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AN INVESTIGATION OF THE FACTORS THAT INFLUENCE STUDENTS' LONG TERM
APPLICATION OF ENVIRONMENTAL LITERACY SKILLS

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at

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Abstract

Schools today are commissioned to provide students with a solid foundation in global citizenship. Future leaders must be knowledgeable problem solvers who can apply those skills to better the world. An awareness of global issues along with a sense of urgency and strength to act are needed for the welfare of all. The achievement of these goals must promote active involvement both at the personal and community levels. This research study investigated the factors related to the long-term environmental literacy skills of students who attended a school with an international and global studies curriculum. Within that curriculum, focus was placed on the pressing environmental issues that challenge our world. Students were not taught using a curriculum-based program but rather were active participants and problem solvers within a school culture that stressed environmental responsibility. One goal of this work was to investigate whether this type of schooling environment contributed to the long-term environmental literacy skills related to a student's knowledge, attitudes, and behaviors.

The role of educators is continually changing. As accountability for performance on standardized tests increases there is less time for instruction in the sciences, particularly environmental sciences in the elementary years. A model that combines knowledge building, active participation, and problem solving in developing a school culture of respect and responsibility for the environment may be the most promising and realistic. This research

examined the environmental literacy levels of middle school students who participated in a school with an embedded environmental education focus at the elementary school level (Group One) and middle school students who had not participated in a school with an embedded environmental focus at the elementary school level (Group Two). A MANOVA was conducted with a final data set of 218 students. The composite dependent variate was not significantly affected by group (Wilks' $\lambda = .955$, $F(4, 213) = 2.529$, $p = .042$, partial eta squared = .045, small). Despite the non-significant MANOVA F , the researcher proceeded with analysis of the F ratios for the ANOVAs. In this case, the possibility of committing a Type 2 error lead to the researcher's decision to cautiously continue analysis. Univariate ANOVAs were conducted on each dependent measure to determine whether significant differences existed between the groups. The more stringent p value of .025 was utilized in the analysis. Ecological knowledge was significantly affected by group (Group One and Group Two), $F(1, 216) = 9.538$, $p = .002$, partial eta squared = .042). Lengths of time in the program and away from the program were also investigated as variables related to environmental literacy scores. Regression results were not significant $F(2,101) = 1.0$, $p = .372$, $R^2 < .001$ indicating that neither of the two independent variables of time were significant predictors of total environmental literacy scores. A deeper understanding of social variables of family, culture, and community was achieved through semi-structured interviews. Students described family relationships and practices as well as activities that promoted environmental affect as being prominent in their lives. Being part of organizations that fostered character building and social responsibility were also significant. They reported that their own personal connections and pro-environmental feelings as well as associating with like-minded peers was important to them. These findings can add to a body of research used for curriculum planning and school programming in the field of environmental education.

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2014

APPROVAL PAGE



*School of Professional Studies
Department of Education and Educational Psychology
Doctor of Education in Instructional Leadership*

Doctor of Education Dissertation

AN INVESTIGATION OF THE FACTORS THAT INFLUENCE STUDENTS' LONG TERM
APPLICATION OF ENVIRONMENTAL LITERACY SKILLS

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Throughout this journey, I have been fortunate enough to have received support from so many people. I had thought several times of pursuing a doctorate but various life circumstances had altered my course. In retrospect, I learned that there is never an ideal time. This program has been challenging and personally rewarding. It has cemented my belief that education is a life-long process and, that regardless of age and professional life point, every day is a learning experience.

Dr. Karen Burke, my primary academic advisor, has provided me guidance and support throughout each phase of the dissertation process. She has gently nudged me when needed and kept me on track by providing encouragement along the way. Dr. Marcy Delcourt, Program Coordinator at Western Connecticut State University, continually raises the standards for the program and expects nothing but everyone's personal best. My dissertation committee members, Dr. Harry Rosvally and Dr. Suzanne Franck, have been both my coach and cheerleader. I appreciate the time they have taken from their own work and personal lives to assist and encourage me on this journey. Dr. Deborah Mumford, my reader, came on board as a second set of eyes and provided me with insight and encouragement. Dr. Anna Rocco audited the qualitative data and was always there as both a colleague and a friend.

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DEDICATION

This dissertation is dedicated to my family. Their love and support have given me the strength and tenacity to see this endeavor through completion.

A special thank you to my husband who has been my biggest cheerleader and friend. He has always believed in me even when I didn't believe in myself. He spent so much time alone while I finished "just one more thing" and always had a smile and a hug for me. We have traveled this road together and are stronger for it!

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CHAPTER ONE: INTRODUCTION AND IDENTIFICATION OF THE TOPIC

In June of 1992, a 12-year-old girl addressed world delegates at the United Nations Conference on Environment and Development pleading for adults in her world to take action on environmental issues not for economics or politics but for the sake of those they love (“Perspectives on Rio,” 2012). Severn Suzuki’s words told a story reminding humans that they are only a small part of a much larger world that must work collaboratively for the benefit of all. Her plea challenged adults to take action then and it remains the same today. This young girl who “silenced the world for six minutes” continues to campaign for global sustainability through joint and individual efforts (“Perspectives on Rio,” 2012). Twenty years later, the United Nations Conference on Sustainable Development again focuses on the role of sustainability for current and future generations (Rio+20, 2012).

Research in the field of environmental education and environmental literacy is extensive. Organizations such as the North American Association for Environmental Education and the National Environmental Education and Training Foundation continue to report current findings in the field so as to inform and identify best practice. The United Nations has stated that sustainable peace must be built on sustainable development (“Sustainable Peace,” 2012). At 12 years old, Severn Suzuki verbalized her environmental concerns to adults in the world. Today Severn, a culture and environmental activist and writer, perseveres as an advocate for intergenerational justice (Cullis–Suzuki, 2014). She is an active member in the Haida Gwaii Higher Education Society and the Spark-Girls Action Foundation, serves as an Earth Charter Commissioner, and has published several books in Japan. Her knowledge and passion for the environment began while she was a child and have guided her throughout her life. As educators and citizens, we need to identify the impact of our curricula, attitudes, and practices so that all

children have the knowledge, attitudes, and behaviors needed to be active participants in their future as global citizens.

This research study investigated the effects of students' participation in a school where an environmental focus was embedded within an international and global studies school-wide curriculum at the elementary school level. The specific domains of environmental affect, ecological knowledge, cognitive skills, and environmental behavior were examined as related to overall environmental literacy. Two groups of middle school students were participants in this study. One group consisted of students who had participated in the school with an environmental focus at the elementary school level; the comparison group was composed of students who had not participated in a school with an embedded environmental focus at the elementary school level. Students in both groups were administered the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth & Bluhm, 2009) and the *School Attitude Assessment Survey-Revised* (McCoach, 2002). Data were collected and analyzed. The existence of a relationship between the number of years that a student participated in the school with the environmental focus and the number of years after completion of that school was also examined as it related to the overall environmental literacy score. Semi-structured interviews were conducted with the six highest scoring students, three from each group in the study, on the MSELs (2009) in an effort to more deeply understand the impact of social variables related to community, family and culture.

Rationale

An evaluation report of interdistrict magnet schools in Connecticut identified the positive impact of themed magnet schools in the academic areas of reading, writing, and mathematics on standardized measures, but little was known about attitudinal and behavioral changes made as a result of participation in these schools with a thematic focus (Beaudin, 2003). Data related to the

benefits and outcomes of participating in schools with thematic programming are needed.

Carefully looking at components within a thematic focus may assist in identifying instructional practices that enhance both academic and social aspects of learning.

Federal funding opportunities exist for states with developed environmental literacy plans (“Environmental Literacy Plan,” 2012). The North American Association for Environmental Education (NAAEE) assists states in the development of those plans. NAAEE speaks to the benefits of environmental education as related to a student’s ability to think, make decisions, and find sustainable solutions for complex environmental issues (“Developing a State,” 2008). Information related to educational practice assists educators in the development and implementation of environmental literacy programming. Funding to states is based on the development of environmental literacy plans.

This study investigated the factors that influence students’ long-term application of environmental literacy skills. It provides new information that can assist in curriculum development, school programming, and insight into environmental education student outcomes. The role of social variables related to family, culture, and community adds to the current body of research as factors linked to building environmental literacy. New research in this field serves to bring closer the reality of a comprehensive coordinated approach to environmental education for all students.

Statement of the Problem

As far back as 1944, Aldo Leopold spoke of the role of education in stimulating the desires and skills required in acts of conservation (Coyle, 2005). In a report released by the National Environmental Education and Training Foundation (NEETF), Coyle combined 10 years of NEETF/Roper research and related studies to describe the current state of environmental

literacy in America. Coyle (2005) reported that 95% of the public supported environmental education in schools and also wanted to understand environmental issues within daily life. Americans believed they knew a great deal about environmental issues but only a small percentage, regardless of age, income, or level of education, actually understood more complex environmental matters. This raised concerns of whether the public would be prepared to handle the environmental responsibilities of the future. The lack of a comprehensive, coordinated approach to environmental education was cited as one reason for this reality. Environmental education has not yet reached core subject status at the elementary school level. It is most commonly taught within the confines of other subject areas and has been reduced even further as the demands on statewide education standards and standardized testing has increased. More controlled studies are needed to explore the relationships between types of environmental instruction and learning strategies with regard to changes in skills, attitudes, and behaviors (Coyle, 2005).

In his book, *Last Child in the Woods*, Richard Louv (2008) presented an interesting argument of society's role in the altered experiences of our children with the outdoors. Louv (2008) claimed that society has taught our youth to avoid direct interaction with nature. Electronics, cyberspace, and parents' concerns over the outdoor safety of their children all contribute to minimal experiences of interacting with and enjoying the outdoors. He described what he termed as nature deficit disorder. Nature deficit disorder is the broken bond between nature and young children. This lack of interaction with the outdoors can impact one's mental, physical, and spiritual health (Louv, 2008).

The United Nation's secretary general, Ki-moon (2012), released the United Nation's International Peace Day theme of *Sustainable Peace for a Sustainable Future*, stressing the

importance of using natural resources for the benefit of society. Accordingly, in the United States, the urgency for comprehensive environmental education continues to grow. States are working with the federal government to create environmental literacy plans to prepare our youth for the challenges they face (“Environmental Literacy Plan,” 2012). Bills currently in the U.S. Senate and Congress contain new language and funding that supports environmental education. *No Child Left Inside* currently includes funding to be utilized to equip teachers with the skills, knowledge, and confidence needed to integrate the environment into their curricula. This funding, however, will be contingent on states having qualifying Environmental Literacy Plans (“Environmental Literacy Plan,” 2012).

The need for environmental education is supported at all levels. Globally, one outcome of the Rio+20 conference was that more than 500 billion dollars were mobilized to strengthen the efforts of creating a more sustainable future for the benefit of the planet and its inhabitants (Mitev, 2012). Federal and local governments are currently allocating funding to propel implementation of environmental education. Roper survey results indicated overwhelming public support for environmental education in our schools (Coyle, 2005). At the individual level, issues related to mental, physical, and spiritual well-being of youth have increased as a result of decreasing amounts of time spent interacting with the environment (Louv, 2008). Research that adds to the current body of knowledge and focuses on strategies, methodologies, and program evaluation continues to be needed. There is no argument that it is necessary that children develop environmental literacy skills. Current research seeks to better understand what strategies and curriculum are needed to develop skills in students that influence change in environmental knowledge, attitudes, and behaviors.

Definition of Key Terms

The following terms were used for the purpose of this research study:

1. *Elementary school level* refers to the early stages of academic learning. In this study it includes kindergarten through grade 5 (“Elementary Grades,” 2014).
2. *Embedded curriculum* conveys aspects of a curriculum that are not explicitly stated as objectives such as socialization, team building, self-expression, and empathy (Higgins, 2009).
3. *Environmental literacy* is knowledge of environmental concepts and issues; the attitudinal dispositions, motivation, cognitive abilities, skills, and the confidence and appropriate behaviors to apply that knowledge to make effective decisions in a range of environmental contexts (Hollweg, Taylor, Bybee, Marcinkowski, McBeth, & Zoido, 2011).
4. *International and global studies* consists of providing students with the information and intellectual tools—coupled with the willingness to use them—that enable them to function as competent American citizens in a complex and rapidly changing international environment (Collins, Czarra, & Smith, 1995).
5. *Middle school* is a level of schooling between elementary and high school. In this study, middle school consists of grades 6, 7, and 8 (“Middle School,” 2014).
6. *School climate/culture* refers to an environment of safety, respect, support, and challenge for all school members across a full range of domains: physical, emotional, social, ethical, civic, and intellectual (“Developing and Assessing School Culture,” 2010).
7. *Social Emotional Learning* is defined by The Collaborative for Academic, Social, and Emotional Learning as “a process for helping children and adults develop the

fundamental skills for life effectiveness. SEL teaches the skills we all need to handle ourselves, our relationships, and our work, effectively and ethically” (“What is Social Emotional Learning?” 2011).

8. *Sustainability* is the creation and maintenance of conditions under which humans and nature can exist in productive harmony fulfilling the social, economic and other requirements of present and future generations (“What is Sustainability?” 2012).

Methodology

Subjects and Setting

This study took place in a large urban district in New England with a population of 80,893 as reported in the 2010 census. The median household income was reported at \$65,275 and 8.4% of the population was identified as falling below the poverty level. The 2010 census also reported that 68% of the citizens were Caucasian. In the year 2010-2011, the school district enrolled 10,343 students in grades pre-K through 12. Within that demographic, 45% were eligible for free or reduced lunch. Students not fluent in English totaled 19% of the population and 39% were from non-English speaking homes. Approximately 11% were receiving special education services and 54% were identified as non-White (Connecticut Education Data and Research, 2012).

This research study was conducted with students attending the two middle schools within the district. Middle school in this district houses students in grades 6, 7, and 8. In the 2010-2011 school year, Middle School One enrolled 1,114 students where 41% were eligible for free and reduced price lunch. Students not proficient in English made up 7% of the enrollment and 14% received special services. Middle School Two enrolled 1,095 students in the 2010-2011 school

year. Of those enrolled, 56% were eligible for free and reduced lunch and 16% were not proficient in English. Within that group, 12% were receiving special services.

One group was selected based on attendance in a school where environmental education was embedded into the international and global studies curriculum at the elementary school level. Students in the comparison group were a convenience sample selected from both middle schools and had not participated in a school with an embedded environmental focus at the elementary school level. Group One contained 106 students who had participated in the school with the environmental focus at the elementary school level. Group Two included 119 students who had not participated in a school with an embedded environmental focus at the elementary school level. All of the participants were age appropriate for sixth, seventh, and eighth grade. The *Middle School Environmental Literacy Survey* (Hungerford et al., 2009) and the *School Attitude Assessment Survey-Revised* (McCoach, 2002) were administered by the researcher at the schools during the school day. Semi-structured interviews were conducted with six students who achieved the highest environmental literacy scores and represented both testing groups.

Instrumentation

Middle School Environmental Literacy Survey. The *Middle School Environmental Literacy Survey* (Hungerford et al., 2009) was administered as a measure of environmental literacy. The MSELs consists of seven parts measuring (1) demographic data, (2) ecological knowledge, (3) verbal commitment, (4) actual commitment, (5) environmental sensitivity, (6) environmental feeling, and (7) issue identification, issue analysis, and action planning. These parts are clustered into four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). Section one of the MSELs collects demographic data related to age, grade, gender, and ethnicity. The MSELs utilizes a multiple

choice and 5-point Likert response format. The instrument is proprietary and permission must be obtained from the authors through the Center for Instruction, Staff Development and Evaluation in Carbondale, Illinois (see Appendix A).

School Attitude Assessment Survey–Revised. The *School Attitude Assessment Survey – Revised* (McCoach, 2002) was administered to all students in the study to collect baseline information about the two groups in the areas of academic self-perception, motivation and self-regulation, attitudes toward teachers and classes, attitudes towards school, and goal valuation. The SAAS-R consists of 35 items with a 7-point Likert response scale ranging from 1 (strongly disagree) to 7 (strongly agree). McCoach and Siegle (2003) report a fifth grade reading level for directions and items, which was calculated using the Flesch-Kincaid formula. The SAAS-R was distributed and administered during the same testing window as the MSELs.

Conclusion

This research study utilized a mixed methods research design with causal comparative and generic qualitative study components. This design was selected purposefully to include both quantitative and qualitative data so as to provide an extensive description of the topic under investigation. In causal comparative studies, the researcher does not manipulate the independent variable in an effort to examine its effect on the dependent variable (Gall, Gall, & Borg, 2007). A primary purpose of causal comparative research is to investigate possible relationships that exist between variables. In this study, the relationships investigated were school programming type and environmental literacy scores. The researcher was not able to manipulate the independent variable of school program type. External threats that address generalization to the larger populations were minimized, as this design did not lend itself to this purpose. A significant limitation in this study was that of subject characteristics. Efforts to mitigate this

threat were taken. All students in both groups were administered the SAAS-R so that they could be described on common characteristics related to student's attitudes toward school. These data addressed concerns relative to the characteristics of the participants prior to the collection of any data used in the analysis of the research questions of this study. A qualitative component followed examination of the quantitative data to further explore any effects related to social variables. Trustworthiness was established in the areas of credibility, transferability, dependability, and confirmability. Full discussions of both quantitative and qualitative limitations are discussed in chapter three.

The purpose of this study was to investigate the impact of an embedded environmental focus school program on student's long-term environmental literacy skills. Students who had not participated in a school with an embedded environmental focus at the elementary school level were used as a comparison group. An explanatory sequential mixed-method design was utilized. Statistical differences between the two groups were examined. Factors related to length of time in the school program and length of time away from the school program also were investigated. Interviews were used to more deeply understand the role of social variables of community, family, and culture on environmental literacy scores. The findings of this study can be used to assist in curriculum development and school programming in the field of environmental education.

CHAPTER TWO: REVIEW OF THE LITERATURE

This chapter begins with a review of the theoretical foundations for this research study. Daniel Goleman's Emotional, Social, and Ecological Intelligences build on and expand on Howard Gardner's Theory of Multiple Intelligences. These theories represent an expanded view of intelligence going beyond traditional cognitive score perspectives. This widened view serves as a basis for the complex development of environmental literacy skills. Methodology using Social and Emotional Learning pedagogy is used to conceptualize the theory into practice. The second section of the chapter examines the field of environmental education in three primary areas: historical perspective, effects of program components on environmental behavior, and childhood nature experiences.

Literature for this review was identified from multiple sources. EBSCO Combined and Academic Search Complete were the primary databases utilized. A-Z Journal Locater also provided direct access to specific journals. The searches consisted of keywords "environmental education," "environmental literacy," "outdoor education," "global education," "multiple intelligence," "place based education," "Goleman," "Gardner," and "social emotional learning." These terms were used to support a larger understanding of the types of and components related to environmental education. Later searches focused more specifically on elements contained in this study. These searches produced a large number of titles that were then separated based on the abstracts. Prominent journals in the field were researched separately for any other published pieces. These included primarily the *Journal of Environmental Education* and *Environmental Education Research*. Initial sources of information included those located from database and online searches. However many additional works were located using the reference sections of selected readings. Most of the literature reflected studies published between 1995 and 2013 with

some seminal pieces inserted to provide context for the reader. The theoretical foundations section moves the reader through the progression of the work of Howard Gardner (Theory of Multiple Intelligences) into the expanded social connections within the theory development of Daniel Goleman (Goleman's Emotional, Social, and Ecological Intelligences). The Social and Emotional Learning section represents the connections between theory and pedagogy contained in the environmental literacy school program components utilized in this study. The Environmental Education section provides background information relative to the topic (Historical Perspective) and explores the research on how program components effect environmental behaviors (Effects of Program Components on Environmental Behavior). The final area explored in this section is that of childhood nature experiences (Childhood Nature Experiences) as related to environmental literacy.

Theoretical Foundation

Theory of Multiple Intelligences

Educational and psychological literature contain multiple theories of intelligence. During the time of Darwin, scholars became interested in the development of intelligence across species (Gardner & Hatch, 1989). Theories of intelligence sought to understand human capabilities as well as measure human intellect. Beliaevsky (2006) proposed that Gardner's Theory of Multiple Intelligences was grounded in the work of Vygotsky.

In the early 1930s, Vygotsky introduced a theory of learning that focused on a concept called the Zone of Proximal Development (ZPD). Vygotsky believed that psychological development occurred within human history and human culture (Beliaevsky, 2006). Children must be exposed to the tools that had been developed by humans over centuries. This exposure occurred within social settings with more knowledgeable partners. Vygotsky believed that the

ZPD was a better predictor of potential than traditional low threshold ways of assessing intelligence. He suggested that a child's performance must be determined at both the independent and assisted levels. The Zone of Proximal Development was the distance between what the child could do independently and what the child could do with the guidance of adults. Vygotsky claimed that the range of what could be done independently and that which was done with assistance, provided a better measure of ability (Beliavsky, 2006). This expanded view of intelligence cemented the idea that human beings are both biological and cultural creatures. The development of connectedness to a larger world reflects this ability to evolve as both a knowledgeable and cultural being.

