. A., & Black, J. S. (1981). Cognitive consistency and environmental action. *Environment and Behavior, 13*(6), 717-734.

Hellden, G. F. (1998). *A longitudinal study of students' conceptualization of ecological processes*. Paper presented at the Annual Meeting of the National Association for Reserach in Science Teaching.

Hershey, M. R., & Hill, D. B. (1978). Is pollution "a white thing?" Racial differences in preadults' attitudes. *Public Opinion Quarterly, 41*, 439-458.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1986). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *Journal of Environmental Education, 18*(2), 1-8.

Huck, S. W., & Cormier, W. H. (1996). *Reading statistics and research* (2nd ed.). New York, NY: Addison Wesley Longman.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *Journal of Environmental Education*, 21(3), 8-21.

Iozzi, L. (1989). What research says to the educator: Part I, environmental education and affective domain? *Journal of Environmental Education, 20*(3-13).

Johnson, C. Y., Bowker, J. M., & Cordell, H. K. (2004). Ethnic variation in environmental belief and behavior: An examination of the New Ecological Paradigm in a social psychological context. *Environment and Behavior, 36*, 157-186.

Jones, R. E. (2002). Blacks just don't care: Unmasking popular stereotypes about concern for the environment among African-Americans. *International Journal of Public Administration, 25*(2), 221-251.

Jones, R. E., & Carter, L. (1994). Concern for the environment among Black Americans: An assessment of common assumptions. *Social Science Quarterly, 75*(3), 560-579.

Jones, R. E., & Dunlap, R. E. (1992). The social bases of environmental concern: Have they changed over time? *Rural Sociology, 5*(1), 28-47.

Jones, R. E., & Rainey, S. A. (2006). Examining linkages between race, environmental concern, health, and justice in a highly polluted community of color. *Journal of Black Studies, 36*, 473-496.

Kahn, P.H. (1999). *The human relationship with nature*. Cambridge, MA: MIT Press.

Kahn, P. H. (2002). Children's affiliations with nature: Structure, development, and the problem of environmental generational amnesia. In P. H. Kahn & S. R. Kellert (Eds.), *Children and nature: Pyschological, sociocultural, and evolutionary investigations* (pp. 95-116). Cambridge, MA: The MIT Press.

Kahn, P. H., & Friedman, B. (1995). Environmental views and values of children in an inner-city black community. *Child Development, 66*(5), 1403-1417.

Kahn, P. H., & Kellert, S. R. (Eds.). (2002). *Children and nature: Psychological, sociocultural, and evolutionary investigations*. Cambridge, MA: The MIT Press.

Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior with the Value-Belief-Norm Model in explaining conservation behavior. *Journal of Applied Social Psychology, 35*(10), 2150-2170.

Kaiser, F. G., Oerke, B., & Bogner, F. X. (2007). Behavior-based environmental attitude: Development of an instrument for adolescents. *Journal of Environmental Psychology, 27*, 242-251.

Keen, M. (1991). The effect of the Sunship Earth Program on knowledge and attitude development. *Journal of Environmental Education, 22*(3), 28-32.

Kellert, S. R. (1984). Urban Amerian perceptions of animals and the natural environment. *Urban Ecology, 8*, 209-228.

Kellert, S. R. (1985). Attitudes toward animals: Age-related development among children. *Journal of Environmental Education, 16*(3), 29-39.

Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. In P. H. Kahn & S. R. Kellert (Eds.), *Children and nature: Psychological, sociocultural, and evolutionary investigations* (pp. 117-151). Cambridge, MA: The MIT Press.

Kellert, S. R. (2005). *Building for life: Designing and understanding the human-nature connection*. Washington, DC: Island Press.

Kellert, S. R., & Westervelt, M. O. (1983). Children's knowledge, attitudes, and behavior toward animals. *Children's Environmental Quarterly, 1*, 8-11.

Kellert, S. R., & Wilson, E. O. (Eds.). (1993). *The biophilia hypothesis*. Washington, DC: Island Press.