It was in the late 1970s that Gardner, an American developmental psychologist, became interested in both the theoretical and practical factors of intelligence. He suggested that human beings were both biological and cultural creatures and that intelligence was realized when biological dispositions interacted with opportunities for learning within a culture (Beliavsky, 2006). Gardner proposed that different psychological processes were utilized in dealing with linguistic, numerical, pictorial, and gestural systems (Gardner & Hatch, 1989). He conceptualized human intellect within a much broader view. Gardner questioned why intelligence theories failed to take into consideration large areas of human endeavor (Gardner, 2006). He proposed a very different view of the mind. This multiple view of the mind recognized different features of cognition, which proposed that individuals had different cognitive strengths and contrasting cognitive styles (Gardner, 2006). This model encompassed cognitive and developmental psychology, differential psychology, neuroscience, anthropology, and cultural studies (Gardner & Moran, 2006). The theory of multiple intelligences presumed that cognitive competence could be described as a set of abilities, talents, or mental skills.

Gardner claimed that all normal individuals possessed these skills but that individuals differed in the degree of the skill and in their combinations (Gardner, 2006). Traditional definitions of intelligence relied on test scores that measured an inborn attribute of an individual. Gardner pluralized this concept and defined it as “An intelligence entails the ability to solve problems or fashion products that are of consequence in a particular cultural setting or community. The problem-solving skill allows one to approach a situation in which a goal is to be obtained and to locate the appropriate route to that goal. The creation of a cultural product allows one to capture and transmit knowledge or to express one's conclusions, beliefs, or feelings” (Gardner, 2006, p. 6).

Gardner utilized a set of specific criteria in defining multiple intelligences. Literature in several areas was examined resulting in the following criteria being considered: cognitive capacities of normal individuals, cognitive capacities within different kinds of organic pathology, abilities among special populations, intellect that existed in different species, intellect valued in different cultures, the evolution of cognition over the millennia, and two forms of psychological evidence (correlations among tests and psychological training studies (Gardner & Hatch, 1989). Gardner explained that only those that satisfied all or a majority of criteria were identified as intelligences (Gardner, 2006). An original list of seven intelligences was identified. Gardner goes on further to explain that within an individual there exist two different kinds of profiles: laser-like and search-like. An individual with a search like-profile has the ability to shift among intelligences of comparable strength while one with a laser-like profile utilizes one or two powerful intelligences in greater depth thus overshadowing the other intelligences (Gardner & Moran, 2006). These profiles can be the underlying components relative to skill development in

the learning of a topic. Table 1 contains a description of the intelligences and their core components.

Table 1

Gardner's Multiple Intelligences

Intelligence	End States	Core Capacities
Logical-mathematical	Scientist/ Mathematician	Sensitivity to, and capacity to discern logical or numerical patterns; ability to handle long chains of reasoning.
Linguistic	Poet/ Journalist	Sensitivity to the sounds, rhythms, and meanings of words; sensitivity to the different functions of language.
Musical	Composer/ Violinist	Abilities to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness.
Spatial	Navigator/ Sculptor	Capacities to perceive the visual-spatial world accurately and to perform transformations on one's initial perceptions.
Bodily-kinesthetic	Dancer/ Athlete	Abilities to control one's body movements and to handle objects skillfully.
Interpersonal	Therapist/ Salesman	Capacities to discern and respond appropriately to the moods, temperaments, motivations and desires of other people.
Intrapersonal	Person with detailed, accurate self-knowledge	Access to one's own feelings and the ability to discriminate among them and draw upon them to guide behavior; knowledge of one's own strengths, weaknesses, desires, and intelligences.
Naturalist	Naturalist/ Landscape Architect	Ability to recognize and categorize plants, animals, and other objects in nature.

Over the years, Gardner has been extremely conservative about adding intelligences to multiple intelligence theory. His reluctance lay primarily in the stringent criteria necessary for the establishment of an intelligence. New technologies developed in the last 25 years have given researchers the ability to more closely see and understand the living brain. Gains made in cognitive-developmental psychology have supported multiple intelligence theory with brain research that moved away from identifying a general intellectual capacity to developing a better understanding of structures related to how the brain processed information (Gardner, 2006). It was a conversation with Ernst Mayr, a twentieth-century authority on evolution that factored into the identification of an eighth intelligence. Gardner was challenged to explain Charles Darwin and John James Audubon within the then seven intelligences. Applying the eight criteria for inclusion as an intelligence, Gardner acknowledged that the naturalist intelligence scored well and proposed inclusion into multiple intelligence theory (Gardner, 2006).

In the naturalist intelligence there existed a core ability to discriminate among living things as well as demonstrated sensitivity to the natural world. In the history of evolution, survival often depended on the ability to recognize plants and animals as part of a species and on the ability to avoid predators (Gardner, 2006). These abilities could be observed even in very young children. Multiple intelligence theory led to three conclusions: everyone has the full range of intelligences: no two individuals have exactly the same intellectual profile primarily because genetic material is not the same: and individuals have different experiences (Gardner, 2006). These conclusions explain that having a strong intelligence does not ensure that one will act intelligently. True environmental literacy requires an individual to not only cognitively understand the issues but to be connected to and willing to create change.

Goleman's Emotional, Social, and Ecological Intelligences

In the mid 1990s, Goleman, a clinical psychologist, came across the work of Mayer and Salovey, two psychologists formulating the concept of emotional intelligence (Goleman, 2005). Goleman continued the work in the theory of emotional intelligence drawing on research in the field as well as developments in affective neuroscience. He sought to explain why some people with high IQ floundered in life yet some with modest IQ did surprisingly well. Goleman argued that these differences could be attributed to one's abilities in the areas of self-control, persistence, and self-motivation (Goleman, 2005). Using brain research, he described the connections between the amygdala and the neocortex as those that harmonize emotion and thought. This circuitry assisted with effective thought in decision-making and a clear thought process in individuals. Goleman stated that working memory is used to hold information that is needed to complete a task and that this is stored in the prefrontal cortex. Because the circuits from the limbic brain to the prefrontal lobes account for signals of emotion, if one experiences strong emotion, the neural static created interferes with working memory. This combination inhibits the ability to think clearly, and accordingly impacts intellectual abilities (Goleman, 2005).

This disconnect between cognitive ability and performance on tasks can be explained in the theory of emotional intelligence that further expanded the notion that IQ is simply a measure of cognitive ability. In his book *Emotional Intelligence: Why It Can Matter More than IQ*, he identified five aspects of emotional intelligence. Goleman (1995) stated that schools can nurture the five aspects of emotional intelligence through knowing one's emotions, managing those emotions, motivating oneself, recognizing emotions in others, and developing successful relationships. Goleman's theory contributed to Gardner's original idea of multiple intelligences

by supporting a broader understanding of intelligence where one's ability to manage emotions and express feeling through frames of mind enables one to access true intelligence (McFarlane, 2011). This understanding of self and others helps develop the ability to recognize how personal action (positive or negative) impacts the lives of others and the larger world.

Goleman's model expanded from the underlying theory of emotional intelligence to include social intelligence. Social intelligence referred to intelligence that is activated within our relationships with others. Goleman reported that the human brain is wired to connect with others and the ability to do this successfully is a key ingredient in life's achievements (Goleman, 2006). Social interaction and interpersonal skills added a broader dimension to understanding human abilities and potential. An example of this expansion would be empathy and rapport. Goleman explained that while empathy is the sensing of another person's feelings and is an individual ability, rapport exists between people and the interaction that emerges. It was his work in these areas that initiated the social and emotional learning movement. Many schools currently utilize social and emotional learning programs as a basis for instruction citing their impact on increasing academic achievement as a rationale for its implementation (Goleman, 2006). This communal sense can be developed within schools and is evidenced in school climate and culture. The establishment of empathy and rapport within the school community provides the backdrop for all learning within the school walls.

In his book, *Ecological Intelligence, The Hidden Impacts of What We Buy*, Goleman draws attention to native peoples everywhere who have the ability to survive despite even the most challenging environmental conditions. Goleman (2010) refers to this type of wisdom as ecological intelligence or one's ability to adapt to ecological surroundings. Innate ecological intelligence represents the understanding of organisms and their ecosystems (ecological) and the

ability to learn from and deal effectively with the environment (intelligence). In today's world, it is the capacity to apply what we have learned about the impact of human activity on ecosystems in the hope that we can do less harm and live sustainably on the planet.

This innate ecological intelligence has changed over time (Goleman, 2010). The conditions of life that existed long ago were a hard wired ability to recognize the needs of man within his environment. Today, those survival skills are altered given the advances of modern technology. In today's world, the focus of individuals has narrowed and society now relies on the expertise of specialists. What was once an innate ability to generalize a range of threats now must be re-engaged to meet the demands of today's world. Goleman proposed that nature originally designed the olfactory cortex to navigate a range of natural odors that no longer exist in today's world. Although one's range to detect danger in this way might not be reignited, the neocortex can take what one intentionally learns and adapt those abilities that have been lost or altered over time (Goleman, 2010). The scents experienced today, such as those of a newly purchased car or newly applied paint must trigger an awareness of chemicals or toxins inhaled by humans. This knowledge comes to us through scientific findings, however its connection to an emotional reaction transforms it into ecological intelligence. The development of environmental literacy requires that individuals reignite these innate abilities and adapt those skills to address the current issues we face in our world.

Goleman expressed concerns that no one individual can store all of the information available to comprehend the complexity of today's issues. He stated that it is only through collaboration with others and a collective effort that one can develop the ecological abilities needed to survive. He attributed our innate abilities to hunt, parent, and survive, which existed in early humans, to a social intelligence (Goleman, 2010). Today, social intelligence is evidenced

in our sharing of cognition to effectively deal with a new set of challenges. When an individual spreads awareness to others, a shared intelligence emerges. It is this contribution of an individual that advances the understanding of a community.

Goleman (2010) compared the natural behavior of insect swarms to collective ecological goals. These swarm rules are explained as follows: knowing your impacts, favoring improvements, and sharing what you learn. Ecological intelligence relies on not only the knowledge or cognitive components of environmental issues but also the perceptions and sensitivity of their impact. Behavioral changes needed in the development of environmentally literate individuals will require the ecological knowledge of the issues, the cognitive skills needed to develop a plan, and the willingness to act. Goleman's ecological intelligence merged cognitive skills with empathy for all life thus connecting mankind to nature. This view removed us as observers of nature and placed us within the natural world. It served as an extension to the understandings of emotional and social intelligences with each expanding connection from self, to others, to all living systems (Goleman, Bennett, & Barlow, 2012).

Educators can design lessons that engage their students. If they know the strengths of their students, they can prepare lessons to those strengths and if students know their strengths, they can use strategies that capitalize on those strengths and enhance their learning. We live in a global society where diversity is evidenced in our classrooms. Multiple intelligence (MI) theory has the capacity to be broad and flexible enough to address the learners of today (McFarlane, 2011). Individualizing education and approaching topics through multiple entry points are consistent with MI theory. Intelligence theory has always influenced methodologies used in education, and current world changes in the areas of technology and classroom diversity have propelled a changing view of intelligence that encompasses a more global view. Educational

accountability in today's world requires recognizing that every individual serves a purpose and that it is within the classroom walls that we recognize and appreciate the expanse of human skills and abilities (McFarlane, 2011). Acknowledging that each individual brings various strengths (intelligences) to the classroom as well as varied emotional abilities allows educators to develop methodologies for success. Ecological intelligence is collective, thus making school communities ideal places to nurture this sensibility (Goleman, Bennett, & Barlow, 2012).

Social Emotional Learning

Citizenship behaviors require that individuals have the necessary skills to understand themselves and others. Instructional methodology that develops this sense of belonging and responsibility for oneself and community is critical in the development of environmental literacy skills. It is through this connection to life that humans can reflect and act to better the world. In the book *Promoting Social and Emotional Learning*, Elias, Zins, and Weissberg (1997) defined social emotional competence as the ability to understand, manage, and express the social and emotional aspects of one's life in ways that enable the successful management of life tasks such as learning, forming relationships, solving everyday problems, and adapting to the complex demands of growth and development. The goals of social emotional learning programs (SEL) are to foster cognitive, affective, and behavioral competencies as well as to develop self-awareness, self-management, social awareness, relationship skills, and responsible decision making (The Collaborative for Academic, Social, and Emotional Learning (CASEL), 2003). These five competencies are defined by CASEL in the following manner.

Self-Awareness is knowing what one is feeling in the moment, having a realistic assessment of one's own abilities and a well-grounded sense of self-confidence (CASEL, 2003).

Social-Awareness indicates understanding what others are feeling, being able to take their perspective and appreciating and interacting positively with diverse groups (CASEL, 2003).

Self-Management denotes handling one's emotions so as to facilitate rather than interfere with the task at hand, being conscientious and delaying gratification to pursue goals, and persevering in the face of setbacks and frustrations (CASEL, 2003).

Relationship Skills refers to handling emotions in relationships effectively; establishing and maintaining healthy and rewarding relationships based on cooperation, resistance to appropriate social pressure, negotiating solutions to conflict, and seeking help when needed (CASEL, 2003).

Responsible Decision Making means making decisions based on an accurate consideration of all relevant factors and the likely consequences of alternative courses of action, respecting others, and taking responsibility for one's decisions (CASEL, 2003).

In a meta-analysis of school-based universal interventions conducted by Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2011), results indicated that social emotional learning programs significantly improved students' skill, attitudes, behaviors, and academic performance. The sample consisted of 213 studies involving 270,034 students. The grand study-level mean for the 213 interventions was 0.30 (CI = 0.26-0.33), which was statistically significant from zero. The majority of SEL programs were classroom-based, either delivered by teachers (53%) or non-school personnel (21%), and 26% were multi-component programs.

About 77% of the programs lasted for less than a year, 11% lasted 1 to 2 years, and 12% lasted more than 2 years (Durlak et al., 2011). Results of the interventions indicated that compared to controls, students demonstrated greater SEL skills ($Q = 193.9$), attitudes ($Q = 56.7$), and positive

social behaviors ($Q = 125.3$) as well as fewer conduct problems and levels of emotional stress after intervention.

Classroom by Teacher programs were effective in all six outcome categories. Effect Sizes (ES) were as follows: SEL skills (ES = 0.62), attitudes (ES = 0.23), positive social behavior (ES = 0.26), conduct problems (ES = 0.20), emotional distress (ES = 0.25), and academic performance (ES = 0.34) where $p \leq .05$. The data supported that social emotional learning program interventions could be effectively conducted by classroom staff and incorporated into routine educational practices (Durlak et al., 2011). The findings of this research support the CASEL guidelines from 1997, which recommended that SEL programs be incorporated into curriculum as well as the life of the classroom and school. Embedded SEL programming achieves the desired effects on students over time (Elias & Weissberg, 2000). Lessons are enriched when students are placed in interactive and creative relationships and it is the combination of peers, classroom, school, family and community that yields significant behavior changes (Elias & Weissberg, 2000). These behavior changes can contribute significantly to the culture of a school. When SEL becomes the foundation and the frame of a school, an integrated and coordinated program results in overall improved school effectiveness (CASEL, 2003).

The development of the emotional mind and the cognitive mind is essential for effective behavior (Basu & Mermillod, 2011). Social emotional learning programs cultivate the emotional intelligence of individuals relative to self-awareness, managing emotions, motivating oneself, empathy, and managing relationships. The development of these skills could dramatically improve student achievement in schools as well as improve a lifetime of outcomes for children

that would strengthen education, the economy, and communities (Bridgeland, Bruce, & Hariharan, 2013).

Environmental Education

Historical Perspective

In 1977, the first UNESCO-UNEP Intergovernmental Conference was convened in Tbilisi, Georgia (USSR) from October 14-26. The field of environmental education emerged from the awareness of the scientific community of the issues arising within the environment (Gough, 2013). By the close of the conference, the Tbilisi Declaration reflected the consensus of the delegates and representatives of the importance of environmental education. It was this declaration that formalized the field of environmental education (Hungerford & Volk, 2005). The Tbilisi Declaration (“Intergovernmental Conference,” 1977) developed the following as the guiding principles of environmental education:

- Consider the environment in its totality-natural and built, technological and social (economic, political, cultural-historical, moral, esthetic);
- Be a continuous life-long process, beginning at the preschool level and continuing through all formal and non-formal stages;
- Be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
- Examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;
- Focus on current and potential environmental situations while taking into account the historical perspective;

- Promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems;
- Explicitly consider environmental aspects in plans for development and growth;
- Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- Relate environmental sensitivity, knowledge, problem-solving skills, and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
- Help learners discover the symptoms and real causes of environmental problems;
- Emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills; and
- Utilize diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with due stress on practical activities and first-hand experiences (“Intergovernmental Conference,” 1977).

Both the government and the scientific community were promoting environmental education while moving cautiously with regard to curriculum development. Environmental Education was not seen as an educational priority to the same degree that it was seen as a scientific priority and it never took hold in the classroom, as there were too many competitors in the current curriculum (Gough, 2013).

The National Environmental Education & Training Foundation (NEETF) commissioned Roper Starch Worldwide to conduct a survey on the environmental attitudes and behaviors of disadvantaged youth in America. The results were to be used to identify gaps in environmental education with the goal of targeting resources to bridge those differences (Roper Starch

Worldwide, 1994). This seminal work shed light on environmental education from a student's perspective. Roper Starch reported that methodology for the report included a school-based survey that included both disadvantaged and non-disadvantaged students. The schools and the classes were randomly selected and students were presented with questionnaires in their English class under the supervision of the teacher. A total of 2,139 students were interviewed between September 23 and October 24, 1994. Four key areas emerged as a result: perceptions, knowledge, impacts and actions, and motivation.

Roper Starch Worldwide (1994) reported that young people cared about the natural environment and they realized that Americans, both young and old, affected it. While perceptions between disadvantaged and non-disadvantaged youth may differ, there was a similar perspective on 13 of the 19 environmental problems asked. Protection of human health emerged as the most important reason for protecting the environment in general with a 54% majority for both disadvantaged and non-disadvantaged youth. Students in both groups reported that they knew a fair amount about the environment.

Roper Starch Worldwide (1994) concluded that a 10% difference existed between the groups (disadvantaged and non-disadvantaged youth) when asked if school was a source of their education (48% vs. 38%, respectively). Results indicated that school was an effective way to reach and educate students, however, it was noted that this process should begin early since learning about the environment in school decreases with time from 76% of fourth and fifth graders to 30% of eleventh and twelfth graders. Young students agreed that those environmental issues that affect everyday life were the most critical and they believed that they could make a difference. Over 7 in 10 students in both groups identified television as the primary medium for their information related to environmental issues (Roper Starch Worldwide, 1994). Overall, the

survey revealed that the identified preferred sources of environmental information were (in order of significance), television, school, museums or zoos, and family. Educational implications from this study included the following (Roper Starch Worldwide, 1994):

- Overall knowledge and learning about the environment in school is related to greater concern, interest, and involvement with the environment.
- Environmental programs need to begin early in schooling.
- Environmental programs must recognize and address student's different needs.
- Environmental educators should focus on issues identified as emerging issues by students.
- Environmental Education must provide opportunities for involvement and development of good environmental practice (p. 127-130).

In 2005, Coyle in conjunction with the National Environmental Education & Training Foundation (NEETF) examined 10 years of NEETF/Roper Research and related studies on the state of Environmental Literacy in America. Findings presented here relate to environmental attitudes and actions as well as programming. Environmental education after 35 years has yet to achieve core subject status in America thus creating inconsistencies in implementation. The challenges of developing a strong knowledge base as well as a sense of stewardship were not well understood in early environmental education efforts (Coyle, 2005). Hungerford and Volk (2005) reached some major conclusions regarding the differences between environmental knowledge and changes in behavior. They noted that developing ecological knowledge did not cause long-lasting behavior change and that personal connections and ownership of environmental issues was a critical factor in changing behavior. Their work continued to add to a growing body of research on curriculum development and effectiveness of environmental

education in America. Conclusions of Coyle's report highlighted three important concepts of environmental education:

1. Environmental Education (EE) required scientifically sound instruction with an emphasis on skill building that at that time was not evidenced.
2. Effective EE would yield individuals more likely to take regular positive actions.
3. Individuals who were more active in society were much more responsive to environmental education in all forms than were individuals in the general public.

Overall, Coyle's (2005) review of the research supported that environmentally literate people could and did take small but important actions. Coyle described the condition of environmental literacy in America as a gifted child that had not yet reached his/her potential.

Effects of Program Components on Environmental Behavior

Education systems around the world work to develop citizens who will behave in desirable ways. It is through this lens that the work in environmental education must also be viewed. Using the objectives of the Tbilisi Declaration, one might define an environmentally responsible citizen as someone who (a) has an awareness and sensitivity to the total environment, (b) has a basic understanding of the environment, (c) has feelings for the environment and is motivated to participate in environmental improvement, (d) has the necessary skills to identify and solve environmental problems, and (e) is actively involved in working towards resolution of environmental problems (Hungerford & Volk, 2005, p. 258). This classic research article challenged traditional thinking in the field of environmental education. Initial environmental education findings suggested that if human beings were well informed, they would be more aware of the environmental issues and thus be more motivated to act in more responsible ways.

Unfortunately, later research did not support this linear model for changing behavior (Hungerford & Volk, 2005).

The research suggested that there existed three categories of variables that contributed to changes in behavior. Entry-level variables, ownership variables, and empowerment variables worked together through programming which led to changes in environmental behavior (Hungerford & Volk, 2005). Entry-level variables were considered pre-requisite variables related to responsible citizenship behavior. They included environmental sensitivity and knowledge. Ownership variables made environmental issues personal and appeared to be critical in developing responsible environmental behavior. Individuals saw these variables as personally important. Empowerment variables were those that gave human beings a sense that they could bring about change in environmental issues. The sensitivity component could be troublesome, as it was not typically seen as an element of formal education. Research studies focused on sensitivity indicated that environmental sensitivity was connected to an individual's contact with the outdoors over time. This is of particular importance when developing school programs, as it appears that it is essential that learners have positive environmental experiences in non-formal outdoor settings for long periods of time (Hungerford & Volk, 2005).

If the goal of environmental education is to change learner behavior then programming must include what research has identified as critical educational components. Hungerford and Volk (2005) identified the following critical education components of environmental education:

1. Teach environmentally significant ecological concepts and the environmental interrelationships that exist within and between these concepts;

2. Provide carefully designed and in-depth opportunities for learners to achieve some level of environmental sensitivity that will promote a desire to behave in appropriate ways;
3. Provide a curriculum that will result in an in-depth knowledge of issues;
4. Provide a curriculum that will teach learners the skill of issue analysis and investigation as well as provide the time needed for the application of these skills;
5. Provide a curriculum that will teach learners the citizenship skills needed for issue remediation as well as the time needed for the application of these skills;
6. Provide an instructional setting that increases learners' expectancy of reinforcement for acting in responsible ways (internal locus of control).

The authors concluded that one of the primary obstacles in program implementation was that the kind of instruction needed for good environmental education was often times very different from typical educational practice. The research did not support educational practice where teaching the content led to modified behavior (Hungerford & Volk, 2005). Students needed to be given opportunities beyond awareness or knowledge where they could develop a sense of ownership and empowerment.

Pro-environmental behavior is the aim of environmental education. The interdependence of knowledge and attitudes as related to environmental behavior continues to be researched. Kollmuss and Agyeman (2002) defined pro-environmental behavior as behavior that consciously seeks to minimize one's negative impact on the natural world. Jensen (2002) discussed the differences between environmental behavior and environmental action. His research at the Danish University of Education over a 10-year period approached the subject of environmental education through what was called the action competence approach. A primary element of this

approach was that prior to action, individuals needed to make up their mind to act. Next, action based activities had to be targeted at effecting change to the environmental problem being addressed. Simply involving students in action activities such as investigations of a polluted lake were not considered action-based activities. He argued that the actions should be targeted toward a personal life style change, a school change, or a change in the local or global community. These environmental actions could be direct or indirect as well as individual or collective. Within a school context, often times actions are carried out frequently as part of the educational experience and are often collective.

All students in the three schools from the Danish town of Jaegerspris, were part of an environmental education project. Within that project, students were required to develop personal visions for an environmental issue and then take action to realize that vision. Jensen (2002) identified the nine most typical actions of the students as: sending applications to the local government's departments, cleaning litter from various locations, writing articles for the local newspaper, petitioning private companies, embellishing the local area, petitioning local village boards, establishing compost containers, hanging posters regarding environmental issues, and demonstrating against traffic conditions. Representation of groups for each action ranged from 5 to 18 with each group composed of 5 to 10 students. The one group demonstrating against traffic conditions consisted of 150 students. The categories of actions ranged from direct to indirect and were reevaluated approximately one year after the conclusion of the project.

Some of the environmental changes made as a result of student actions included the reduction of the speed limit to 30 mph at some of the schools, the planting of trees along the cycle paths between two neighborhoods, and the establishment of compost containers. The results of The Jaegerspris Project suggested that students and schools could act as a catalyst for

environmental change in the community. Environmental education at school must develop in students the ability to act at the personal and societal levels by increasing action competence (Jensen, 2002).

Schools are in a unique position for the development of culture and community. Students experience daily school life both individually and collectively. School culture and climate serve as a vehicle for academic and personal growth. Mutisya and Barker (2011) investigated the environmental awareness and knowledge of primary school students in Kenya's Rift Valley. Environmental education knowledge had been infused primarily in the science and social studies areas at the primary level. The research in creating environmental awareness became critical at the primary schools, as many Kenyans do not progress beyond that level (Mutisya & Barker, 2011). Environmental education programming focused on ecological knowledge infused in the school curricula as well as on the availability of co-curricular activities such as wildlife clubs, Boy Scouts, and Girl Guides. The study was undertaken to assess students' awareness of key environmental issues in their local areas as well as their knowledge of the cause, effects, and solutions to these issues.

Mutisya and Barker (2011) described the methodology as descriptive survey where the researchers did not manipulate the variables. Proportional random samples from 44 public primary schools were used. Students were between the ages of 12 and 16 and were selected from each zone and school. The final sample consisted of 274 students. A researcher-developed survey instrument containing 13 structured questions was used. Students were asked to identify and select local environmental issues as well as their causes, effects, and solutions. Student responses were categorized and item percentages were calculated. Content analysis techniques

were utilized with the data collected. Descriptive statistics were applied to distinguish sets of categories.

Mutisya and Barker (2011) reported that the students were aware of the key environmental issues that were happening in their local areas. They also had the knowledge of causes for those issues but did not have an understanding of how human activities contributed to some of those issues. Their data revealed that students had solutions to some of the problems but not all. Programming which contained ecological knowledge that was infused in the curriculum along with co-curricular activities had increased a better understanding and awareness of the issues but had failed to assist with the creation of effective solutions to the issues. Mutisya and Barker suggested that primary school students needed to be developed into informed decision makers and action takers and that environmental education must go beyond knowledge awareness and include opportunities for students to take action. Environmental education needed to be taught theoretically in the classroom and practically in the environment where students provided solutions to local environmental issues (Mutisya & Barker, 2011).

Environmental education research speaks to student involvement through programming and experiences as a critical source in changing learner behavior. Smith, Rechenberg, Cruey, Magness, and Sandman (1997) investigated the impact of recycling education on the knowledge, attitudes, and behaviors of grade school children. The purpose of the study was to investigate whether a short duration recycling education program that attempted to link knowledge and attitudes toward paper recycling with actual paper recycling behavior was effective. A sample of 349 students in Grades 3 through 6 attending private and public schools in Cincinnati were utilized. There were two versions of the paper recycling education program implemented. One version consisted of classroom presentation stressing basic knowledge of paper recycling along

with the need for recycling and paper reuse suggestions. Version two was similar to version one but classroom knowledge focused on landfill composition and then included a visit to the local landfill. Knowledge measures were developed assessing either paper production and recycling or landfill composition and recycling. A 5-point Likert-type scale attitude questionnaire was used to score pro-recycling behaviors. The behavioral measure consisted of a self-report of pro-recycling behaviors engaged in over a week's time. Knowledge, attitude, and behavior surveys were administered two days prior to the educational program implementation. Post knowledge scales were administered immediately after program implementation while post-attitude and behavioral measures were administered 7-14 days after the program.

Dependent *t* tests were used to determine impact of the program on each dependent measure. Smith et al. (1997) reported significant differences on the dependent measures of knowledge ($p < .0001$), pro recycling attitudes ($p < .001$), and behaviors ($p < .001$) after the recycling program. Significant differences were found for program type ($p < .0001$) with more pro recycling attitudes and behavioral changes as a result of the landfill visit compared to the classroom group. Intercorrelations between change scores for attitudes, behavior, and knowledge were calculated for program type. Significant correlations were found between knowledge and behavior ($p < .05$) for the classroom group and significant correlations were found between attitudes and behavior ($p < .05$) for the landfill group. This may have indicated that the classroom group demonstrated a behavior change as a result of having more knowledge while the landfill group demonstrated a behavior change due to a change in attitude (Smith et al., 1997). Knowledge comparisons were not made due to the differences in the content presented between the two program versions.

Significant differences were found in grade level ($p < .0001$) where fifth-and-sixth grade students had greater changes in knowledge, attitudes, and behaviors than third-and-fourth grade students. School type (private, public) was also significant ($p < .0001$). Private schools students had more knowledge, pro-recycling attitudes, and behaviors than public school students. Results indicated that a good field trip highlighting the consequences of not recycling was an effective way of increasing recycling behavior while classroom discussion was more effective in increasing student knowledge. Findings related to age indicated that there might be a critical time prior to adolescence that is important for environmental education. Smith et al. (1997) concluded that environmental education that focused on early school-age children and that closely linked environmental knowledge with specific environmental behaviors could be effective in changing environmental attitudes.

Researchers have examined the human-nature interaction question since the 1970s (Thorpe & Townsend, 2001). Studies from the disciplines of horticulture therapy, socio-horticulture, and environmental education have demonstrated that gardens provided a useful venue for experiential learning. The purpose of this study was to develop a phenomenological understanding of the impact of a garden-based curriculum on the students and teachers of a Midwestern elementary school. Purposive sampling was used to identify individuals that were willing to converse about their experiences with the garden and the garden-based curriculum. This qualitative study focused in depth on a sample of five teachers and 40 students from one school. Data collection included interview, conversation, observation, photo elicitation and document analysis. Teacher interview protocol was developed based on the research questions of the study. Unstructured and semi-structured interviews were scheduled throughout the 2000-2001 school year. Student interview protocols were developed collaboratively with the teachers

in the study. Thorp and Townsend (2001) collected extensive field notes through participant observation during the year on site. Student garden journals, maps, stories, poetry, and artwork were collected and interpreted for insight into children's garden experiences. The researchers also photographed the teachers and students during their participation in the project.

Naturalistic data analysis was utilized as it served a recursive function and contained a built in mechanism for self-correction and validation. The researchers reported several findings. The garden had changed the culture of the school environment. In this study, the garden symbolized hope, growth, and community, which changed the perceptions that this school was underperforming. Teachers and students expressed that the garden provided a venue for them to escape from the modern world and slow the rhythm of their lives. The garden connected students to an organizing principle of experience. They were connected to a larger living world. The students and teachers felt more present in the tasks of their daily lives. It also became a place of self-expression. The garden changed the status of food for everyone involved. It represented communal living between people and plants. A primary finding here was that a school garden could be an investment in not only the curriculum experiences of students but in the development of a nurturing and safe school culture (Thorp & Townsend, 2001).

Environmental education program components often utilize the immediate surrounding of the schools. Students interact with those areas that are convenient and accessible. Schools around the world have reacted to the ambitious environmental education goals of the Tbilisi Declaration. Sustainable development must meet the needs of the present without compromising the needs of the future (Marcus, 2012). Environmental projects that have taken shape are varied and unique to each community, place, and time period. More recently, a new environmental approach rooted in different pedagogy focused on where humans have settled and emphasized

quality of life (Marcus, 2012). This is more commonly known as place-based education. In place-based education, culture and social dimension set the stage for learning and local issues are dealt with before global information is presented. Using the local environment provides opportunities for students and schools.

The Green School concept is rooted in the concept of place-based education and the Green School certification trend has been spreading worldwide. Green schools (Eco-Schools) must develop seven steps to sustainability. These include the development of an eco-school committee composed of students, parents, teachers, support staff, and local community representatives. This group conducts an environmental review and action plan. This plan must be monitored, evaluated, and reflected in the curriculum. Its overall purpose is to inform and involve resulting in a school-wide eco-code (Conneely, 2014). Marcus (2012) reported that in 2002, there were more than 2,000 elementary schools in 11 different countries participating in the Eco-Schools Program. Green schools “seek to provide the pupils with knowledge, attitudes and skills which will train them for critical and environmental thinking, independent learning and conscientious environmental behaviors” (Marcus, 2012, p. 53). Green Schools commit to long term educational processes rather than short-term projects, where students, teachers, and administration create a school culture based on green school principles for the entire school community.

Marcus (2012) stated that these schools were required to develop an action program that contained the following: theoretical study of environmental issues within the elementary school curriculum, a sustainable use of resources through school practice, an environmentally related community project, and a green council made up of all stakeholders. This study was designed to evaluate the effectiveness of the Green School Program as perceived by the students. The

research design was mixed methods and included three school types that had similar background characteristics and were located in an urban center of Israel. The research was conducted in two stages where quantitative data were collected prior to qualitative data. Quantitative data were collected using a closed-ended questionnaire that had been used as a national survey in Israel for sixth through 12th graders. It contained 81 questions and was given to 146 sixth-grade students from six classes: two from a green school; two from a diligent green school (a follow up program intended for schools to deepen engagement with EE issues); and two from a control (Marcus, 2012). Data were analyzed using SPSS.

Semi-structured interviews were conducted with 24 students representing eight students from each school group. Qualitative data were coded by themes using grounded theory. Marcus (2012) reported that no statistical differences were found between the three groups in system knowledge but Green School students and diligent Green School students could identify more creative ways of dealing with global environmental issues. Control group students mentioned a limited range of problems while Green School and diligent Green School students were able to identify a larger range of environmental problems.

In the attitudes dimension, all students had a general awareness of the issues. All of the students acknowledged that mankind had a responsibility to care for the environment. Only the Green School and diligent Green school students identified school as the main source of information and teachers as the most influential person when discovering nature. Those students identified school and teachers as a link to greater environmental awareness (Marcus, 2012). Student interviews reflecting the behavior dimension revealed that Green School students were more inclined to be involved in pro-environmental projects including environmental decision-making in their schools. They also reported participation in outdoor learning experiences most

likely due to the Green School multi disciplinary curriculum. The Green school students became more involved in the community and developed partnerships around solving environmental issues. Implications from this study in the field of environmental education are that EE curricula that are multi disciplinary, provides outdoor experiences, and utilizes the community as partners in working on environmental issues produces students who are more involved in pro-environmental behaviors. These Green School students exhibited more citizenship behaviors and the school experiences played a critical role in initiating social change (Marcus, 2012). Many other schools offer extended outdoor experiences for students at the elementary school level. Residential environmental education programs such as Nature's Classroom utilize scientific inquiry and critical thinking in an environment beyond the classroom's walls while helping students develop a sense of community ("Natures Classroom," 2014).

Smith-Sebasto and Obenchain (2008) conducted a study exploring whether sixth grade student's perceptions of an environmental education experience changed over time. The study was conducted with a purposive sample of sixth-grade students ($n = 336$) from three classrooms in a central New Jersey school district, which participated in a four day, three-night program. The New Jersey School of Conservation (NJSOC) program provided sessions in four curricular areas (environmental sciences, humanities, outdoor pursuits, and social sciences). The sessions were taught by visiting teachers using a NJSOC lesson plan. The students were asked to complete an open-ended questionnaire containing three items about their experience. The questionnaire was completed first at the conclusion of the program and then again six months later at the student's school. The three questions utilized were:

1. What was the most meaningful thing you learned during your time at the NJSOC?
2. What was the most confusing point of the trip?

3. Of all the things that you learned while at the NJSOC, what would you like to learn more about? (Smith-Sebasto Obenchain, 2008, p. 51).

Smith-Sebasto and Obenchain (2008) employed grounded theory methodology in their study. Initially, responses were labeled with key words. Next open codes from responses were compared and categories were developed. Lastly, one category was chosen as a core category and all other categories were related to it. This allowed the researchers to reasonably account for the data incidents indicating each concept (Smith-Sebasto & Obenchain, 2008). The distribution of data from the immediate post experience for question one and the delayed post experience data for question one was statistically significant ($p = .0001$). The highest number of student responses for the immediate post experience was in the social category whereas the scientific category contained the highest number of student responses in the delayed post experience data. The change between the immediate post experience data and the delayed post experience data are attributed to a situational influence on student perceptions (Smith-Sebasto & Obenchain, 2008). The authors noted that the students' ability to process their trip over time or subsequent lessons in the classroom might have altered their perceptions. Social experiences were more strongly noted when students were in social situations requiring teamwork while the ability to process and participate in scientific topics in the classroom became more meaningful over time.

Examination of the data for question two revealed that students were most confused about the scientific topics on the immediate post experience questionnaire and that remained the same in the delayed post experience data. The authors attributed this to the possibility that the concepts might be too abstract for the developmental stages of the students. This indicated that students who failed to receive proper instruction or explanation on a topic would continue to be confused even months after the presentation. This confusion would lead to misinterpretation of

the scientific information (Smith-Sebasto & Obenchain, 2008). The immediate post experience data for question three indicated that most students wanted to know more about issues in the science area. This remained consistent with the responses in the delayed post experience data. Smith-Sebasto and Obenchain (2008) noted that for this question, the students were drawing directly from their own interests and as a result this had not changed over time. This implied that supplying students with knowledge of environmental sciences and scientific processes seemed to create some enjoyment and positive emotions for the students whether through memories made or increased interest in the topic (Smith-Sebasto & Obenchain, 2008). This research supported that residential outdoor programs have a lasting effect on student's knowledge and interest in environmental sciences provided they are organized, clearly articulated, and appropriate for the student's developmental level.

Childhood Nature Experiences

Environmental education curricula and implementation are multifaceted and draw from elements found in research. School-based programs face the challenge of balancing core curriculum status subjects with environmental education. Schools act as extensions of families and communities that work together for the welfare of children. It is worthwhile then to look more closely at the impact of childhood nature experiences as related to environmental education outcomes. Wells and Lekies (2006) investigated how childhood interactions with nature might begin to shape a life trajectory of respect for environmental concerns and ecological actions. Data used for their study were obtained from a larger study of childhood environmental experiences and adult sensitivities to urban and community forests conducted by Lohr, Pearson-Mims, Tarnai, and Dillman (1999). The telephone survey included 108 closed-ended questions and was administered to adults living in the United States. Selection of participants occurred

through a combination of random-digit dialing and listed numbers. A final sample size consisted of 2,004 participants ranging in age from 18 to 90, with a mean age of 45. Participants were asked how often they participated in nature related activities, environmental education, and nature experiences with other people before the age of 11.

Nature related activities were categorized in two ways: wild nature activities and domesticated nature activities. Wild nature activities referred to hiking, walking, camping, etc., and domesticated nature activities consisted of picking vegetables or flowers from a garden and taking care of indoor or outdoor plants. Environmental education included not only school experiences but also outside of school experiences such as Boy Scouts, Girl Scouts, and summer camp. Participants were also asked to identify with whom they spent time in the outdoors before the age of 11. The dependent variables included in the model were adult environmental attitudes and adult environmental behaviors. Sociodemographic variables of age, gender, race, education, and income were used as controls. Structural equation modeling was used to test the hypothesized model (Wells & Lekies, 2006).

Childhood participation in both categories of nature related activities (wild nature and domesticated nature) had significant direct effects ($p < .05$) on adult environmental attitudes. Childhood nature experiences with other people had a marginally significant ($p < .10$) negative effect on adult environmental attitudes and the effect of environmental education on adult environmental attitudes was non-significant (Wells & Lekies, 2006). Adult environmental attitudes were expected to predict adult environmental behavior in the model. Wells and Lekies, (2006) reported that environmental attitudes were influenced by various forms of childhood participation with the environment and had a positive influence ($p < .05$) on environmental behaviors. It was noted that wild nature activities in childhood had a significant direct effect

($p < .001$) on environmental behaviors, as well as an indirect effect ($p < .05$) through environmental attitudes.

Childhood domesticated nature activities were also positively associated with environmental behaviors. Childhood participation in environmental education and childhood experiences in nature with other people had no significant effects on adult environmental behaviors (Wells & Lekies, 2006). Results from this study suggested that outdoor activities, whether considered wild or domesticated in childhood, play a role in shaping adult environmental attitudes and behaviors. These experiences in youth also played a role in adult choices and life trajectory.

Significant life experience, as it relates to environmental education, represents those nature-based activities, either alone or with others that hold special meanings to individuals (Chawla, 2006). Research on significant life experiences suggested that when children had access to the outdoors and permission to explore it, they had a strong interest in the environment. This, coupled with education, membership in organizations, or life pursuits led to activism to protect the environment they love. Children need the freedom to explore in nature. If they do not have that availability, parents can take them to places where it exists. When children are discovering nature with others, it becomes a place for developing social competence as well. Children's positive experiences in the world outside encourage them to explore further, which builds greater levels of environmental knowledge and personal competence (Chawla, 2006).

Research on significant life experiences has come under criticism. Questions have been raised about the use of active environmental adults as subjects. This criticism is based on the belief that adults may not accurately remember their childhood experiences especially within the context of their current work. Chawla, a well-known researcher in this field, addressed these

concerns regarding the accuracy of memory as data when she revisited the research on significant life experiences. While she took note of the commentary, she cited that people's construction of their past has directed us to forms of experience and as such should be taken seriously. These data cannot be dismissed, as environmental education must be more than just formal school curricula. Education for sustainable development has included both formal and nonformal methods (Chawla, 2001).