Kostka, M. D. (1976). Nature center program impact. *Journal of Environmental Education, 8*, 52-64.

Kruse, C. K., & Card, J. A. (2004). Effects of a conservation education camp program on campers' self-reported knowledge, attitude, and behavior. *Journal of Environmental Education*, 35(4), 33-45.

Laing, M. (2004). *An examination of children's environmental attitudes as a function of participation in environmental education programs.* University of Rhode Island, Kingtson, RI.

Leeming, F. C., Dwyer, W. O., & Bracken, B. A. (1995). Children's environmental attitude and knowledge scale: Construction and validation. *Journal of Environmental Education, 26*(3), 22-31.

Leeming, F. C., Dwyer, W. O., Porter, B. E., & Cobern, M. K. (1993). Outcome research in environmental education: A critical review. *Journal of Environmental Education, 24*(4), 8-21.

Leeming, F. C., Porter, B. E., Dwyer, W. O., Cobern, M. K., & Oliver, D. P. (1997). Effects of participation in class activities on children's environmental attitude and knowledge. *Journal of Environmental Education, 28*(2), 33-42.

Legault, L., & Pelletier, L. G. (2000). Impact of an environmental education program on students' and parents' attitudes, motivation, and behaviours. *Canadian Journal of Behavioural Science, 32*(4), 243-250.

Lieberman, G. A., & Hoody, L. L. (1998). *Closing the achievement gap: Using the environment as an integrating context for learning.* Paper presented at the State Education and Environment Roundtable, San Diego, CA.

Louv, R. (2005). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books of Chapel Hill.

Mahadeva, M. N. (1989). From misinterpretations to myths. *Science Teacher, 56*(4), 33-35.

Maloney, M. P., Ward, M. P., & Braucht, G. N. (1975). A revised scale for the measurement of ecological attitudes and knowledge. *American Psychologist, 30*, 787-790.

Manoli, C., Johnson, B., & Dunlap, R. E. (2007). Assessing children's environmental worldviews: Modifying and validating the New Ecological Paradigm Scale for use with children. *Journal of Environmental Education, 38*(4), 3-13.

Marouli, C. (2002). Multicultural environmental education: Theory and practice. *Canadian Journal of Environmental Education, 7*(1), 26-42.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*, 370-396.

Milfont, T. L., & Duckitt, J. (2004). The structure of environmental attitudes: A first- and second-order confirmatory factor analysis. *Journal of Environmental Psychology, 24*, 289-303.

Mittlestaedt, R., Sanker, L., & VanderVeer, B. (1999). Impact of a week-long experiential education program on environmental attitudes and awareness. *Journal of Experiential Education, 22*(3), 138-148.

Mohai, P., & Bryant, B. (1998). Is there a "race" effect on concern for environmental quality? *Public Opinion Quarterly, 62*(4), 475-505.

Musser, L. M., & Malkus, A. J. (1994). The children's attitudes toward the environment scale. *Journal of Environmental Education, 25*(3), 22-26.

Narode, R. (1987). *Teaching thinking skills: Science*. Washington, DC: National Education Association.

National Center for Education Statistics. (2005). Kids zone: Learning with NCES. Retrieved March 21, 2007, from http://nces.ed.gov/nceskids/tools/

National Environmental Education Advisory Council. (2005). *Setting the standard, measuring results, celebrating successes: A report to Congress on the state of environmental education in the United States*. Washington, DC.

National Environmental Education Training Foundation. (1999). Environmental readiness for the 21st century. The eighth annual national report card on environmental attitudes, knowledge and behavior. Washington, DC: National Environmental Education and Training Foundation.

National Environmental Education Training Foundation & Roper Starch Worldwide. (2001). *Lessons from the environment: The ninth annual national report card on environmental attitudes, knowledge and behavior*. Washington, DCo. Document Number)

Pallant, J. (2007). *SPSS suvival manual: A step by step guide to data analysis using SPSS for Windows* (3rd ed.). New York, NY: McGraw-Hill, Open Univeristy Press.