These personal experiences with nature have allowed children to explore, socialize, and develop a sense of belonging. Louv (2008) wrote about the increasing divide between young people and the natural world. He discussed that this disconnect with the outdoors is having mental, physical and spiritual impacts on our children. Louv coined the phrase “Nature Deficit Disorder” which he acknowledged is not a medical diagnosis but rather a way to think about the problem. The most potent force keeping children from the outdoors is fear, fear of traffic, of crime, of strangers, and of nature itself (Louv, 2008). A survey of US parents in 2002 reported that 56% of parents said that by the age of 10 they were allowed to walk or bike to school, yet only 36% of those same parents said they would allow their children the same experience. These societal changes increase the challenges of environmental education. The personal connections and experiences needed to develop care for the natural world are established to some extent from childhood interactions with the outdoors yet children are afforded fewer opportunities with minimal role models. Schools then must take on the role of not only implementing the formal curricula but also must provide opportunities for exploration and investigation.

The ultimate goal of environmental education is to promote positive citizenship through the development of ecological knowledge, environmental affect, cognitive skills, and environmental behaviors. The task, however, is more complex. Intertwined with these more

measurable domains are the more affective areas that deal with human connections to all living things. Mortari (2004) described this as an ethic to care. He argued that schools are responsible for encouraging students to not only care for the human world but also the natural world. This framework reflected eco-ethical education, which developed and fostered care for all living beings (Mortari, 2004). The framework of his research was participatory inquiry where the problem to be solved was identified during the study rather than organized as the subject of the study.

In his work, teachers outlined the educational need and identified the educational experiences that would promote responsible attitudes in students. From this inquiry, an experience where children would care for plants was planned. This experience consisted of a questioning phase and an operative phase. In the questioning phase, a conceptual exploration of the definition of care took place. In the operative phase, students planned, implemented, and reflected on the activity of caring for plants. A total of 97 students ranging in age from 6 to 10 participated in the study over the course of an entire school year. Data were collected through participatory observation, recoding of conversational activity, and student journals. Mortari (2004) used an inductive procedure based in grounded theory to analyze the data. Line by line coding was used in the development of the initial codes and then recoded to develop a final list of codes supported by student text.

Three concepts emerged from the data: operative, participatory, and ethical. In the operative concept, the practice of care came from a set of practical actions with plants. In the participatory concept, the care of plants was interpreted in an emotionally involved way. The ethical concept emerged when the practice of care was related to a relationship with plants. Findings of the study were that the operative concept was prevalent (age 6 = 94%; age 7 = 53%;

age 8 = 64%; age 9 = 50%) and only in the 10-year-old group was it found to be marginal. In this group, the ethical conceptualization dominated instead. Data from the questioning stage of the study suggested that students are able to discuss multiple worldviews related to the life-centered ethic of care. This is a capability that schools can preserve and cultivate. Analysis of student diaries revealed that the practice of care produced a significant change in the student's attitudes. At the beginning of the study, only a few children articulated that plants were living beings and a relationship could be established with them. However, this attitude changed after the concrete experience of caring for the plants and reflecting on their feelings. Mortari (2004) concluded that this is a sign that involvement in an act of care allowed a relationship with other life forms to be established. This is a crucial dimension of environmental education.

Conclusion

This review of the literature was conducted to inform the researcher by providing foundational knowledge in the field of environmental education as well as the theoretical foundations upon which educational pedagogy in this area is based. The complexity of providing a comprehensive environmental education program that has an overall desired effect of positive citizenship is evident. Research in the environmental education field related to effective program components and environmental behaviors as well as childhood nature experiences was discussed. In addition, sound theoretical foundations and social emotional learning methodology as connected to school culture were examined. Each of these areas served as the foundations for this study.

CHAPTER 3: METHODOLOGY

This study was implemented to investigate the impact of schooling with an embedded environmental focus on students' long-term environmental literacy skills. Environmental literacy scores were analyzed between students who had participated in a school with an embedded environmental focus and students who had not participated in a school with an embedded environmental focus. The four domains of environmental affect, ecological knowledge, cognitive skills, and environmental behaviors as well as the total environmental literacy scores were analyzed. Data also were examined to determine relationships between the number of years that students attended the school with an embedded environmental focus and the number of years post graduation of that school as related to environmental literacy scores. Semi-structured interviews were conducted with the six highest scoring students representing both groups to deepen the understanding of the impact of social variables on environmental literacy scores.

This chapter begins with the research questions that guided this study's investigation of the factors that influence students' long-term application of environmental literacy skills. Also included is the researcher's biography, the setting of the study, the subjects involved, and sampling procedures used. Next, a rich description of the school programming with the embedded environmental focus as experienced by the students in Group One is discussed. Following is the research design, instrumentation, and analysis procedures utilized. Subsequently, data collection procedures and limitations to the study are discussed. The chapter concludes with an ethics statement.

Research Questions and Hypotheses

This study investigated the following research questions.

1. Are there significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level?
 - a. Non-directional hypothesis: There will be significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level.
2. To what extent and in what manner do the variables of time (years attending a school with an embedded environmental education focus and years of post completion attendance of a school with an embedded environmental education focus) explain the variation in the environmental literacy score?
 - a. Directional hypothesis: The variable number of years attending a school with an embedded environmental education focus at the elementary school level will significantly explain the environmental literacy score while number of years

post completion of attendance in a school with an embedded environmental education focus at the elementary school level will not.

3. What role in the development of environmental literacy skills is played by social variables related to family, culture, and community?

Researcher Biography

This dissertation was written at the onset of my 35th year in education. Over the course of my career, I have had the opportunity to work with all grade levels from preschool through twelfth grade in multiple capacities. Working in three school districts, urban and suburban, in the northeast, I have seen various models of programming adapted to meet the needs of students. My teaching certifications include elementary education, special education, bilingual /world language education, and administration. As the foreign born daughter of immigrants, I have been inspired by my roots to learn three languages and move through the higher education system. These life experiences have been the backdrop for the inspiration of this work.

Schools are most closely associated with the academics of learning. I have seen that teachers are trained to develop skills in core curriculum areas and monitor students for acquisition of those skills. Instruction is differentiated to meet the needs of all students and standardized tests are used to measure progress. It is, however, my experience that schools are much more than academics. They are environments where children learn social skills, adjust their own thinking to reflect their experiences, and grow to be the future leaders of our world. It is through this unwritten curriculum that we nurture the whole child.

As a school leader for the last 14 years, my work has been both administrative and instructional. The rigors of curriculum and the implementation of new teacher evaluation protocols require a focused vision for the instructional leader. In the end, it was new

opportunities and challenges that guided my decision-making. Eight years ago, I was given the opportunity to open a district-run international and global studies elementary magnet school. That school would embody the vision of socially responsible global citizenship for all students who attended. All district curricula would be implemented but a global focus would envelop and extend that curriculum. This layer did not exist in other district schools. A subcommittee of staff members was enlisted to write the international and global studies curriculum. Over the years, that curriculum has been embedded in instruction and has evolved to include current world issues. Environmental sustainability needed to be experienced within the culture of the school so as to expose and deepen an awareness of the environmental issues facing our world.

The ability to have 35 years of experience with children guided me in this investigation. As I observed children daily within the school participating in all kinds of activities, I noticed behaviors and actions that were unique to these students. Their willingness to embrace and take on environmental challenges at the school and community level was evident. I wondered how much of this behavior was prompted by the programming and culture developed within the school. There was also the question of what other variables might be working alongside the school curriculum. This study followed those students into middle school and examined whether this programming had a significant effect on environmental literacy skills. It also examined if there were relationships related to the number of years a student was in the school and the number of years they were away from the school. The question of what social variables were at play also was investigated.

It was important to detail my background so as to identify my close association to the school and students in Group One. While this close association might be viewed as strong researcher bias in the study, it is this very connection that keeps me alert and vigilant for

processes and data analyzation. Throughout the study, checks were put in place to monitor for researcher bias. During testing, a colleague was present to monitor for comparable testing environments. A second scorer was utilized to minimize error in scoring and recording of data. Interviews were recorded, transcribed, and analyzed using various methods to minimize researcher bias.

The ability to be part of the school experienced by the students in Group One offers me the insight to fully understand the exposure provided the children. It also makes me keenly aware that I must remain objective and distant from the work to minimize any bias. It remains essential that I focus on the goal of the investigation which is to add to a body of research needed to better understand school programming as related to environmental literacy skills.

Description of the Setting, Subjects, and Sampling

Setting

This research study took place in a large urban district in New England with a population of 80,893 as reported in the 2010 census. The median household income was reported at \$65,275 and 8.4% of the population was identified as falling below the poverty level. The 2010 census also reported that 68% of the citizens were Caucasian. This district consisted of 17 schools with 13 at the elementary school level (kindergarten through fifth grade), two middle schools (sixth, seventh, and eighth grades), one large comprehensive high school, and one alternative high school (ninth through twelfth grade). In the year 2010-2011, the school district enrolled 10,343 students in grades pre-K through 12 (“Connecticut Education Data and Research,” 2012). Within that demographic, 45% were eligible for free or reduced meals. Students not fluent in English totaled 19% of the population and 3.7% were identified as gifted and/or talented. Approximately 11% were receiving special education services (“Connecticut

Education Data and Research,” 2012). The district’s student population demographics are included in Table 2.

Table 2

Student Population Demographics for District and Participating Middle Schools (CSDE, 2012)

Race/Ethnicity	Percentage		
	District	School One	School Two
American Indian	0.1	0.1	0.0
Asian American	7.9	8.3	6.2
Black	9.0	10.4	11.0
Hispanic	36.2	27.4	38.9
Pacific Islander	0.0	0.1	0.0
White	45.7	52.7	42.8
Two or More Races	1.1	1.0	1.1
Total Minority	54.3	47.3	57.2

This research study was conducted with students attending the two middle schools within the district. Middle school in this district housed students in grades 6, 7, and 8. In the 2010-2011 school year, the CSDE reported that Middle School One enrolled 1,114 students where 41% were eligible for free and reduced price meals. Students not proficient in English made up 7% of the enrollment and 14% received special services. Students identified as gifted and/or talented comprised 6% of the group. Middle School Two enrolled 1,095 students in the 2010-2011 school year. Of those enrolled, 56% were eligible for free and reduced meals and 16%

were not proficient in English. Within that group, 12% were receiving special services and 6% were identified as gifted and/or talented.

Subjects

A total of 225 students participated in this study. There were 106 students in Group One who had attended a school with an embedded environmental education focus at the elementary school level. Within that group there were 56 females and 50 males. The grade level breakdown for this group was 42 sixth-grade students, 36 seventh-grade students, and 28 eighth-grade students. Group Two contained 119 students who had not participated in a school with an embedded environmental focus at the elementary school level. There were 65 females and 54 males in Group Two. The number of students in grade 6 was 39, grade 7 was 35, and grade 8 was 45. Students in both groups represented a sample of convenience. Demographic data were collected on all students as part of the MSELs and were verified using the district database. The demographic data for each group are included in Table 3.

Table 3

Student Demographic Data for Group One and Group Two

Race/ Ethnicity	Group One (<i>n</i> =106)	Group Two (<i>n</i> = 119)
American Indian	1	0
Asian American	6	8
Black	7	15
Hispanic	24	46
Pacific Islander	0	0
White	67	50
Two or More Races	1	0
Total	106	119

Students asked to participate in the interviews were a purposeful sample drawn from the data collected on the MSELs. Students from both groups with the highest total environmental literacy scores were invited to interview. Three students from Group One and three students from Group Two interviewed. All students invited received parental permission and agreed to participate. Within that group, there were three males and three females. The three highest scoring students in Group One represented a sixth, a seventh, and an eighth grader. The highest scoring students in Group Two were all eighth graders.

Sampling

Permission to conduct this study was obtained from the Institutional Review Board of the researcher's university (see Appendix B). A meeting was then secured with the district's

superintendent of schools where the purpose, goal, and benefit of the work were reviewed and discussed. Once approval of the superintendent was secured (see Appendix C), meetings with the principals of the two middle schools were scheduled. At those meetings, the format and logistics of the study as well as the overall goals were shared. Permission to proceed was granted and a timeline for data collection explored (see Appendix D).

Students in Group One were identified from the grade 5 class lists for the following school years: 2011-2012, 2010-2011, and 2009-2010. A complete list was assembled with the names of the students and their grade level at the time of data collection. Each principal scheduled a date and location in the school where the researcher met with the students and provided information relevant to type of survey instrument to be used, overall purpose (examination of environmental literacy skills), and impact on school day. Each school's principals were present for these sessions. A cover letter along with parent consent and student assent documents were distributed at that time (see Appendix E). While the students in Group One had been together for their elementary schooling, they were currently separated between the two middle schools as well as throughout various school clusters.

Students in Group Two were invited based on randomly selected homerooms within grade level clusters at each school. The researcher met with each of the selected homeroom's students and teachers. Information shared was the same as that shared with students and staff in Group One. Parent permission and student assent documents were distributed at that time and students were asked to return the signed documents to their homeroom teacher.

The researcher returned to both schools several times over three weeks to collect and record permissions received. Permission slips were reissued to all students who expressed a

willingness to participate but had lost or misplaced the initial documents. A data collection spreadsheet was constructed to record student permission documents.

The MSELs and the SAAS-R were administered by the researcher to all students in the study. Student assent was obtained prior to testing on each of the days (see Appendix F). The surveys were conducted in the cafeteria of each school with an assigned school member present. Students completed the SAAS-R independently while the MSELs was read aloud by the researcher. The reading levels of the students were unknown to the researcher and as such it became essential that students' responses reflected their knowledge, thoughts, and perceptions on the subject and not be limited by reading ability. A script of the directions was utilized (see Appendix G).

School Program Information

This study investigated the effects of embedded programming on students' long-term application of environmental literacy skills. It is essential that the reader fully understand the environment that students in Group One (students who have attended a school with an embedded environmental education focus at the elementary school level) experienced in order to accurately interpret the results of this work. In this section, the researcher describes in detail the school's programming related to school curriculum, culture, and vision.

Each school creates its own climate and culture based on the beliefs and values of its occupants. Some might argue that it is the school leadership that sets the tone for the overall atmosphere. Others would point out that school climate is an ever changing phenomenon that reflects the mood of the students, staff, and families that work within the building confines. This school built its program on a combination of school mission, curriculum, inhabitants, and visionary leadership.

The school is a public school of choice and operates using a magnet school model. All students are encouraged to apply and selection is by lottery for any available seats within the school. Outreach is conducted to encourage families from all demographic profiles to apply. In the 2009-2010 school year, the student demographic for minority students in the district at the kindergarten through grade 5 level ranged from 35% to 65%. The student body for this school includes 40% of its students who do not live in the urban district. As a result, if the total school population was included in the demographic, it would reflect 30% minority. If the population was compared to the district, utilizing only the 60% of the students who live in the district, the minority numbers would rise to 52% and lie within the normal range for other district schools. The students included in this study represented only the 60% who lived in the district and attended the district's middle schools.

Magnet programs are unique in that they are centered on a theme of study. Standard core curriculum is utilized and a thematic focus envelops the delivery of that curriculum. This school's theme was international and global studies. It contained three primary curriculum threads that spiral around a nucleus of study. Those three areas were continent study, language instruction, and a peace curriculum (see Figure 1).



Figure 1. School Program Information

Continent study began in kindergarten and each year built upon the previous years' work. The curriculum was entwined within the social studies and science curriculum. The entire school would study a continent at the same time and that study became the primary focus of the work in the school. Students learned that to live in a global community, it was imperative to be knowledgeable of culture, location, climate, foods, and etiquette. It is here that the value of respect for self and others was modeled and taught.

Simultaneously, students began world language instruction in kindergarten. Language was seen as a vehicle to better understand culture and customs. The ability to speak another language was viewed as an asset so as to foster communication and an understanding of others. The goal was to demonstrate for children that another way to respect and value others was to be willing to learn and speak another's language.

It was the peace curriculum that was responsible for the overall tone of the school. This curriculum permeated the general organization of the school. It provided a backdrop for how

groups moved through the school, how disciplinary procedures were carried out, how children were spoken to and viewed as decision makers within the larger community. As the students traveled through the grade levels, they were challenged to develop an understanding of who they were as people, what they understood about people, and how the combination of the two guided their interactions with people. They were taught that every action had a ripple effect on others and within the school community; they were expected to examine that ripple. Staff and parents also worked to that end.

It was within these primary areas that the environmental focus was embedded. The culture of the school focused on everyone being part of a larger whole. Everyone took responsibility for themselves and their interactions with others. Conflicts were resolved through discussion, problem solving, and corrective plan development. The environmental focus took root as not only an international and global problem but also as everyone's individual responsibility to a larger world. Connections were made to how one's individual choices contributed to the status of the global community. Students worked on school grounds, shared their harvests with community organizations, and developed systems for sustainability of the work of those before them. The school community as a whole was responsible for the composting of all foods in the cafeteria. All students were invited to participate in a walking club that encouraged students to begin their school day by walking outdoors. Small groups of students could take part in nature walks with staff during recess.

Kindergarten students developed sensory gardens and were responsible for planting, weeding, and caring for their plants. First graders learned about the life cycle of the butterfly and tended to butterfly gardens that they not only cared for but also used as a natural habitat for their newly released butterflies. Second graders tended the largest of the gardens for two

plantings in the spring and fall. Initially it was the planting of seedlings that led to the preparation of soil beds, which led to transplanting, tending, and harvesting their crop. They weighed, measured, graphed, and shared their learning with others in the school and greater community. Third graders were responsible for all recycling efforts of the school. Their observant eyes noticed that state parks were without recycling bins and garbage companies were placing recyclables and trash in the same trucks. Action steps were developed through student led investigations and as a result, changes occurred in the community. Students in fourth grade saw a need to replenish trout in a local river and decided to take action. Combined efforts of staff, parents, and local organizations initiated a program where small eggs were hatched, cared for, and released into the river each year.

Knowledge of habitats and predator–prey relationships grew within the realm of that initiative. They also took responsibility for an outdoor herb garden and its yield that helped support a yearly trip to Nature’s Classroom in fifth grade. The fifth grade was the senior group that led the actions of all younger grades. They trained compost committee members for each lunch wave to assure the instruction and implementation of composting guidelines. In the end, it was their responsibility to examine the compost prior to placing it into the composting bins on the schools grounds. They became problem solvers when bees invaded the bins, making it impossible to add daily compost. It was their research and development of apple juice attraction bottles that led to the organic solution to the problem. Each grade level saw their responsibility to the school and local community as evidence of individual and group behaviors, which led to improvement. Most importantly, it was the collective efforts of the groups that made change happen.

It was the goal of the researcher to help create the mindful picture of the programming and experiences to which these children were exposed. Children were not expected to blindly share the same belief system on which the school’s vision was created. They were challenged to think for themselves and became keen observers of others. It was here that they functioned with the knowledge of knowing oneself enough to understand and respect the views of others. An atmosphere of life-long learning, creative problem solving, and continuous striving for one’s personal best, were part of the embedded life within the school. This vision (“Mission Statement,” 2012) was articulated in the strategic goals of the school (see Appendix H).

Faculty, students, and parents at this school functioned as a community. It was the integration of curriculum, individual and collective experiences, and the value of creative and innovative thinking that embodied the living culture of the school. In this study, it was the participation in that environment that was examined relative to those long-term changes in knowledge, attitudes, and behaviors related to environmental issues.

Research Design, Instrumentation, and Data Analysis

Research Design

This study employed a mixed-methods explanatory sequential design (see Figure 2).

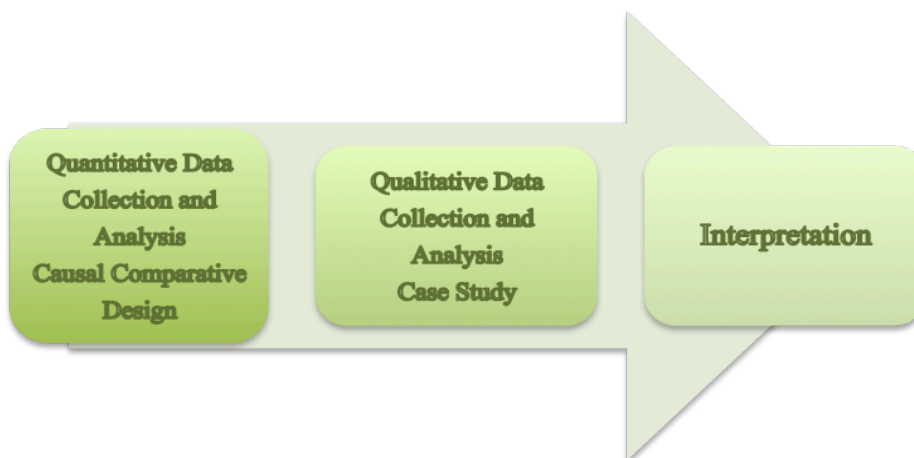


Figure 2. Explanatory Sequential Mixed Methods Design

The overall purpose of the explanatory sequential design was to use a qualitative component to explain initial quantitative results (Creswell & Plano Clark, 2011). Researchers may use this type of design when the important variables are identified and can be measured by a quantitative instrument. Creswell and Plano Clark (2011) suggested that this design lends itself to an emergent approach where the second phase is designed from what is learned in the first phase. This design was best suited for this study as the variables under study (environmental literacy) could be measured with a valid and reliable quantitative instrument. The instrument was age appropriate for the groups, was administered in one sitting, and could be analyzed relative to the important variables. It was never the intent of the researcher to presume that school programming alone would contribute to group differences. The ability to explore additional contributing factors was essential to the understanding of the results. Semi-structured interviews, developed and conducted after the quantitative analysis, provided the researcher with additional data used to further explain the phenomenon.

Survey research is used to describe research studies that are primarily dependent on questionnaires or interviews for data collection (Gall et al., 2007). In this study, the survey method of data collection was utilized to collect data from a sample of students who represented the population under study. The quantitative data collected to support Research Questions One and Two were based on a causal-comparative research design. Causal-comparative research is used when the researcher is investigating cause and effect relationships between different groups where the independent variable is present or absent (Gall et al., 2007). The students in Group One attended a school with an environmental education focus at the elementary school level. They were not selected to that school for environmental literacy purposes under investigation but rather chosen based on a lottery process. The researcher had no ability to manipulate the

students in this group but rather looked for relationships between this group as compared to students who had not participated in the school's programming on environmental literacy domain scores. The primary goal was to investigate the effect of prior school programming on environmental literacy skills. This non-experimental investigation was utilized to add to a body of research that currently existed on factors related to environmental literacy development in children.

In a mixed-method explanatory sequential design, the researcher connects to a second phase where the quantitative results are used to guide the development of the qualitative strand (Creswell & Plano Clark, 2011). After all the data were scored and entered into a database, students from both groups with the highest total environmental literacy scores were invited to participate in the second phase of the study. Six students comprised the purposeful sample used during this qualitative phase. This investigation sought to identify additional factors related to social variables for those with the highest scores. Equal representation from each of the two groups was necessary to add depth to the quantitative results. Parental consent and student assent was secured for each of those students eliminating the need to move to others on the list (see Appendix I).

A generic qualitative design was used in this second phase. Generic qualitative studies are those that contain characteristics of different qualitative methodologies but do not focus the study on any one approach (Caelli, Ray, & Mill, 2003). This design can be used when the topic under study warrants a better understanding of an experience or an event. Caelli et al. (2003) proposed that establishing credibility in generic qualitative research must occur by addressing four key areas. These areas include the theoretical position of the researcher, the balance between the methodology and methods, the establishment of rigor, and the lens of the researcher

(Caelli et al., 2003). In this study, the researcher added a biography to inform the reader of background experiences as well as any connections to the students or school programming. Methodology, rigor, and the lens of the researcher were addressed in the limitations of the study, specifically in the trustworthiness section. The ability to speak individually with each of the students allowed the researcher to gather data related to the students' background and experiences. Student assent was obtained prior to the interview (see Appendix J).

Semi-structured interviews were conducted with each of the students to further examine the role of social variables relative to their high total environmental literacy scores. Semi-structured interviews are conducted by asking a series of structured questions and then probing more deeply with open-form questions (Gall et al., 2007). Students were informed that they had been asked to participate based on their environmental literacy scores. The purpose of the interview was to learn more about them as individuals. This information would assist in understanding the role of social variables in the study of environmental literacy skills. Efforts to reduce possible stressors for the students included informing them that all questions were based on gathering information and were not connected to academic achievement (see Appendix K). Students were prompted with questions in three primary areas including family, culture, and community. The interview was formatted so the researcher would ask a question and based on student response, clarifying questions were pursued. Interviews for each student were approximately 30 minutes.

Instrumentation

Data for this study were collected using three instruments: the *Middle School Environmental Literacy Survey* (MSELS) (Hungerford et al., 2009), the *School Attitude Assessment Survey Revised* (SAAS-R) (McCoach, 2002), and semi-structured interviews. The

MSELS was used as a measure of environmental literacy skills. A subject characteristics threat exists in causal comparative research. In this study the SAAS-R was used to address this threat and describe the students in the areas of academic self-perception, attitudes toward teachers, attitudes toward school, goal valuation, and motivation. Interviews provided a qualitative measure of additional social variables at play in the development of environmental literacy skills.

Middle School Environmental Literacy Survey. The *Middle School Environmental Literacy Survey* (Hungerford et al., 2009) was administered as a measure of environmental literacy. The MSELS consists of seven parts measuring demographic data, ecological knowledge, verbal commitment, actual commitment, environmental sensitivity, environmental feeling, and issue identification, issue analysis, and action planning. These parts are clustered into four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). Section one of the MSELS collects demographic data related to age, grade, gender, and ethnicity. The MSELS utilizes a multiple choice and 5-point Likert response format. Ecological knowledge is a multiple choice format where each correct response is scored one point for a total of 17 items. Test items using a Likert response format are scored numerically based on questions stated either affirmatively or negatively. Affirmatively stated items are scored as follows: a = 5, b = 4, c = 3, d = 2, e=1. Negatively stated items are scored in reverse. Test items included in the cognitive skills domain are scored one point for each correct response except for action planning where responses are weighted. The authors provide a comprehensive administration and scoring protocol with the instrument. Permission for use of the MSELS must be obtained from the authors through the Center for Instruction, Staff Development and Evaluation in Carbondale, Illinois.

The MSELs was used in the National Environmental Literacy Assessment project (McBeth, Hungerford, Marcinkowski, Volk, & Meyers, 2008) and was based on several earlier instruments. The base instrument, the *Middle School Environmental Literacy Instrument (MSELiv9)* developed by Bluhm, Hungerford, Mcbeth, and Volk in 1995 was one of the products of the Environmental Literacy Assessment Consortium. Several revisions of that earlier instrument produced the MSELiv9, for possible use in the National Environmental Literacy Assessment project. One goal of phase one of the NELA project was to develop a comprehensive research-based instrument to measure environmental literacy among middle school students in the United States. This instrument needed to be valid and reliable, be appropriate for middle school students, and be administered within a typical class period (McBeth et al., 2008). Construct validity for the MSELiv9 was established through an 18-member panel. They reflected a balance of educational levels and responsibilities: four middle school teachers; two high school life/environmental science teachers; two school district environmental education coordinators; six university environmental educators/researchers; and two officers in state/federal agencies related to environmental education. Panel members agreed that the instrument reflected a reasonable definition of environmental literacy, was of suitable length, and was appropriate for sixth through eighth grade students. Over three-quarters of the panel members reported no political, gender, or racial bias.

The MSELiv9 was field-tested using 65 sixth, seventh, and eighth grade students from two locations, Molokai, HI and Steeleville, IL. Three teachers field tested the materials and reported no difficulties in the process as well as completion times between 28 and 41 minutes. These testing times were deemed acceptable for middle school students. The field test scores were used to compute reliability estimates. Cronbach's Alpha Coefficient was used to determine

the internal consistency of the instrument. Alpha coefficients ranged between .701 and .869, with one exception. Issue Identification, a three-item scale, yielded an alpha coefficient of .389. The total instrument reliability was .82 (McBeth et al., 2008). Reliability estimates are included (see Appendix L). Following the field-testing of the instrument, the environmental sensitivity scale was revised to include emotion in environmental affect. Two emotion items were pilot-tested, analyzed, and later added to the instrument.

The Flesch Reading Ease and Grade Level Indexes were used to determine readability of the survey. A final score of 66.4, indicated a standard reading ease and acceptable for grades 6, 7, and 8. Prior to its use in the National Environmental Literacy Assessment project, the name of the instrument itself was changed, from the *Middle School Environmental Literacy Instrument (MSELIV9)* to the *Middle School Environmental Literacy Survey (MSELS)*, to reflect the addition and refinement of scales and to differentiate this version from earlier versions.

Additional estimates of construct validity and reliability of scales within the MSELS were pursued by the research team (McBeth et al., 2008). Originally, contrasted-groups comparison was used to establish construct validity for those scales that measure the cognitive dimensions of environmental literacy (Ecological Knowledge, Issue Identification, Issue Analysis, and Action Planning). Contrast group comparisons in the non-cognitive scales did not detect differences indicating a need for a secondary analysis (McBeth et. al., 2008).

Factor analysis was used as a second method for the non-cognitive scales. The results of the factor analyses for the non-cognitive scales of the MSELS revealed that the one-factor model for each scale was the best fit, confirming that each scale was uni-dimensional (McBeth et. al., 2008). McBeth et al. (2008) reported that each scale did indeed measure the one conceptual

variable it was designed to measure, and as such could be deemed a valid measure of that variable (or psychological construct) for a middle grades population.

The final reliability analysis of the MSELs scales utilized the sixth and eighth grade data from the national baseline study conducted by McBeth, Hungerford, Marcinkowski, Volk and Meyers. Again Cronbach's Alpha Coefficient was used. Alpha coefficients from this analysis ranged between .717 and .847. These reliability estimates approximated those obtained in the field test for MSELiv9 (McBeth et. al., 2008). Reliability estimates are included. Scoring procedures for the MSELs were provided with the instrument. Each survey was hand scored by the researcher and second scored by an associate. Each item in the ecological foundations category received 1 point for each correct response with a maximum score of 17. Subscale scores for how you think about the environment, what you do about the environment, you and environmental sensitivity, and how you feel about the environment were calculated using a 5, 4, 3, 2, 1 scoring for responses in the affirmative. Reverse scoring was used for items stated in the negative. The total score for each of these sections was the sum of the individual scores. Subscales in issue identification, and issue analysis were scored based on correct responses for each item. One point was assigned for each correct response. The final subscale of action planning utilized a weighted response format for responses chosen by the respondent.

School Attitude Assessment Survey–Revised. The *School Attitude Assessment Survey – Revised* (McCoach, 2002) was administered to all students in the study to establish baseline data related to academic self-perception, attitudes toward teachers, attitudes toward school, goal valuation, and motivation. It was essential that the researcher gather these data so as to address subject characteristic threats inherent with causal comparative research studies. The SAAS-R was selected for this purpose for several reasons. The survey could be taken in a short time

frame, was self explanatory to the students, and provided a good measure of school attitudes. The results were then analyzed and compared on those factors describing the groups used in the study.

Confidence is developed in many ways but students who are confident about their skills are more likely to engage in activities. Students' perceptions of themselves and their skills can influence the types of activities they select, how much they challenge themselves, and their levels of perseverance (McCoach, 2002). Research cited by Suldo, Shaffer, and Shaunessy (2007) supports that students' perceptions in their academic abilities, their feelings of belonging within a school, and perceived relationships with teachers are related to achievement. Motivation/self regulation and goal valuation address factors associated to how students approach and engage in a task as well as the processes utilized when they are engaged in their own learning (McCoach & Siegle, 2003).

The SAAS-R was the final version of the instrument based on multiple validity studies. Construct validity for the SAAS-R consisted of a two-step process. The initial version of the instrument contained 48 questions and was administered to 942 ninth–twelfth grade students. It employed a 7-point Likert scale. Examination of the data resulted in the elimination of 16 of the original 48 questions (McCoach & Siegle, 2003). The author later removed an additional two questions as they were felt to be vague and misleading, resulting in 30 validated items and 13 newly reworded questions for the final pilot instrument. McCoach and Siegle (2003) reported internal consistency reliability coefficients of at least .80 on each of the five factors (see Appendix M). Additional data were collected from three different convenience samples. Confirmatory factor analysis was used with the data of 537 students. It was in this second analysis that 8 of the 43 items were removed. The final SAAS-R consisted of 35 questions; eight

questions for academic self perception, seven questions related to attitudes towards teachers, five questions on attitudes towards school, six questions related to goal valuation, and 10 questions related to motivation (McCoach & Siegle, 2003). Final findings of McCoach and Siegle (2003) suggested that the scores for the SAAS-R evidence sufficient construct validity, criterion-related validity and internal consistency reliability.

Interviews

Interviews are used to gather descriptive data from subjects' own words so the researcher can gather data and insight about some phenomenon (Bogdan & Biklen, 2007). In this study semi-structured interviews were conducted with six high scoring students identified from the data collected on the MSELs. A deeper understanding of social variables was needed to add to the quantitative data related to a students' long-term application of environmental literacy skills. Questions related to family, culture, and community were written by the researcher. They were structured yet open-ended and allowed for further investigation of the topic. The interviews were audio-recorded, transcribed, and coded. An audit of the qualitative data included all documents used in the development of the codes and coding categories. A description of each code, the frequency of the code, and the development criteria for the themes were provided. HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013) reports were used to analyze the results and provide support for researcher conclusions. An auditor was used to examine coding terms, coding patterns, and themes in efforts to address qualitative trustworthiness and assure reliability of the findings.

Data Analysis

Data for this study were researcher scored and entered using multiple computer programs. A spreadsheet was used to enter data later used in SPSS v .18 (SPSS Inc., 2009) for

statistical analysis. Demographic information as well as permission to participate was also charted for verification purposes. Interviews were audio recorded using a digital voice recorder and transcribed into a word processing program for coding and entry into HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013). HyperRESEARCH is computer software that allows the researcher to identify and describe codes within the transcript text as well as generate reports related to frequency and code reference elements.

Research Question One

A typical causal comparative study includes multiple dependent variables (Gall et al., 2007). A multivariate analysis of variance (MANOVA) was used to determine whether there were statistically significant differences between the independent variable (group—two levels) and the dependent variables related to domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior). Groups consisted of students at the sixth, seventh, and eighth grade levels who had participated in a school with an embedded environmental focus at the elementary school level and those who had not participated in a school with an embedded environmental focus. Efforts to reduce the risk of a Type 1 error included a Bonferroni adjustment. This adjustment was calculated by dividing the standard alpha level of .05 by the number of research questions utilizing quantitative analyses (.05/2). A *p* value of .025 was utilized in the statistical analysis. This Bonferroni adjustment led to a more rigorous alpha level but it eliminated the problem of an inflated Type 1 risk (Huck, 2008).

Research Question Two

Multiple linear regression is used to check for a correlation between a criterion variable and two or more predictor variables (Gall et al., 2007). A multiple linear regression was used to analyze Research Question Two. In this question, the predictor variables were the number of

years that students in Group One attended the school with an embedded environmental education focus and the number of years post attendance of that school. The criterion variable was the total environmental literacy score. Multiple linear regression was chosen as it provided estimates of magnitude and statistical significance of the relationships between the variables of number of years in the program and number of years away from the program.

Research Question Three

Question Three utilized qualitative methodology to investigate the role of social variables for high scoring students on the MSELs. Semi-structured interviews were conducted with six students representing both groups. Initially, students with the highest overall environmental literacy scores were sorted by group from the data spreadsheet. Three students from Group One and three from Group Two were invited to interview. All students invited received parental permission to participate eliminating the need to secure alternate students. Semi-structured interviews were conducted in the student's school at a location assigned by the school principal. Conversations were audio recorded with permission from the student. The recordings were loaded to a computer and transcribed. The documents were hand coded by the researcher and then re-coded utilizing HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013). Codes and coding categories were analyzed and themes developed. An auditor and an audit trail were utilized to address qualitative trustworthiness.

Data Collection Procedures and Timeline

The following procedures were followed according to the proposed timeline.

1. Submitted proposal for Institutional Review Board (IRB) approval (November 30, 2012). Received approval from IRB on December 18, 2012.

2. Requested approval and received permission from the superintendent to conduct the study in the district (January 2013).
3. Requested and received consent from the building principals to conduct the research at the sites (February 2013).
4. Students in both groups received information about the study and were invited to participate. Two sessions were held at each middle school to accommodate number of students as well as students that may have been absent for the initial presentation (March 2013).
5. Each student was provided a packet containing a letter from the principal (middle school one only), a cover letter to the parents and a consent form. Researcher contact information was provided for parents who wanted additional information (March 2013).
6. Student assent forms were distributed and collected for students participating in the study (April 2013).
7. The SAAS-R and the MSELs were administered at each respective middle school (April 2013).
8. Data were entered and analyzed for the SAAS-R and the MSELs (April 2013).
9. Parent permission forms, student assent documents and interview information were distributed to students invited to interview (May 2013).
10. Interviews were conducted at each of the respective middle schools (June 2013).
11. Final data analysis and peer review (July 2013- May 2014).

Limitations of the Study

Internal Validity

In causal comparative research, a dominant limitation is the lack of control over threats to internal validity. A subject characteristics threat addresses the possibility that the groups were not equivalent on one or more variables other than the identified group variable. In this study, all of the students were administered the SAAS-R in order to control for the subject characteristic threat. The possibility that a student's attitude toward school had an effect on the overall school experience existed. The data collected from the SAAS-R allowed the researcher to look more closely at potential differences that existed between the groups in isolation from the variable under study.

A secondary area to address was that of instrumentation. The MSELs is designed for middle school students and states a readability level appropriate for sixth, seventh, and eighth grade students. The research sample consisted of students from varying grade levels, unknown academic levels, and some not proficient in English, therefore the researcher eliminated readability threats by reading the survey to all of the students. The MSELs also uses both positively and negatively worded questions, which can sometimes create confusion for students with reading difficulties. The response time for each question was monitored to give students additional time if needed to answer. The survey is designed to be administered in a typical middle school class time allotment, however it was noted that the 75 components took approximately 15 minutes longer. Reading the instrument and circulating the testing area during administration mitigated any attention and focus issues that may have existed. The ability for the researcher to read each question clearly and slowly minimized concerns that student's responses were affected by an inability to read the questions.

External Validity

Population validity is defined as “the extent to which the results of an experiment can be generalized from the sample that was studied to a specified, larger group” (Gall et al., 2007, p. 389). Causal comparative studies often will begin with a difference between two groups and then look for possible cause for or consequences of that difference (Fraenkel & Wallen, 2006). The students in Group One of this study were a sample of convenience that once attended a school with an embedded environmental education focus at the elementary school level. Students’ experiences within that environment varied based on factors of time, personal investment, and interest. The inability to manipulate the independent variable and the lack of randomization inhibited the capacity to establish cause and effect relationships with confidence. Elements of programming relating to curriculum and exposure were controlled, however the findings of this study cannot be generalized to the larger group. It was intended to be an investigation and as such was exploratory in nature.

Ecological validity is defined as “the extent to which the results of an experiment can be generalized from the set of environmental conditions created by the researcher to different environmental conditions” (Gall, et al., 2007, p. 390). The Group One students had attended a school with an embedded environmental education focus that was part of the overall climate and culture of the school. While the program was designed for all students enrolled in the school, each student was not enrolled for the exact same period of time. Varying degrees of exposure to the program could not be controlled by the researcher adding another element to the makeup of the students in this group. Research Question Two examined these relationships associated to time in an effort to account for these differences. These variations would make it difficult to replicate this study in another setting; therefore ecological validity threats remained high. The

inability to manipulate the independent variable and the lack of randomization inhibited the study from establishing cause and effect relationships with a high degree of confidence, however the goal of the work was to add to current research for purposes of program planning and was not meant to determine causation.

Qualitative Trustworthiness

The purpose of this research was to investigate the effects of school programming on the four domains of environmental literacy as well as to deepen an understanding of the factors related to social variables. During the qualitative phase of the study, six interviews were conducted with the highest scoring students on the MSELs. The semi-structured interviews were recorded and transcribed. Credibility was established through member checking. Krefting (1991) reports that member checks are more difficult for informants during later stages of the research process rather than initially when descriptive data are reviewed. Due to the age of the students and the end of the school year approaching, the researcher chose to review the conversations with each interviewee both during the interview by restating responses to check for accuracy and immediately following the interview through discussion. Notes taken during the interview served as the basis for confirming what each student had stated during the conversation. Discrepant items were clarified immediately to maintain preciseness. This form of member checking ensured that the questions and responses were clear in the student's mind as well as the researcher's.

Transferability can depend on a researcher's orientation to qualitative research. Krefting (1991) states that if the assumption is made at the beginning of the study that the findings are descriptive in nature and unique to the perspective of the informant, then the transferability criterion may not be applicable. In this study, the researcher chose to address transferability

through the data rather than the subjects. The content of the interviews along with descriptive details of the behaviors of the informants during interviews were examined to address transferability. A rich description of the setting was also included to aid the reader in determining if the findings would be applicable to other situations.

Efforts to minimize a dependability threat in this study included a data code-recode procedure as well as a peer auditor. This code-recode procedure can increase the dependability of the findings (Krefting, 1991). During the analysis phase, the researcher coded a segment of the data and then waited two weeks to recode the same data after which the results were compared. An audit was conducted to validate the findings of this researcher and ensure the absence of researcher bias. An auditor with previous experience in qualitative research was selected. The auditor reviewed procedures utilized over the course of the study. Reports of initial and focused codes generated from the interview transcripts were submitted and examined by the auditor. The transcripts were also provided to the auditor for coding agreement. The auditor randomly selected five instances of data to code. The auditor was in complete agreement with how the data had been coded (see Appendix M).

Confirmability is the concept that the data can be confirmed by someone other than the researcher (Toma, 2006, p. 417). Researcher bias in this study remained high, as the school and school curricula of the students in Group One was very well known to the researcher. This threat was addressed using an audit trail. Guba (1981) described this strategy as a major technique in establishing confirmability. Records included in the audit were raw data (audio recordings, interview transcripts), data reconstruction (thematic categories, frequencies, code descriptions), and process notes (all information related to the collection and analysis of the data). The researcher also continuously checked and remained aware of personal biases by challenging

conclusions made at various points in the study. Members of the advisory committee utilized the data to critically review interpretations and conclusions made by the researcher.