Palmer, J. A. (1998). *Environmental education in the 21st Century: Theory, practice, progress and promise*. New York: Routledge.

Parker, J. D., & McDonough, M. H. (1999). Environmentalism of African Americans: An analysis of the subculture and barriers theories. *Environment and Behavior, 31*, 155-177.

Partners for a Prosperous Athens. (2006). Poverty in Athens: What we have learned. Retrieved March 20, 2007, from http://www.prosperousathens.org

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage.

Pergams, O. R. W., & Zaradic, P. A. (2006). Is love of nature in the US becoming love of electronic media? 16-year downtrend in national park visits explained by watching movies, playing video games, internet use, and oil prices. *Journal of Environmental Management, 80*, 387-393.

Piaget, J. (1969). *The child's conception of the world*. London: K. Paul, T. Trubner and Co. Ltd.

Pyle, R. M. (1978). The extinction of experience. *Horticulture, 56*, 64-67.

Ramey-Gassert, L. (1997). Learning science beyond the classroom. *The Elementary School Journal, 97*(4, Special Issue: Science), 433-450.

Salmivalli, M. (1998). Children's environmental response inventory among Finnish adolescents. *Journal of Environmental Education, 29*(3), 49-54.

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*, 327-339.

Schultz, P. W., Oskamp, S., & Mainieri, T. (1995). Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology, 15*, 105-121.

Schultz, P. W., & Zelezny, L. (1999). Values as predictors of environmental attitudes: Evidence for consistency across 14 countries. *Journal of Environmental Psychology, 19*, 255-265.

Shepard, C. L., & Speelman, L. R. (1985). Affecting environmental attitudes through outdoor education. *Journal of Environmental Education, 17*(1), 20-23.

Smith-Sebasto, N. J., & Cavern, L. (2006). Effects of pre- and posttrip activities associated with a residential environmental education experience on students' attitudes toward the environment. *Journal of Environmental Education, 37*(4), 3-17.

Smyth, J. C. (1995). Environment and education: A view of a changing scene. *Environmental Education Research, 1*(1), 3-21.

Snelgar, R. S. (2006). Egoistic, altruistic, and biospheric environmental concerns: Measurement and structure. *Journal of Environmental Psychology, 26*, 87-99.

SPSS, Inc. (2006). SPSS Version 15.0 for Windows. Chicago, IL: SPSS, Inc.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*, 407-424.

Stone, S. J., & Glascott, K. (1998). The affective side of science instruction. *Childhood Education, 74*, 102-104.

Stranix, E. L. (1975). *A study of attitudinal changes in inner city students as a result of constructive participation in an urban environmental studies program*. Paper presented at the First National Conference on Urban Education.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed.). Boston: Allyn and Bacon.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (1998). Growing up in the inner city: Green spaces as places to grow. *Environment and Behavior, 30*(1), 3-27.

Thompson, S. C. G., & Barton, M. A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology, 14*, 149-157.

Uitto, A., Juuti, K., Lavonen, J., & Meisalo, V. (2006). Students' interest in biology and their out-of-school experiences. *Journal of Biological Education, 40*(3), 124-129.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (1975, October 13-22). *The Belgrade Charter.* Paper presented at the International Workshop on Environmental Education, Belgrade, Yugoslavia.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (1977, October 14-26). *Intergovernmental conference on environmental education*, Tbilisi, Georgia (USSR).

United States Census Bureau. (2006). Current Population Survey, 2006 Annual Social and Economic Supplement. Retrieved April 18, 2007, from http://pubdb3.census.gov/macro/032006/pov/new01_100.htm

United States Census Bureau. (2008). State & county quickfacts (Publication. Retrieved April 24, 2008: http://quickfacts.census.gov

Van Liere, K. D., & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypotheses, explanations, and empirical evidence. *Public Opinion Quarterly, 44*, 181-197.

Van Petegem, P., & Blieck, A. (2006). The environmental worldview of children: A cross-cultural perspective. *Environmental Education Research, 12*(5), 625-635.

Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources, 12*, 523-537.

Vaske, J. J., Donnelly, M. P., Williams, D. R., & Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about National Forest management. *Society and Natural Resources, 14*, 761-776.

Vikan, A., Camino, C., Biaggio, A., & Nordvik, H. (2007). Endorsement of the New Ecological Paradigm. *Environment and Behavior, 39*(2), 217-228.

Waliczek, T. M., Logan, P., & Zajicek, J. M. (2003). Exploring the impact of outdoor environmental activities on children using a qualitative text data analysis system. *HortTechnology, 13*(4), 684-688.

Walsh-Daneshmandi, A., & MacLachlan, M. (2006). Toward effective evaluation of environmental education: Validity of the Children's Environmental Attitudes and Knowledge Scale using data from a sample of Irish adolescents. *Journal of Environmental Education, 37*(2), 13-22.

Weigel, R., & Weigel, J. (1978). Environmental concern: The development of a measure. *Environment and Behavior, 10*(1), 3-15.

Wendling, R. C., Wuensch, K. L., & Christiano, B. L. (1989). Effects of an experiential education program on rural fifth-graders. *Journal of Rural and Small Schools, 3*, 43-47.

Whittaker, M., Segura, G. M., & Bowler, S. (2005). Racial/ethnic group attitudes toward environmental protection in California: Is "environmentalism" still a white phenomenon? *Political Research Quarterly, 58*(3), 435-447.

Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.

Wiseman, M., & Bogner, F. X. (2003). A higher-order model of ecological values and its relationship to personality. *Personality and Individual Differences, 34*, 783-794.

Zelezny, L. (2000). Elaborating on gender differences in environmentalism. *Journal of Social Issues, 56*(3), 443-458.

Zimmermann, L. K. (1996). The development of an environmental values short form. *Journal of Environmental Education, 28*, 32-37.

APPENDIX A

Overview of Existing Children's Environmental Attitude Scales

Overview of Existing Children's Environmental Attitude Scales

Authors	Scale	Target Age	Structure	Results
Musser & Malkus, 1994	Children's Attitudes Toward the Environment Scale (CATES)	8-12 year-olds	25 items that describe two different types of children , easy language, short duration	Not yet used to evaluate programs
Leeming et al., 1995	Children's Environmental Attitude & Knowledge Scale (CHEAKS)	6-14 year olds (Grades 1-7)	36 attitude items (verbal commitment, actual commitment, affect), 30 knowledge questions	Low correlation between attitudes and knowledge, best of older kids
Evans et al., 2007	Environmental attitude & behavior scale for young children	6-8 year-olds (Grades 1-2)	11 items in 3 games related to attitudes, 8 items in 1 game related to behavior, Rasch model to address behavior	No correlation between children's attitudes and behaviors, parents' attitudes not correlated with kids'
Kaiser et al., 2007	Behavior-based attitude measure	9-18 year-olds	19 traditional attitude items (preservation vs. utilization) 40 behavior items	Attitudes become traceable from behavior reports
Manoli et al., 2007	NEP Scale for Children	10-12 year-olds	10 Likert-type items (based on NEP), 3 attitudinal dimensions (Rights of Nature, Eco-Crisis, Exemptionalism)	Participation in EE program = shift to more pro-ecological worldview

APPENDIX B

Environmental Attitude and Awareness Survey (EAAS)

My name is _____.

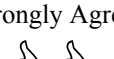
I am _____ years old. I am a: Boy Girl

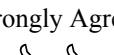
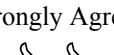
Instructions: We want to know what you think about some things. There are no right or wrong answers. Just be honest about the way you feel. After I read each sentence, you will see five choices: Strongly Disagree (two thumbs down), Disagree (one thumb down), Not Sure (question mark), Agree (one thumb up) and Strongly Agree (two thumbs up). Circle the one that best describes how you feel about each statement.

Let's try an example.