Ethics Statement

Permission to participate in this study was secured from the University Institutional Review Board (IRB), the district's superintendent, the schools' principals as well as parents and students. All subjects were informed that participation was strictly voluntary. To assure confidentiality, each participant's data were coded using a numerical system. The data collected by the researcher were stored in a locked area away from any schools to further protect student privacy. All data were kept confidential until the conclusion of this study at which point it was destroyed. Aggregated data results were made available upon request.

CHAPTER FOUR: ANALYSIS OF DATA

The purpose of this study was to investigate the factors that influence students' long-term application of environmental literacy skills. Three research questions were addressed:

1. Are there significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level?
 - a. Non-directional hypothesis: There will be significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level.
2. To what extent and in what manner do the variables of time (years attending a school with an embedded environmental education focus and years of post completion attendance of a school with an embedded environmental education focus) explain the variation in the environmental literacy score?
 - a. Directional hypothesis: The variable number of years attending a school with an embedded environmental education focus at the elementary school level will significantly explain the environmental literacy score while

number of years post completion of attendance in a school with an embedded environmental education focus at the elementary school level will not.

3. What role in the development of environmental literacy skills is played by social variables related to family, culture, and community?

The results of the research and its findings are presented in Chapter Four in two major sections: descriptive statistics and data analysis. Descriptive statistics contain subsections of code and value cleaning, analysis of outliers, and analysis of groups. Quantitative findings related to Research Questions One and Two were examined in two subsections: data analysis and question summary. Qualitative findings related to Research Question Three are discussed using subsections of data analysis (qualitative themes) and question summary. A final review of the data is presented in the chapter summary.

Descriptive Statistics

Code and Value Cleaning

Upon completion of the data collection, a visual review and cleaning process occurred. The data recorded in a spreadsheet were imported into SPSS v .18 (SPSS Inc., 2009) and the data set created. The research sample consisted of 225 students and descriptive statistics were generated using the procedures identified by Meyers, Gamst, and Guarino (2006). Case identification was established using the code/test number assignment generated during the study. All variables were screened for possible code and statistical assumption violations as well as for missing values and outliers. The 225 middle school students were screened on four continuous variables (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). No missing values were found in the analysis.

Analysis of Outliers

An analysis of univariate outliers was conducted as the next step in the cleaning process. Box plots can serve as a visual method to determine outliers within a data set (Meyers et al., 2006). An examination of the box plots for each of the four domains per group occurred. Outliers were present in two of the four domains of environmental literacy (see Figure 3). The domain of environmental affect contained one outlier in Group One and three outliers in Group Two. Group One contained one outlier that was more than three standard deviations below the mean. Group Two contained two lower extreme values more than three standard deviations below the mean and one upper extreme value more than three standard deviations above the mean. In the knowledge domain, one outlier in Group One with an extreme score more than three standard deviations below the mean was identified. Group Two contained two extreme values exceeding three standard deviations from the mean. An analysis of the domains of cognitive skills and environmental behaviors did not identify any outliers for Group One (students who have attended a school with an embedded environmental education focus at the elementary school level) and Group Two (students who have not attended a school with an embedded environmental education focus at the elementary school level). Outliers must be addressed when using a MANOVA procedure as Meyers et al. (2006) warn that failure to exclude them could inflate Type I and Type II error rates. The researcher was cautious in the deletion of outliers from the lower and higher ranges of scores.

Descriptive statistics were conducted using multiple combinations of outlier deletions to determine the most accurate data set to be used in the remaining data analyses. Seven univariate outliers (five in environmental affect and two in ecological knowledge) were more than three standard deviations from the mean in the domain and removed. Deletion of the seven outliers

revealed an additional two outliers in the environmental knowledge domain for Group One, however these values were less than three standard deviations from the mean and as such were included in the data set (see Figure 3). The final sample size was 218 students with 104 students in Group One and 114 students in Group Two. These numbers exceeded the sample size requirements of 20 cases per cell for each of the dependent variables across the independent variable (two levels) discussed by Meyers et al., (2006).

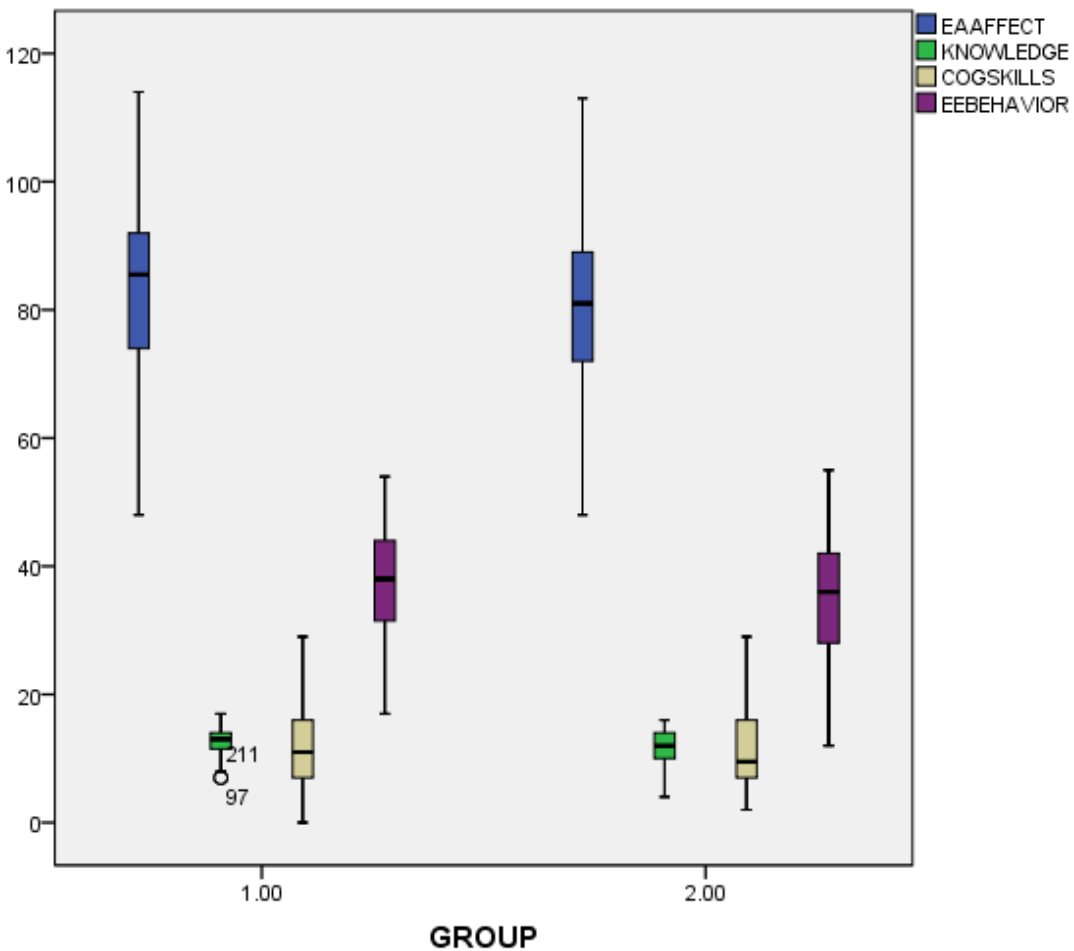


Figure 3. Box plots for each of the four domains of Environmental Literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of the MSELs for Group One and Group Two.

The descriptive statistics (see Table 4) represent the MSELS data set that was used for statistical analysis after the initial data screening process. The means and standard deviations of the domains of environmental literacy are within a reasonable range for the instrument. Skewness and kurtosis values of each continuous variable for each group were between -1.0 and +1.0 indicating a normal distribution of the data.

Table 4

Descriptive Statistics for Domains of Environmental Literacy on the MSELS for Group One and Group Two

	Group	Mean	Std. Deviation	Skewness	Kurtosis
Environmental Affect	1	82.72	13.99	-.450	-.143
	2	80.50	12.56	-.071	-.082
Ecological Knowledge	1	12.60	2.35	-.384	-.102
	2	11.59	2.50	-.378	-.163
Cognitive Skills	1	12.18	6.30	.666	.003
	2	11.52	6.57	.782	-.110
Environmental Behaviors	1	37.62	8.72	-.312	-.531
	2	35.84	9.26	-.082	-.484

Note. Group One $n=104$; Group Two $n=114$

Analysis of the Groups

A causal comparative research design contains a subject characteristic threat that can raise question with the composition of the groups prior to any analysis of new data. In this study, the researcher administered the School Attitude Assessment Survey-Revised SAAS-R (McCoach, 2002) prior to administration of the Middle School Environmental Literacy Survey

MSELS (Hungerford et al., 2009) to address this threat. The SAAS-R is a survey instrument designed to collect data related to academic self-perception, attitudes toward teachers, attitudes toward school, goal valuation, and motivation. Each student in the study was given the SAAS-R prior to the administration of the MSELS in the same setting and on the same day. The scoring information provided by the author identified specific questions related to each of the subscales in which mean scores were calculated. Assumptions of normality, independence of groups, and homogeneity of variance were met. Data were collected and analyzed for 218 students to describe characteristics of the groups relative to attitudes towards schools. Group One contained 104 students and Group Two contained 114 students. An independent-samples *t* test was conducted for each of the five subscale scores of the SAAS-R (academic self perception, attitude towards teachers, attitude towards school, goal valuation, and motivation scores) for Group One and Group Two (see Table 5). These comparisons found that there were no significant differences between the groups in four of the five areas. The independent-samples *t* test which compared the mean academic self perception score of Group One ($M = 5.58, SD = .94$) with those of Group Two ($M = 5.13, SD = 1.17$) indicated statistical significance $t(212.30) = 3.13, p < .05$ in this subscale.

Table 5

Descriptive Statistics of the SAAS-R for Group One and Group Two

	Group	N	Mean	Std. Deviation	Sig. (2- tailed)
Academic Self Perception	1	104	5.58	.940	.039
	2	114	5.13	1.17	
Attitudes Towards Teachers	1	104	4.74	1.39	.139
	2	114	5.0	1.14	
Attitudes Towards School	1	104	4.46	1.59	.103
	2	114	4.83	1.65	
Goal Valuation	1	104	6.57	.597	.246
	2	114	6.45	.945	
Motivation	1	104	5.42	1.03	.183
	2	114	5.23	1.09	

Data Analysis

Research Question One

Research Question One: Are there significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level?

Non-directional hypothesis. There will be significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level.

Data analysis. Quantitative data analysis in this study utilized the results of the *Middle School Environmental Literacy Survey* (Hungerford et al., 2009). This instrument produced scores related to four domains of environmental literacy: environmental affect, ecological knowledge, cognitive skills, and environmental behavior as well as a total environmental literacy score. The sample included 218 students in sixth, seventh, and eighth grade attending two district middle schools. The examiner and one assistant administered the assessment to all students by grade level. The MSELs was read to all students eliminating concerns related to reading level discrepancies. Each participant was assigned a code/test number, which maintained both confidentiality and accuracy of the data. Environmental domain scores were utilized for statistical analysis of Question One as the dependent variables and group with two levels (middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level) as the independent variable. A MANOVA was used to determine if there were any significant differences in the four domain scores between students in Group One and students in Group Two. Statistical analysis using MANOVA was appropriate for use in this research question as it allowed the researcher the ability to examine relationships between the dependent variables at

each of the two levels of the independent variable as well as the ability to identify the dependent variables that provided the most group differences (Meyers, et al., 2006). Data collected from the MSELs were utilized in Research Questions One and Two. In an effort to reduce the possibility of a Type 1 error, a Bonferoni correction was used. The adjustment was calculated by dividing the standard alpha level of .05 by the number of research questions utilizing quantitative analyses (.05/2). A p value of .025 was utilized in the statistical analysis.

Statistical assumptions and limitations must be addressed before proceeding with MANOVA analyses. Outliers and missing values concerns have been addressed through the initial review of the data discussed earlier in this chapter. Sample size is also a factor for a MANOVA procedure. Meyers et al., (2006) report that some authors suggest a minimum sample size of 20 cases per cell. The final data set consisted of 218 students. This exceeded the 20 cases per cell and 80 cases per group minimum needed. Independence of the participants was established by grouping procedures. Students in Group One had attended a single school in the district while students in Group Two had attended various elementary schools within the district. This distinction separated the groups maintaining independence from each other. Bartlett's Test of sphericity was statistically significant ($p < .001$), which indicated that there existed sufficient correlation between the dependent variables to proceed with further analysis. When assessing for equivalence-of variance-covariance matrices, the Box's M test is a standard measure used (Meyers et al., 2006). Variances and covariance are within an acceptable range for each of the variables if the significance value is greater than .001. The Box's M value (Box's M = 11.840, $p > .313$) was not significant, meeting the assumption of equal variances. Statistical approaches to assess univariate normality often include measures of skewness and kurtosis. All skewness

and kurtosis values of the dependent variables for both Group One and Group Two were within the -1.0 and + 1.0 range which indicated normality of the distribution of the data set (see Table 6).

A Hotelling's T^2 or two group between-subjects multivariate analysis of variance (MANOVA) was conducted to determine the effect of group (Group One and Group Two) on the four dependent variables: environmental affect, ecological knowledge, cognitive skills, and environmental behaviors. Wilks Lambda was used as the primary multivariate test criterion. The composite dependent variate was not significantly affected by group (Wilks' $\lambda = .955$, $F(4, 213) = 2.529$, $p = .042$, partial eta squared = .045, small). Despite the nonsignificant MANOVA F , the researcher proceeded with analysis of the F ratios for the ANOVAs performed on the individual domains of environmental literacy. In this case, the possibility of committing a Type 2 error lead to the researcher's decision to cautiously continue analysis as noted by Gall et al. (2007, p .322). Univariate ANOVAs were conducted on each dependent measure separately to determine whether significant differences existed between the groups. The more stringent p value of .025 was utilized in the analyses. Data supported that levels of the independent variable (group) significantly affected knowledge, $F(1, 216) = 9.538$, $p = .002$, partial eta squared = .042). Group One demonstrated higher levels of environmental knowledge ($M = 12.60$, $SD = 2.35$) than Group Two ($M = 11.58$, $SD = 2.49$). No statistically significant group effects were observed for environmental affect ($F(1, 216) = 1.526$, $p > .05$), cognitive skills ($F(1, 216) = .564$, $p > .05$), or environmental behaviors ($F(1, 216) = 2.132$, $p > .05$).

Table 6

Univariate ANOVA comparing Group One and Group Two for each variable

ANOVA						
	Sum of					Partial eta
Between Groups	Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Squared
Environmental Affect	268.311	1	268.311	1.5	.218	.007
Ecological Knowledge	56.366	1	56.366	9.5	.002	.042
Cognitive Skills	23.431	1	23.431	.56	.453	.003
Environmental Behaviors	172.875	1	172.875	2.1	.146	.010

Summary. Research Question One examined whether there were significant differences between Group One and Group Two on the four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). All students completed the School Attitude Assessment Survey- Revised (SAAS-R) as well as the Middle School Environmental Literacy Survey (MSELS). Descriptive statistics revealed seven outliers, which were removed. A MANOVA was performed with the final data set of 218 students. Despite the non-significant MANOVA *F*, the researcher proceeded with analysis of the ANOVAs in efforts to address Type 2 error concerns. Examination of the univariate ANOVA displayed that ecological knowledge was significantly affected by group (Group One and Group Two), $F(1, 216 = 9.538, p = .002, \text{partial eta squared} = .042)$. Students who participated in a

school with an embedded environmental focus at the elementary school level demonstrated higher levels of ecological knowledge than students who had not participated in a school with an embedded environmental focus at the elementary school level. No statistically significant group effects were observed for environmental affect, cognitive skills, and environmental behavior.

Research Question Two

Research Question Two: To what extent and in what manner do the variables of time (years attending a school with an embedded environmental education focus and years post completion attendance of a school with an embedded environmental education focus) explain the variation in the environmental literacy score?

Directional hypothesis: The variable number of years attending a school with an embedded environmental education focus at the elementary school level will significantly explain the environmental literacy score while number of years post completion of attendance in a school with an embedded environmental education focus at the elementary school level will not.

Data analysis. Multiple linear regression uses several variables to predict a value on a criterion variable (Meyers et al., 2006). Question Two utilized a standard regression method to examine the degree and manner in which the number of years that a student participated in a school with an embedded environmental focus and the number of years post completion of that school predicted a total environmental literacy score. Examining the correlations matrix allowed the researcher to examine not only the inter-relationship between the dependent and independent variables but also between the independent variables themselves. The correlations show the results of these data (see Table 7). Bivariate correlations of .90 or higher are indicative of multicollinearity and should be considered for removal (Meyers et al., 2006). The variable,

number of years in a school with an environmental focus, was minimally correlated ($r = .14$, $p > .05$) to total environmental literacy score and number of years post-completion of a school with an environmental literacy focus was also minimally correlated ($r = .08$, $p > .05$) to total environmental literacy scores. The correlation between the two predictor variables was $r = -.54$, $p < .001$) indicating a strong negative relationship. This is evidence that when one predictor variable value increased, the other predictor variable value decreased.

Table 7

Correlations between Number of Years in a School with an Environmental Focus and Number of Years Post Completion of a School with an Environmental Focus on Total Environmental Literacy Scores

	Number of Years in the School	Number of Years Post-completion
Total Environmental Literacy Score	$r = -.139$ $p = .079$	$r = .076$ $p = .221$

Prior to the regression analysis, data were screened for multivariate outliers. The Mahalanobis distance for each case was calculated and the chi square criterion was used to evaluate the distances. None of the values equaled or exceeded the chi-square criterion (13.816), indicating that there were no outliers warranting removal from the data set.

Issues of collinearity were examined using Tolerance values ($> .01$) and Variance Inflation Factor (VIF) values (< 10). Tolerance values for the predictor variable, years attending a school with an embedded environmental education focus were .709, VIF = 1.41 and the predictor variable, years post-completion attendance of a school with an embedded

environmental focus were .709, VIF = 1.41. Tolerance and VIF values were within normal bounds verifying that collinearity assumptions had been met.

A standard multiple linear regression procedure was conducted with the total environmental literacy score as the criterion variable and number of years attending a school with an embedded environmental focus at the elementary school level and number of years post-completion of attendance in a school with an embedded environmental literacy focus at the elementary school level as the predictor variables. Regression results are summarized (see Table 8 and Table 9). Multiple *R* for regression was not significant $F(2,101) = 1.0, p = .372, R^2 < .001$.

Table 8

Regression Analysis ANOVA for Years in a School with an Embedded Environmental Education Focus and Years Post-completion of a School with an Embedded Environmental Education Focus as Predictors of Total Environmental Literacy Scores

		ANOVA				
		Sum of				
Model		Squares	<i>Df</i>	Mean Square	<i>F</i>	Sig.
1	Regression	1106.97	2	553.48	1.0	.372
	Residual	55911.15	101	553.58		
	Total	57018.16	103			

Table 9

Regression Analysis for Years in a School with an Embedded Environmental Education Focus and Years Post-completion of a School with an Embedded Environmental Education Focus as Predictors of Total Environmental Literacy Scores

	Unstandardized Coefficients		Standardized Coefficients		
	<i>B</i>	Std. Error	<i>Beta</i>	<i>t</i>	Sig.
Constant	154.516	12.823		12.049	.000
Years Participating in the School	-2.117	1.790	-.138	-1.183	.240
Years Post-Completion of the School	.046	3.419	.002	.013	.989

Note: $R^2 = .019$

The data did not support the directional hypothesis that the number of years that a student participated in a school with an environmental focus would be a significant predictor of total environmental literacy score. Neither of the two independent variables were significant predictors of total environmental literacy scores.

Summary. Research Question Two was used to explore if the number of years that a student attended a school with an embedded environmental focus and the number of years post-completion of a school with an embedded environmental focus were significant predictors of total environmental literacy scores. The correlations matrix revealed that both predictor variables were minimally correlated to total environmental literacy scores and a strong negative relationship existed between the two predictor variables. No multivariate outliers were identified

and collinearity assumptions were met. Standard multiple linear regression was conducted with the total environmental literacy score as the criterion variable and number of years attending a school with an embedded environmental focus at the elementary school level and number of years post-completion of attendance of a school with an embedded environmental focus at the elementary school level as the predictor variables. Regression results were not significant $F(2,101) = 1.0, p = .372, R^2 < .001$ indicating that neither of the two independent variables were significant predictors of total environmental literacy scores.

Research Question Three

Research Question Three: What role in the development of environmental literacy skills is played by social variables related to family, culture, and community?

Data Analysis. The explanatory sequential mixed methods research design lends itself to an emergent approach where the second phase is designed to elaborate on what is learned in the quantitative phase (Creswell & Plano Clark, 2011). In this study, the results of quantitative analysis of the MSELs were used as the basis for the qualitative interviews that were addressed in Research Question Three. The data related to total environmental literacy scores were used as the basis for the selection of the students interviewed in this second phase. A purposeful sampling method was used to identify three students from Group One and three students from Group Two with the highest total environmental literacy scores. Total environmental literacy scores are computed by adding the point value achieved for each of the four domain scores (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors) of the MSELs. The spreadsheet developed to record the raw data included a formula, which calculated the total environmental literacy scores for each participant. The final data set of 218 students used in the quantitative data analysis for Research Questions One and Two was

examined. Students were sorted by group and descending order of total environmental literacy score. Total environmental literacy scores on the MSELS have a maximum 231-point value. The six students invited to interview received total environmental literacy scores ranging from 187 to 199 (see Table 10). The researcher contacted and obtained parental permission from each of the students.

Table 10

Environmental Literacy Scores for Highest Scoring Students

Student	Environmental Literacy Score
Student One	189
Student Two	199
Student Three	188
Student Four	190
Student Five	190
Student Six	187

The group consisted of two males and one female from Group One and two females and one male from Group Two. Group One contained one student from each grade level (6, 7, and 8) while Group Two students were all eighth graders. Dates and locations for the interviews were obtained from the building principals. The researcher met with each student at his or her school in a location designated by the school principal as appropriate during a one week time period. Students were informed that their absence from class was excused and the time of the interview was determined to be the most appropriate by the teachers, student, and examiner. Each student was aware of the purpose of the interview and all efforts to create a relaxed atmosphere were

made. It was noted that each student assented to the interview and expressed positive feelings about being asked to participate. Student interview times ranged from 28 to 40 minutes and were recorded using a digital voice recorder. The recordings were transcribed for analysis (see Appendix M).

A generic qualitative study design was utilized in the data collection for Research Question Three and was described in detail in chapter three. This was best suited for examining other factors related to environmental literacy among subjects. Generic qualitative studies are those that contain characteristics of different qualitative methodologies but do not focus the study on any one approach (Caelli et al., 2003). This design can be used when the topic under study warrants a better understanding of an experience or an event. This design was appropriate as the goal of Research Question Three was to investigate additional social variables related to the development of environmental literacy.

The questions utilized in the semi-structured interviews were developed after examination of the quantitative data in the study as well as from information collected during the review of the literature. Of particular interest were the social variables that might present as factors related to overall environmental literacy. In this study, environmental literacy scores were obtained from the MSELS. While the questions were straight forward, they were designed to be open-ended allowing the researcher to clarify related areas.

Analysis of the interview data by the researcher included listening to the audiotapes, reading the interview transcripts, hand coding, and the use of a qualitative research computer package. Initially the line-by-line coding of the transcripts revealed 44 codes. Several codes were consolidated into coding categories and resulted in 26 total codes. HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013) was utilized in the final data analysis. HyperRESEARCH

allows the researcher to identify and describe codes within the transcript text as well as generate reports related to frequency and code reference elements. Samples of codes with assigned text (see Table 11) and a listing of all codes and their descriptions are provided (see Appendix O).

Table 11

Qualitative Codes and Samples from Interview Transcripts

Codes		
Environmental Behaviors	Elementary School Experiences	Environmental Issues and Knowledge
“I also recycle”	“We did that whole composting and that was really fun and the garden”	“We’re cutting down the rain forest”
“We take three cars down every time and we all bunch into one car and we go “	“I already know that we do composting”	“Because if we can get a nuclear fusion reactor working that could like power the entire world cleanly”
“Walk if you can”	“Earth Day like every year like we would make some stuff on Earth Day”	“I think that a lot of people waste things like they consume and consume”

Using the imported transcripts, codes were applied to sections of the text and saved as individual cases. A frequency report was generated after coding the six interview transcripts. Analysis of the coding categories occurred within and between cases. Bogdan and Biklen (2007) described a theme as a concept that emerges from the data. Three dominant themes emerged

from this examination. The first theme is connected to the influence and activities associated to family and extended family. Code titles included in this theme were extended family influence, family activities and experience, family practice and positive family influence. The codes, descriptions, and frequencies for the six cases are presented (see Table 12).

Table 12

Codes, Code Descriptions and Frequencies Related to Theme One

Influence and Activities of Family and Extended Family			
Code	Code Description	Case	Frequency
Extended Family Influence /Background	This code was used when students referenced extended family or background information about their parents.	1	0
		2	0
		3	4
		4	3
		5	2
		6	3
Family Activities and Experiences	This category was used when family was explicitly referred to in the verbiage. It consolidated experiences and activities but cited them only when they were specifically mentioned or implied within the family context. This included extended family.	1	8
		2	2
		3	8
		4	4
		5	2
		6	4

Table 12 (*continued*)

Code	Code Description	Case	Frequency
Family Practice	This code was used to identify discussion around what happened within the family as it related to environmental practice.	1	0
		2	4
		3	1
		4	4
		5	1
		6	1
Positive Family Influence	This code was used when reference was made to how family had shaped or helped them in a positive way.	1	3
		2	5
		3	4
		4	6
		5	4
		6	3

Influence and activities of family and extended family. During the interviews, each of the students spoke at length about the influence of their families as it related to environmental concerns and practices. The question posed to the students by the researcher was “Would you be willing to share information about your family and whether you feel they have shaped any of your views about the environment?” Each of the six students readily spoke about activities they had done and continued to do with their families. As this was one of the social variables being examined, the researcher continued to ask probing questions so as to better understand the student responses. As the interviews continued, four of the students spoke of extended family

influences including grandparents, uncles, and cousins and all six included environmental family practices. Some examples include:

Student 1: “I remember one year we went camping with my grandma and like this big place that was meant specifically for camping and exploring and stuff”

Student 2: “ I feel like my whole entire family is involved. I feel like my mom strives for it like the most.”

Student 3: “ Since me and my dad are hunters like we don’t like to see like the land get destroyed so we like really care about it and like go and try to help out”

Student 4: “My family like we’ve always been kind of like an outdoorsy family like we’re always outside.”

Student 5: “Both my parents help me with like food chain kind of stuff.”

Student 6: “When I was in third grade my grandmother started composting and we helped a lot with that so that was a big thing for me.”

Examination of the code frequencies from the interview data supported that family experiences and practices as well as family influence and behavior were factors in total environmental literacy scores. Students were willing to speak about their families and openly explained and elaborated responses to the researcher. It did not appear that any of the six students were reluctant to speak about their experiences.

Organizational influence. The second theme of organizational influence emerged from the coding of participation and involvement in organizations and clubs within the transcripts. The question asked in this area was “Are there any groups or clubs that you participate in?” Coding in this area consisted of participation in an organization and organizational activities. The frequency total for participation in an organization was 15 and 13 for participation in

organizational activities. The code, code descriptions and frequency amounts for each of the six students for organizational influence are presented (see Table 13).

Table 13

Codes, Code Descriptions and Frequencies Related to Theme Two

Organizational Influence			
Code	Code Description	Case	Frequency
Participation in an Organization	This code identified when a student made reference to participating in some organization or club.	1	0
		2	1
		3	1
		4	1
		5	8
		6	4
Organizational Activities	This code was used when a student referenced an activity in which they participated because of their involvement in an organization or club.	1	0
		2	2
		3	1
		4	0
		5	6
		6	4

A review of the frequency data for codes related to belonging and participation in an organization or club revealed that five of the six students participated in an organization or club. Four of those five participated in environmental activities as part of being a member of that organization. Four of the students indicated that activities related to the organization were

related to protecting or caring for the environment. The purpose of Research Question Three was for the researcher to learn more about what in the lives of the students aside from schooling might be effecting their knowledge and behaviors with respect to the environment. Student responses supported that being part of an organization and participating in activities with that organization were part of their lives. It was relevant and present for five of the six students interviewed. Student dialogue provides insight into the codes connected with theme two.

Student 2: "I took Girl Scouts which also made me like very aware of everything!"

Student 3: "There's Boy Scouts" "with the Scouts like each month we go and camp out and sometimes we just like go to a summer camp for like a whole week and they explain the importance of nature and other things"

Student 4: "For my sports teams"

Student 5: "Boy Scouts" "I took Environmental Science Merit Badge so that kind of acknowledged me."

Student 6: "I'm in Girl Scouts" "We used to go camping a lot so we would always properly put out our campfire and we would always have to pick up everything because we needed to leave it nice for the next troop."

The most reported organizations that the students spoke of were the Girl Scouts and Boy Scouts. Official websites for both the Girl Scouts of America and Boy Scouts of America described programs for youth that were based on values, character building, and citizenship ("About the BSA," 2014). The Girl Scout website clearly stated goals that included improving neighborhoods and protecting the planet ("Who We Are," 2014). As these are the organizations cited in the interviews, a relationship may exist between environmental literacy and participation particularly in these two organizations.

Personal connections, feelings, and friends. Personal connections, feelings, and friends emerged as the third theme. Codes utilized in the development of this theme were values/beliefs/feelings, personal environmental connection, and friends that share views/practice. The values/beliefs/feelings code had a frequency total of 23 and friends that share views/practice had a frequency value of 15. Personal environmental connection totaled four. The code, code description, and frequency totals for each student in the three code areas for personal connection, feeling, and friends are presented (see Table 14).

Table 14

Codes, Code Descriptions and Frequencies Related to Theme Three

Personal Connections, Feelings, and Friends			
Code	Code Description	Case	Frequency
Values/Beliefs/Feelings	This code was used when a student talked about a behavior that demonstrated an underlying value or belief system. Those recognized by the standard population.	1	0
		2	6
		3	5
		4	1
		5	3
		6	8
Personal Environmental Connection and Commitment	This code was used if a student talked about how the environment connected them on a deeper more personal level and also when a student identified an aspect of personal commitment to a situation related to environmental issues.	1	4
		2	0
		3	2
		4	1
		5	0
		6	0
Friends That Share Views/Practice	This code was used to record friendships where reference was made specifically to how those relationships existed with regard to common views on the environment.	1	1
		2	5
		3	3
		4	1
		5	2
		6	3

Researcher questions asked were, “When you think of your friends, would you say they share similar views? Can you tell me more? What kinds of things do you do with friends that you might consider to be environmentally friendly?” All six students indicated that their friends shared similar views related to what they valued and that many of their friend’s interests were also aligned to their environmental values. Embedded in the conversations were the underlying values and beliefs, which they expressed through personal connections to the topic. Five of the six students interviewed articulated their feelings and three of the six expressed personal commitment. Collectively, the student responses supported that an underlying value and belief system, supported by interests and activities they share with friends may assist in the development of overall environmental literacy. Student responses corroborating this theory are contained here.

Student 1: “We used to always go there the huge fields was like one of the very few places I could actually like get away from it all and stuff.”

Student 2: “I feel that if they think they should do something about it they should do it. Like they shouldn’t just sit around and wait for somebody else to do it they should...they could be that one person that makes a huge difference in how our future world could be.”

Student 3: “I tell them not to like just go messing around or like breaking things in nature because it’s important”

Student 4: “So like that’s a responsibility we kind of take in the outdoors.”

Student 5: “I don’t feel like it’s because of their beliefs it’s because of their choices and that led to their beliefs.”

Student 6: “If your friends are environmentally conscious which I think most of mine are around me anyway, then if you’re hanging out with people who do things like go hiking or value the environment then you’re more likely to feel the same way.”

Summary. Research Question Three investigated the role of social variables in total environmental literacy scores. Semi-structured interviews were conducted with the six students whose total environmental scores were the highest in the study. Interviews were between 28 and 40 minutes in duration and took place at the student’s school. All interviews were digitally recorded and transcribed. During the initial hand coding process, 44 codes were identified. Several codes were consolidated into coding categories and resulted in 26 total codes. HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013) was utilized in the final data analysis. Frequency totals were analyzed within and between student transcripts and three themes emerged; influence and activities of family and extended family; organizational influence; and personal connection, feelings, and friends. Overall, students described family relationships, and practices and activities that promoted environmental affect as being prominent in their lives. Being part of organizations that fostered character building and social responsibility were also significant. They reported that their own personal connections and pro-environmental feelings as well as associating with like-minded peers was important to them. Based on these interviews, it appears that family, organizational participation, and friendships where similar beliefs are present played a role in the overall environmental literacy scores.

Interpretation

Creswell and Plano Clark (2011) discussed the final stage of an explanatory sequential mixed methods design as interpretation. It is in this phase that the researcher “ interprets to what extent and in what ways the qualitative results explain and add insight into the quantitative

results and what overall is learned in response to the study's purpose" (p. 83). Results of the quantitative data in this study indicated that there were significant differences between the students in Group 1 (students who had attended a school with an embedded environmental education focus at the elementary school level) and the students in Group 2 (students who had not attended a school with an embedded environmental education focus at the elementary school level in the domain of ecological knowledge). Additionally, the quantitative data showed that time (years attending a school with an embedded environmental education focus and years of post completion attendance of a school with an embedded environmental education focus) was not a significant predictor of the total environmental literacy score. The qualitative data were used to further explain whether social variables may also have had an impact in the development of environmental literacy. The total environmental literacy scores were used to identify the students who participated in the semi-structured interviews. After analysis of the data, three themes emerged. These three themes of influence and activities of family and extended family; organizational influence; and personal connections, feelings, and friends may have been additional variables which impacted the development of environmental literacy. The purpose of this study was to investigate the factors that influence students' long term application of environmental literacy skills. The findings from both the quantitative and qualitative phases of the study indicated that schools could be effective in the development of ecological knowledge and that variables related to family, organizational participation and personal affect toward the environment are also important in the development of environmental literacy.

Chapter Summary

The analyses presented in this chapter addressed the factors that influence students' long-term application of environmental literacy skills through the investigation of three research

questions. Research Question One examined whether there were significant differences between Group One and Group Two on the four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). After the removal of seven outliers, the final data set included 218 students. A MANOVA was performed with no statistical significance at the .025 level. The researcher proceeded with analysis of the F ratios for the ANOVAs performed on the individual domains of environmental literacy addressing concerns of committing a Type 2 error. Univariate ANOVA analysis revealed that ecological knowledge was significantly affected by group (Group One and Group Two, $F(1, 216) = 9.538$, $p = .002$, partial eta squared = .042). Students who participated in a school with an embedded environmental focus at the elementary school level demonstrated higher levels of ecological knowledge than students who had not participated in a school with an embedded environmental focus at the elementary school level. No statistically significant group effects were observed for environmental affect, cognitive skills, and environmental behaviors.

Research Question Two was used to explore if the number of years that a student attended a school with an embedded environmental focus and the number of years post-completion of a school with an embedded environmental focus were significant predictors of total environmental literacy scores. Standard multiple linear regression was conducted with the total environmental literacy score as the criterion variable and number of years attending a school with an embedded environmental focus at the elementary school level and number of years post-completion of attendance of a school with an embedded environmental focus at the elementary school level as the predictor variables. Regression results were not significant $F(2,101) = 1.0$, $p = .372$, $R^2 < .001$ indicating that neither of the two independent variables was a significant predictor of total environmental literacy scores.

Research Question Three investigated the role of social variables in total environmental literacy scores. Semi-structured interviews were conducted with six students whose total environmental scores were the highest in the study. Frequency totals were analyzed within and between student transcripts and three themes emerged. The first theme related to the influence and activities of family and extended family. Students described family relationships, practices, and activities that promoted environmental affect as prominent in their lives. Organizational influence emerged as the second theme. The students expressed that they were part of organizations such as Girl Scouts or Boy Scouts, which fostered character building and social responsibility. They described participating in activities such as camping, community service, and merit badge work while they were members of the group. The final theme was that of personal connection, feelings, and friends. All of the students were able to express a personal connection to a greater good. They acknowledged that their friends had similar interests and many also participated in the same organizations. It appeared that these students chose to be with like-minded peers. The data from these interviews suggested that family influence, organizational participation, and friendships where similar beliefs were present played a role in the development of overall environmental literacy. The implications of the findings of these three research questions will be discussed in Chapter Five.

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Growing concern exists about whether or not Americans are prepared to deal with current and future environmental issues. A national report card on environmental knowledge, attitudes, and behaviors found that Americans are unprepared for our environmental future and will need to become more knowledgeable of the issues to help play a role in solving the problems (National Environmental Education & Training Foundation and Roper/Starch Worldwide, 1999). Schools are commissioned to develop environmental citizenship, yet environmental education has still not attained core curriculum status. This study was conducted to investigate the factors that influence students' long-term application of environmental literacy skills.

This chapter contains five sections: Summary of the Study and Findings, Relationships Between Findings and the Literature, Limitations of the Study, Implications for Education, and Recommendations for Future Research. The Summary of the Study and Findings section provides an overview of the design, analyses, and outcomes of the research questions. The Relationships Between Findings and the Literature section compares the findings of this study as related to the review of the theory and literature contained in Chapter Two. Limitations of the study are discussed in the third section of the chapter. The Implications for Education section reflects on the findings of the study as they relate to the field of environmental education. The final section, Recommendations for Future Research, provides suggestions for additional research in the field.

Summary of the Study and Findings

This study investigated the following three research questions:

1. Are there significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental

- behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level?
- a. Non-directional hypothesis: There will be significant differences in the domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level.
2. To what extent and in what manner do the variables of time (years attending a school with an embedded environmental education focus and years of post-completion attendance of a school with an embedded environmental education focus) explain the variation in the environmental literacy score?
- a. Directional hypothesis: The variable number of years attending a school with an embedded environmental education focus at the elementary school level will significantly explain the environmental literacy score while number of years post-completion of attendance in a school with an embedded environmental education focus at the elementary school level will not.
3. What role in the development of environmental literacy skills is played by social variables related to family, culture, and community?

An explanatory sequential mixed methods research design with causal comparative and generic qualitative research components was used in this study. It was conducted in a large urban school district in New England. Subjects of the study were a sample of convenience attending the two middle schools (grades 6, 7, and 8) in the district. The initial sample size of 225 students was reduced to a final data set of 218 students after data cleaning procedures. Quantitative data were collected using the *Middle School Environmental Literacy Survey* MSELS (Hungerford et al., 2009), and the *School Attitude Assessment Survey-Revised* SAAS-R (McCoach, 2002). Qualitative data were collected through semi-structured interviews conducted with a purposeful sample of the six highest scoring students on the MSELS representing three students from each group (Group One and Group Two). Students were administered the MSELS and the SAAS-R in one sitting at their schools. All items of the MSELS were read to the students by the researcher to eliminate reading ability factors. The data were then collected, scored, and analyzed. A summary of findings for each of the research questions follows.

Research Question One

The first research question examined whether there were significant differences between Group One and Group Two on the four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). A directional hypothesis stated that there would be significant differences in the domains of environmental literacy between the two groups (Group One and Group 2). A subject characteristics threat exists in causal comparative research. In this study the SAAS-R was used to address this threat by providing a description of the students in the areas of academic self-perception, attitudes toward teachers, attitudes toward school, goal valuation, and motivation. Independent *t* tests were conducted for each of the five subscale scores for Group One and Group Two. These

comparisons found that there were no significant differences between the groups in four of the five areas. Statistical significance $t(212.30) = 3.13, p < .05$ was found between Group One and Group Two in the area of academic self-perception. A MANOVA with the final data set of 218 students was conducted to determine the effect of group (Group One and Group Two) on the four dependent variables: environmental affect, ecological knowledge, cognitive skills, and environmental behaviors. The composite dependent variate was not significantly affected by group (Wilks' $\lambda = .955, F(4, 213) = 2.529, p = .042$, partial eta squared = .045, small). Despite the nonsignificant MANOVA F , the researcher proceeded with analysis of the F ratios for the ANOVAs performed on the individual domains of environmental literacy. In this case, the possibility of committing a Type 2 error lead to the researcher's decision to cautiously continue analysis as noted by Gall et al. (2007, p.322). The more stringent p value of .025 was utilized in the analyses. Data supported that ecological knowledge was significantly affected by group (Group One and Group Two), $F(1, 216) = 9.538, p = .002$, partial eta squared = .042). Students who participated in a school with an embedded environmental focus at the elementary school level demonstrated higher levels of ecological knowledge. No statistically significant group effects were observed for environmental affect, cognitive skills, and environmental behaviors.

Research Question Two

Research Question Two explored whether the number of years that a student attended a school with an embedded environmental focus and the number of years post-completion of a school with an embedded environmental focus were significant predictors of total environmental literacy scores. The hypothesis stated that the number of years that a student participated in the school would significantly explain the environmental literacy score while the number of years post-completion of the school would not. Standard multiple linear regression was conducted

with the total environmental literacy score as the criterion variable and number of years attending a school with an embedded environmental focus at the elementary school level and number of years post-completion of a school with an embedded environmental focus at the elementary school level as the predictor variables. Regression results were not significant $F(2, 101) = 1.0$, $p = .372$, $R^2 < .001$ indicating that neither of the two independent variables were significant predictors of total environmental literacy scores.