EXAMPLE: Ice cream tastes great.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 

Are there any questions? I'll read one sentence at a time and you decide how you feel about each one. Raise your hand if you need help.

1. I like to learn about plants and animals	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
2. Plants and animals are important to people.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
3. I like to read about plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
4. Plants and animals are easily harmed or hurt by people.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
5. I am interested in learning new ways to help protect plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
6. People need plants to live.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 

7. My life would change if there were no trees.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
8. I would give some of my own money to help save wild plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
9. I would spend time after school working to fix problems in nature.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
10. We need to take better care of plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
11. I like to spend time in places that have plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
12. It makes me sad to see homes built where plants and animals used to be.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
13. I like to learn about nature.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
14. I would help to clean up green areas in my neighborhood.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
15. Nature is easily harmed or hurt by people.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 
16. My life would change if there were no plants and animals.	Strongly Disagree 	Disagree 	Not Sure ?	Agree 	Strongly Agree 

Instructions: Good job. Now, we want to find out what you already know about nature. For each question, circle the answer choice you think is right.

Let's try an example.

EXAMPLE:
What color is SpongeBob SquarePants?

a) blue

b) yellow

c) purple

d) green

Are there any questions? I'll read one question at a time and you circle the answer choice you think is right. Try your best. Your answers will help us plan fun activities for summer camp. Raise your hand if you need help.

1. Which of these living things produces its own food?

a) grasshopper

b) eagle

c) sunflower

d) catfish

2. What happens to a dead tree in the forest?

a) It pollutes the air and the soil.

b) It is broken down into soil.

c) It keeps growing.

d) It stays the same forever.

3. What do bumblebees, hummingbirds, and other animals carry from one flower to another?

a) nectar

b) water

c) sugar

d) pollen

4. What is the main problem for many endangered animals and plants?

a) acid rain

b) hunters

c) loss of habitat

d) hurricanes

For the last question, think of as many answers as you can and write them in the space below.

5. Plants are important because they give us...

1.

2.

3.

4.

5.

6.

7.

8.

APPENDIX C

Garden Earth Naturalist Overview

Garden Earth Naturalist Overview

GEN Conceptual Framework

"Our home, our Garden Earth, is a treasure. Its ecosystem provides valuable ecological services such as pollination, air and water purification, climate control, soil production, recycling, pest and disease control, food production, and a genetic library. These 'free services' can be impacted by human activities and impaired by poor societal choices. Garden Earth Naturalist (GEN) helps children, grades 3-6, understand the importance of these free services by studying, exploring, and enhancing natural habitats on their sites and surrounding communities" (From GEN Brochure, 2007).

Essential Questions for Investigation

- What life support services are provided by natural ecosystems in my neighborhood?
- Why should I care about natural ecosystems?
- What can I do to improve the health of natural ecosystems in my neighborhood?

APPENDIX D

Treatment and Control Group Sites

Treatment and Control Group Sites

EE Program Site	Address
Boys & Girls Club of Athens	592 Oconee St., Athens, GA, 30605
East Athens Community Center	400 McKinley Dr., Athens, GA, 30605
Oconee 4-H Center	34 Water St., Watkinsville, GA, 30677
Rock Springs Center	285 Rocksprings Ct., Athens, GA, 30606
State Botanical Garden	2450 S. Milledge Ave., Athens, GA, 30605

ASP Site	Address
Barrow Elementary School	100 Pinecrest Dr., Athens, GA, 30605
Gaines Elementary School	280 Gaines School Rd., Athens, GA, 30605

APPENDIX E

Camp Evaluation Form

Instructions: Almost done! Now, we want to know what you think about camp. Please write your answers to each question in the spaces below.

1. What camp activity did you like the most?

_____

2. What camp activity did you like the least? (This survey does not count.)

_____

3. If you could change one thing about camp, what would it be?

_____

_____

_____

4. Would you like to go to this camp again? Why or why not?

_____

_____

_____

_____

_____

Thanks for your help!

APPENDIX F

Personal Interview Questions

Personal Interview Outline - Before Camp Questions

1. What is your name?

    1b. How old are you?

2. Where do you live? (address OR city, country, neighborhood)

3. When you're not in school, what do you like to do? (TV, video games, being outside, other activities)

4. Do you enjoy being outside? Why or why not?

5. Where do you go when you are outdoors?

6. What do you think about when you hear the word "nature"?

7. Do you talk with your parents about nature? If yes, how often? (every day, every week, every month, etc.)?

    7b. If you talk to your parents about nature, what do you talk about?

8. What are some things you can do to help nature?

Personal Interview Outline - After Camp Questions

1. What is your name?

2. What do you think about when you hear the word "nature"?

3. Did camp change the way you feel about nature? Why or why not?

4. Can you think of a camp activity that made you excited about plants and animals?

    4b. What did you learn from the activity?

5. Have you talked with your parents about nature this week after being at camp?

    5b. If so, what did you talk about?

6. What are some things you can do to help nature?

APPENDIX G

Pre- and Post-test Scores for Specific EAAS Items

Pre and Post-Test Scores for Specific EAAS Items – Treatment Group

Item	N	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Eco-Affinity					
1. I like to learn about plants and animals	71	4.30	0.82	4.49*	0.65
3. I like to read about plants and animals.	72	3.88	1.14	4.13	0.98
5. I am interested in learning new ways to help protect plants and animals.	72	4.43	0.77	4.49	0.75
8. I would give some of my own money to help plants and animals.	72	3.94	1.16	4.14	1.07
9. I would spend time after school working to fix problems in nature.	70	3.91	1.06	3.87	1.20
11. I like to spend time in places that have plants and animals	71	4.27	0.89	4.39	0.78
13. I like to learn about nature.	71	4.24	0.84	4.39	0.85
14. I would help to clean up green areas in my neighborhood.	72	4.00	0.93	4.08	1.03
Eco-Awareness					
2. Plants and animals are important to people.	70	4.50	0.70	4.70*	0.75
4. Plants and animals are easily harmed or hurt by people.	72	3.94	1.12	4.31*	0.98
6. People need plants to live	71	4.55	0.77	4.76*	0.60
7. My life would change if there were no trees.	72	4.33	1.19	4.42	1.11
10. We need to take better care of plants and animals.	72	4.68	0.55	4.69	0.57
12. It makes me sad to see homes built where plants and animals used to be.	72	4.06	0.99	4.28*	1.02
15. Nature is easily harmed or hurt by people.	72	4.14	1.05	4.33	0.93
16. My life would change if there were no plants and animals.	72	4.33	1.15	4.35	1.26
Content Knowledge					
1. Which living thing produces its own food?	72	0.86	0.35	0.81	0.40
2. What happens to a dead tree in the forest?	72	0.67	0.48	0.83*	0.38
3. What do bumblebees, hummingbirds, and other animals carry from one flower to another?	72	0.53	0.50	0.74*	0.44
4. What is the main problem for many endangered animals and plants?	72	0.50	0.50	0.76*	0.43
5. Plants are important because…	72	2.92	1.75	4.58*	2.20

* Paired t-test indicated mean post-test score increase was significant at $\alpha = 0.05$.

Pre and Post-Test Scores for Specific EAAS Items – Control Group

Item	N	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD
Eco-Affinity					
1. I like to learn about plants and animals	81	3.93	1.14	4.11	1.01
3. I like to read about plants and animals.	80	3.74	1.32	3.66	1.19
5. I am interested in learning new ways to help protect plants and animals.	81	3.96	1.18	3.96	1.16
8. I would give some of my own money to help plants and animals.	81	3.65	1.32	3.60	1.21
9. I would spend time after school working to fix problems in nature.	80	3.49	1.21	3.49	1.23
11. I like to spend time in places that have plants and animals	79	4.03	1.15	4.01	1.08
13. I like to learn about nature.	80	3.99	1.12	4.05	1.04
14. I would help to clean up green areas in my neighborhood.	81	3.89	1.14	3.75	1.23
Eco-Awareness					
2. Plants and animals are important to people.	78	4.27	0.99	4.55*	0.73
4. Plants and animals are easily harmed or hurt by people.	81	4.11	1.01	4.17	1.02
6. People need plants to live	81	4.49	0.88	4.79*	0.54
7. My life would change if there were no trees.	81	4.16	1.38	4.32	1.26
10. We need to take better care of plants and animals.	81	4.46	0.87	4.42	0.93
12. It makes me sad to see homes built where plants and animals used to be.	80	4.01	1.06	4.06	1.18
15. Nature is easily harmed or hurt by people.	81	4.07	1.09	4.15	1.11
16. My life would change if there were no plants and animals.	81	4.27	1.31	4.35	1.22
Content Knowledge					
1. Which living thing produces its own food?	80	0.63	0.49	0.65	0.48
2. What happens to a dead tree in the forest?	80	0.76	0.43	0.76	0.43
3. What do bumblebees, hummingbirds, and other animals carry from one flower to another?	80	0.55	0.50	0.65	0.48
4. What is the main problem for many endangered animals and plants?	80	0.50	0.50	0.64*	0.48
5. Plants are important because…	80	2.26	1.65	2.54*	1.70

* Paired t-test indicated mean post-test score increase was significant at $\alpha = 0.05$.

APPENDIX H

EAAS Administration Instructions

Survey Administration Instructions

Pre-test

Pass out the survey forms to your small group (5 children). **Read the child consent form**. Give each child an opportunity to sign the form. If a child does not wish to participate, they may leave the room and sit quietly until their friends are finished. Next, tell the children to complete the information at the top of the first page. Make sure each child has written his/her name, age, and circled the appropriate gender before you continue.

Next, read directly off of the survey page. Make sure you **read every word out loud and slowly**, allowing time for the information to soak in. Address questions as necessary. When you begin to read the 16 attitude statements, make sure you **read each statement twice**. Give students ample time to respond to each statement (until each child has circled an answer or about 30 seconds).

For the second section, the multiple choice questions, continue to read directly off of the page. Read each question once, and then read each multiple choice answer. **Repeat the question and answers so that students hear each option twice.** That should allow plenty of time for each child to respond. For the last question, #5, give children enough time (1-2 minutes) to think of possible answers. When students have finished open-ended question #5, they may go get a snack.

Post-test

Children will not have to complete a consent form for the posttest, so they may complete the information at the top of the first page as soon as they receive the survey.

Make sure each child has written his/her name, age, and circled the appropriate gender before you continue.

Now read the survey just as you read the pretest (See above). Once you have read through all of questions, including open-ended #5, the **children must complete the camp evaluation form before moving on to another activity**. For the camp evaluations, read directly off of the page and give each child enough time to answer.

APPENDIX I

Personal Interview Administration Instructions

Personal Interview Administration Instructions

Script

"I'd like to ask you a few questions about nature. There are no right or wrong answers. Just be honest about the way you feel. If you have any questions, please let me know. The whole interview should only take a few minutes. Ready?"

Advice for Interviewers

Remember, this is an informal interview. **Try to make sure each child feels comfortable throughout the interview process.** Allow children to expound on certain ideas to some degree, even if they are not directly related to the topic. If a child feels comfortable, he/she is more likely to provide candid, honest answers. **Before the interview begins, please push play on the digital recorders**. Do not stop the recorder until the entire interview is over. As children answer each question try to record quick answers in the space provided. This will provide backup if the recorders fail.

The questions are fairly straightforward, but some children may still be confused. If necessary, use the information in parentheses to make the questions more understandable. Help children with questions, but do not attempt to guide their answers. Let the children think for themselves.

The word "nature" may be confusing for some children. If a child asks what "nature" means, tell them nature is all the living things and natural areas around us like plants, animals, forests, ponds, etc. **Remember to let children do most of the talking**. Please let me know if you have any additional questions about the interviews before you begin. Thanks so much for your help!