Research Question Three

Research Question Three investigated the role of social variables as related to total environmental literacy scores. Semi-structured interviews were conducted with the six students whose total environmental literacy scores were the highest in the study and equally represented students from each group. All interviews were digitally recorded and transcribed. The initial hand coding process identified 44 codes, which were then consolidated into 26 coding categories. HyperRESEARCH v.3.5.2 (ResearchWare, Inc., 2013) was utilized in the final data analysis. Frequency totals were analyzed within and between transcripts and three themes emerged: influence and activities of family and extended family, organizational influence, and personal connection, feelings, and friends. Overall, students described family relationships as well as practices and activities that promoted environmental affect as prominent in their lives. Additionally, being part of organizations that fostered character building and social responsibility were routinely discussed. They also described their own personal connections and pro-environmental feelings as well as associating with like-minded peers as important to them. Based on these interviews, factors of family, organizational participation, and friendships where similar beliefs are present played a role in the student's overall environmental literacy scores

Findings and the Literature

The results of this study are largely supported by the review of the literature presented in Chapter Two. The literature as related to the research questions will be discussed. The elements of the school program information described in Chapter Three will be examined and compared to the research literature.

Research Question One and the Literature

Research Question One examined whether school program participation (embedded environmental focus) affected the four domains of environmental literacy. The independent variable in this question was group (Group One and Group Two). Many of the program elements are identified in the research literature. Hungerford and Volk (2005) noted that earlier theories of environmental education indicating a linear progression from knowledge, to attitudes, to environmental behaviors were unsupported by the research. They concluded that developing ecological knowledge did not cause long-lasting behavior change and that personal connections and ownership of environmental issues was a critical factor in changing behavior. The findings in this study indicated that students in Group One were statistically different from the students in Group Two students in the ecological knowledge domain but not in the domains of environmental affect, cognitive skills, and environmental behaviors. The development of ecological knowledge and sensitivity are considered entry-level variables and prerequisites to responsible citizenship behavior (Hungerford & Volk, 2005). The significant differences found between the groups supported that the school program experiences were effective in the development of the entry-level variables described by Hungerford and Volk.

The embedded environmental focus school programming experienced by students in Group One consisted of the development of environmental knowledge, practical hands-on and

interactive experiences, and a school climate that fostered care and respect for one another as well as the natural world. Mutisya and Barker (2011) suggested that primary school students needed to be nurtured into informed decision makers and that environmental education must go beyond knowledge awareness and include opportunities for students to take action. The students in Group One engaged in both school-wide and grade-level activities that gave practical experience to the knowledge learned in the classroom.

A major component to the embedded environmental focus school programming was the collective school-wide efforts made in school grounds and school garden achievements. Thorp and Townsend (2001) found that the school garden changed the culture of the school environment. It represented communal living between people and plants and was considered to be an investment in not only the curriculum experiences of students but in the development of a nurturing and safe school culture.

School events that promoted interactions with the outdoors were also incorporated into the embedded environmental focus school programming. Students participated in Nature's Classroom, a week-long outdoor classroom program. Smith-Sebasto and Obenchain (2008) investigated whether students' perceptions of a residential outdoor experience changed over time. They found that residential outdoor programs can have a lasting effect on a student's knowledge and interest in environmental sciences provided they are organized, clearly articulated, and appropriate for the student's developmental level. Students in this study who had participated in the Nature's Classroom experience through the embedded school programming routinely referred to it and commended the experience as one they remember. When asked about experiences they considered significant, students responded with the following examples:

Student 1: “The planting in third grade”

Student 4: “Nature’s Classroom,” “school field trips,” “community projects”

Student 6: “I think the hands-on experience is better. If someone tells you to compost you’re just going to kind of say, Ok yea I’ll do that when I get home and then you’re going to forget about it. But if you actually do it for lunch and it’s like with your friends and it’s cool and you’re having fun then you’re more likely to go home and say, Mom this is something I really want to do. We did it at school. It’s really good for the environment and it’s not that hard.”

The roots of environmental education date as far back as the Tbilisi Declaration of 1978. Numerous researchers have conducted studies to add to a body of knowledge of what works in the field. Common threads of effective environmental education continue to include ecological knowledge and environmental sensitivity (Hungerford & Volk, 2005), practical application of concepts in the field (Mutisya & Barker, 2011), residential programs in nature (Smith-Sebasto & Obenchain, 2008), and the development of a culture of care (Mortari, 2004). The data of those who participated in the embedded environmental focus school programming did support that significant differences existed in the area of ecological knowledge. While those experiences did not have the same effect on environmental affect, cognitive skills, or environmental behaviors based on the data of this study, they are considered appropriate and effective in the field of environmental education based on the research.

Research Question Two and the Literature

Research Question Two explored whether a relationship existed between the number of years a student was in the school with an embedded environmental focus and the length of time post-completion of that school and overall environmental literacy scores. A large body of research exists reporting that environmental education should begin with early school age

children and be consistent in its approach (Coyle, 2005). Smith et al. (1997) studied the effects of a recycling education program on the knowledge, attitudes, and behaviors of grade school children. Their findings concluded that environmental education that focused on early school age children and closely linked environmental knowledge with specific environmental behaviors could be effective in changing environmental attitudes. Roper Starch Worldwide (1994) reported that school was an effective way to reach and educate students but that education needed to begin early. Hungerford and Volk (2005) noted school programming that contained positive environmental experiences in non-formal outdoor settings for long periods of time were effective factors related to the development of sensitivity.

In this research study, no relationships were established between and within the elements of time and overall environmental literacy scores. The findings were not supported by the research and this may have been a result of the high correlation between the two predictor variables. Also noted is that the students who had the highest post-completion time were also the students with the least amount of time in the program. This is due to the fact that the school with the embedded environmental focus had not been in existence long enough for all of the students to have participated for the full amount of time. These circumstances may have factored into the outcomes of the multiple linear regression used in Question Two.

Research Question Three and the Literature

Research Question Three used semi-structured interviews to investigate additional factors related to social variables of family, culture, and community on environmental literacy scores. Three primary themes emerged from analysis of the data; influence and activities of family and extended family; organizational influence; and personal connections, feelings and friends. These findings are well supported by research in the field. Marcus (2012) reported on the effectiveness

of Green Schools through data collected from school participants. Students reported that they participated in outdoor learning experiences as well as becoming more involved in the community. These Green School students exhibited more citizenship behaviors and these experiences played a critical role in initiating social change (Marcus, 2012). Wells and Lekies (2006) reported that environmental attitudes were influenced by various forms of childhood interactions with the environment and had a positive influence on environmental behaviors. Students interviewed in this study reported being involved in outdoor experiences either alone or with family. Some examples include the following.

Student 1: “I remember one year we went camping with my grandma and like this big place that was meant specifically for camping and exploring and stuff”

Student 2: “ I feel like my whole entire family is involved. I feel like my mom strives for it like the most.”

Student 3: “ Since me and my dad are hunters like we don’t like to see like the land get destroyed so we like really care about it and like go and try to help out”

Student 4: “My family like we’ve always been kind of like an outdoorsy family like we’re always outside.”

Student 5: “Both my parents help me with like food chain kind of stuff.”

Student 6: “When I was in third grade my grandmother started composting and we helped a lot with that so that was a big thing for me.”

Research on significant life experiences suggests that when children have access to the outdoors and permission to explore it, they have a strong interest in the environment. This, coupled with education, membership in organizations, or life pursuits can lead to activism to protect the environment they love (Chawla, 2006). In this study, the theme of organizational

activities emerged from the student interviews. Four of the six students verbalized the importance of participation in organizations such as the Girl Scouts or Boy Scouts. These organizational experiences support the concept of social emotional learning. The development of the emotional mind and the cognitive mind is essential for effective behavior. Social emotional learning cultivates the emotional intelligence of individuals relative to self-awareness, managing emotions, motivating oneself, empathy, and managing relationships (Basu & Mermillod, 2011). Interview data in this study corroborated the connections that the students had to self, others, and the natural world. One student's thoughts were so clearly stated on the role of friendship and feelings to environmental awareness:

Student 2: "I feel that if they think they should do something about it they should do it. Like they shouldn't just sit around and wait for somebody else to do it they should...they could be that one person that makes a huge difference in how our future world could be."

Included in this question was the role of culture as a social variable. None of the information in this study, collected through interviews, supported that culture played a significant role in environmental literacy. Qualitative data from the interviews suggested that family influence, organizational participation, and friendships where similar beliefs were present played a role in the development of overall environmental literacy. These findings are supported in the literature related to environmental education and sustainability.

Limitations of the Study

Internal Validity

A significant limitation in causal comparative research is the lack of control over threats to internal validity. A subject characteristics threat addresses the possibility that the groups were not equivalent on one or more variables other than the identified group variable. To address this

threat, all students were given a measure of their attitudes toward school. Students' perceptions, attitudes, and levels of motivation influence their academic achievement (McCoach, 2002). All participants in the study were administered the *School Attitude Assessment Survey Revised* (SAAS-R) in order to describe attributes related to areas of academic self-perception, attitudes toward teachers, attitudes toward school, goal valuation, and motivation. The data collected from the SAAS-R allowed the researcher to establish baseline data between the groups in isolation from the variable under study.

Threats may also exist in instrumentation, and history. The instrument used in this study is considered a valid and reliable measure of environmental literacy. Efforts to reduce instrumentation threats included: reading the test to all of the subjects; providing an appropriate setting for administration; and having an assistant to aid in the distribution, collection, and monitoring of students as well as overseeing the implementation consistency of the researcher. The *Middle School Environmental Literacy Survey* (MSELS) was administered once during this study eliminating any learning gains that might have occurred if it had been used multiple times over a longer time period.

External Validity

Population and ecological validity were external threats of this study. Causal comparative studies often will begin with a difference between two groups and then look for possible causes for, or consequences of, that difference (Fraenkel & Wallen, 2006). In this design, the inability to manipulate the independent variable and the lack of randomization inhibited the capacity to establish a cause and effect relationship with confidence. The environmental focus was embedded into the culture of the school and as such cannot be generalized from this study setting to a different setting. While generalization from the sample

group to the larger population cannot occur, it is important to note that the purpose of this study was to explain an educational phenomena. The students in Group One attended a school with an embedded environmental education focus that was part of the overall climate and culture of the school. The students' experiences within that environment were varied based on factors of time, personal investment, and interest; however, the elements of programming related to curricula were consistent. This research study was designed to investigate the effects of this type of school programming on the four domains of environmental literacy (environmental affect, ecological knowledge, cognitive skills, and environmental behaviors). Qualitative findings through semi-structured interviews further examined additional contributing social factors. The overarching goal of the work was to add to a body of research for purposes of curriculum planning in the field of environmental education.

Qualitative Trustworthiness

Qualitative trustworthiness was established through credibility, transferability, dependability, and confirmability. In this study, six semi-structured interviews were conducted with the highest scoring students on the MSELs equally representing both groups. Efforts to establish credibility were addressed through member checking. Krefting (1991) reports that member checks are more difficult for informants during later stages of the research process rather than initially when descriptive data are reviewed. Due to the age of the students and the end of the school year approaching, the researcher chose to review the conversations with each interviewee both during the interview by restating responses to check for accuracy and immediately following the interview through discussion. This proved to be an effective way to assure accuracy of the information. The transcripts support the rephrasing that occurred between the student and the researcher at the time of the interview. If any discrepancies occurred, the

researcher immediately sought clarification of the concept. This member-checking process ensured that the questions and responses were clear in the student's mind as well as the researcher's.

Transferability, in this study, was addressed through the data rather than the subjects. The interview transcripts along with descriptive details of the behaviors of the informants during interviews were examined to address transferability. Providing a rich description of the setting can aid the reader in determining if the findings are applicable to other studies.

Dependability was addressed through a code-recode procedure as well as by a peer auditor. During the analysis phase, the researcher coded a segment of the data and then waited two weeks to recode the same data after which the results were compared. The final coding categories along with code frequencies, code descriptions and interview transcripts were given to a peer auditor for review. The auditor was in complete agreement with how the data had been coded.

Researcher bias remained high in this study and was addressed in various manners. As was discussed earlier in this work, the school program of the students in Group One was well known by the researcher. All efforts were made to maintain objectivity and accurate data throughout the entire study. Three students interviewed were familiar with the researcher and did perhaps have a comfort level in the interviews. In order to maintain consistency with the three students from Group Two, the researcher took additional time to engage the students in nonrelated conversations so as to establish a relationship with them and develop an increased level of comfort. All of the students spoke openly with the researcher about any level of anxiety they might be experiencing. All of the students indicated that they were happy to be interviewed and comfortable with the process. An audit trail was utilized to address threats to confirmability.

Records included in the audit were raw data (audio recordings, interview transcripts), data reconstruction (thematic categories, frequencies, code descriptions), and process notes (all information related to the collection and analysis of the data). Members of the advisory committee had access to all of the data throughout the study and critically reviewed interpretations and conclusions made by the researcher.

Implications for Education

Our planet, which has sustained us for so many years, continues to be consumed, used, and abused. This reality has increased the urgent need for maintenance and sustainability (Rio+20, 2012). It is clear from the research that citizens know that this deterioration is occurring yet many still do not really understand enough about the issues to change behaviors that will begin to alter the current track (Coyle, 2005). Many still ask why. Changing environmental behaviors is complicated. What was once thought to be a linear model of knowledge, attitudes, and behaviors has proven to be multifaceted. The review of the literature illustrates that having ecological knowledge does not always lead to a change in attitudes or more importantly, a change in behaviors (Hungerford & Volk, 2005). Traditionally, school personnel have been given the task to educate. More recently, they have been given the task to help children think, become active problem solvers, and develop an internal locus of control (“Developing a State,” 2008). This is to be done in a traditional model of education with a limited amount of time. This researcher is of the opinion that today’s teachers are stressed and the addition of one more educational responsibility will overwhelm them. This is one of the challenges faced in elevating environmental education to core curriculum status in today’s standards-based world (Coyle, 2005).

Students in Group 1 attended a school where an environmental education focus was embedded in the curriculum. It was not an additional feature or a structured class on environmental studies. It was a school-wide culture that used collective and individual practice, along with problem solving and action, to provide students a deeper level of understanding and an ethic to care. The data did not support the changes in three of the domains of environmental literacy but did illustrate that this approach can create statistical differences in students' ecological knowledge. School programs can put into place experiences that assist in this task. School gardens can be woven into science units of study and provide a hands-on classroom for instruction. Using community partnerships with programs such as master gardeners and master composters can provide assistance to school personnel. Often, these individuals will work in a voluntary capacity. Many grants exist either through federal funding ("Environmental Literacy Plan," 2012) or local businesses. Parent/Teacher Organizations may also conduct fundraising to support the school in this area

Field trips can be organized to promote awareness and opportunity for students to investigate environmental issues. There are many museums and community locations (landfills, recycling centers, etc.) that will bring students through at little or no cost. A five-day residential outdoor opportunity when attended can be costly; however many skills are taught and used in these program settings (Smith-Sebasto Obenchain, 2008). As supported by the interviews, three of the students made reference to this type of experience. Whole school efforts such as composting offers students of all ages the ability to participate in a school-wide environmental experience and to see that they can make a difference. Children are able to see the full cycle of their work. Keeping projects accessible to children at other times of the day can provide them the ability to explore on their own time and in their own interest area. The gardens in this school

are located in the recess area of the school. This allows access and choice for what children want to explore.

The interview data supported the additional social variables of family, organizational involvement, and personal connections. Many of today's children do not have access to the outdoors (Louv, 2008). Parents are working and unscheduled free time (time to explore versus time that is tightly scheduled between sports and other activities) is limited. Schools may need to take on this challenge. They may have to plan and provide activities that can get families outside. The concept of a family field trip organized by the school on weekends may take the burden of organizing the event off the plate of the busy parent. Staff members who are willing to assist in this endeavor might be compensated with time. Most union contracts contain language that requires staff members to be available for a certain number of night activities or conferences. This time could be traded off to provide some compensation to those interested in planning weekend nature activities for families. Organizations such as Girl Scouts and Boy Scouts often need a meeting place in order to form groups. Opening up and making available our schools may provide access and opportunity for students in neighborhoods to participate in these activities.

The data in this study support school programming that teaches ecological knowledge through a school-wide and hands-on culture. It adds the need for family interactions with the outdoors as well as participation in character building organizations. The most difficult task generated from the data is the fostering of those personal connections that children develop with the natural world. This can take place in the company of caring and loving adults who interact daily with youth. Building that loving connection can only take place when adults themselves feel connected to each other and the larger community (Goleman, 2010). While this was not

measured in this study, it does remain at the center of the environment experienced by students who attended this school. Perhaps the best avenue to pursue here is the development of Goleman's Emotional, Social, and Ecological Intelligences. Building a culture in a school needs to be taken as seriously as the curriculum provided each day. In this sense, school personnel are truly members of a child's family. Society continually changes and the children who arrive at school each year are unique in so many ways, yet the work of education is to develop positive citizenship in our youth. The subjects and the demands have changed but the job description has not.

Suggestions for Future Research

This study sought to investigate the factors that influence students' long-term application of environmental literacy skills. It used a mixed methods explanatory sequential design. Causal comparative research is limited due to the inability of the researcher to manipulate the variables. Experimental studies that are used to collect data around key elements of a program over a longer period of time would provide the researcher with more control and a sample that is reflective of the general population. More information is needed in the area of changing learner behavior in environmental education. These studies may be better suited for qualitative research. Criticisms to existing work have been identified because of the age of the subjects in the study (Chawla, 2001). Future research should focus on children rather than adults. While children can sometimes have difficulty articulating exactly what they are feeling or experiencing, they are usually quite truthful. A researcher immersed in a school community can gain a tremendous amount of insight relative to the development of sensitivity within an environmental education program (Thorpe & Townsend, 2001). Curriculum currently exists for environmental studies at the middle-and high-school level. Less is in existence at the elementary school level. Perhaps

this is because instructional time devoted for science is limited at the elementary school level. The development of written curricula with embedded experiences that are focused on problem solving and analysis skills, would be promising research areas that might provide clearer programming guidelines for those in the field.

The importance of a value system that guides individuals to care and connects humans with all living things has been documented in the research (Mortari, 2004). Additional examination in this area is necessary if schools are to create opportunities for young children to grow in this realm. Studies that explore the attitudes and beliefs of school personnel can add to the research on adult influence in environmental education.

Research in the field supports environmental education that begins with early school-age children, and links environmental knowledge with specific environmental behavior (Smith et al., 2007). Additional work in this area is needed. Longitudinal studies that follow individuals or groups of students through their school career can add much needed information on the long-range effectiveness of programming. We may not see the inclusion of environmental education in core curriculum in the near future even though parents, community members, and the larger public support its importance. Any work that finds effective ways to integrate or embed the key components of environmental education into the existing frame of schooling will be the most practical and effective way to get this work done.

Conclusion

The Tbilisi Declaration (“Intergovernmental Conference,” 1977) developed the first guiding principles of environmental education. Abundant research in the field continues to support those guiding principles developed over 30 years ago. Young people care about the natural world and they realize that Americans, both young and old, affect it (Roper Starch

Worldwide, 1994). Pro-environmental behavior is the aim of environmental education. It remains unclear as to how the development of ecological knowledge, changes in attitudes, and environmental behaviors are achieved through education and experiences. This researcher sought to identify factors related to students' long term application of environmental literacy skills. Findings indicated that students who attended a school with an embedded environmental focus at the elementary school level scored significantly higher in ecological knowledge than students who had not attended that elementary school. The factors of time related to participation in the school program and the time away from the school program did not reveal any significant relationships. Data obtained from student interviews further explained the social variables of family interactions, participation in outside organizations, and personal connections to the natural world as consistent themes that emerged among the highest scoring students.

Components of the school's programming can be integrated into educational practice through various avenues. Creative solutions to problems related to cost, time, and investment can be found in the traditional frames of our schools. Additional research that can provide guidance and support for an integrated model may be the most valuable and practical. The importance of working together with family and community cannot be underestimated. The awareness is there, the task is understood, and with the commitment of all those involved, the work can be done.

When we try to pick out anything by itself, we find it hitched to everything else in the universe.

—John Muir, naturalist, explorer, and writer (1838-1914) (“John Muir Quotes,” 2014)

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Appendix A: MSELs (2009) Request and Permission to Use

REQUEST TO USE
The Middle School Environmental Literacy Survey

1. If you wish to use the Middle School Environmental Literacy Survey in your research, please provide the information specified below. You may send us a hard copy letter that includes this information, or simply enter your responses into this electronic file, and email it to us.

Your Name: Helena Nitowski

Position: [REDACTED]

Email: lnitowh@danbury.k12.ct.us

Phone: 203-778-7462 / 203-240-0344

Mailing Address: 12 Starr Lane, Bethel, Ct. 06801

Please identify the version of the MSELs that you would like to use:

MSELs 2006

MSELs 2009

Please provide a brief description of your proposed study, including

AN INVESTIGATION OF THE FACTORS THAT INFLUENCE STUDENTS' LONG-TERM APPLICATION OF ENVIRONMENTAL LITERACY SKILLS

Purpose of Study:

The purpose of this study is to investigate the environmental literacy skills of students who have attended a school of international and global studies with an embedded environmental focus and the environmental literacy skills of students who have participated in traditional curriculum at the elementary school level. Factors related to the number of years of participation in the program and number of years post completion of the program will also be examined. The role of social variables of family, culture, and community will be explored. The data obtained will contribute to the research on environmental education and assist in curriculum and program development.

Research Questions

1. Are there significant differences in the domains of environmental literacy (ecological knowledge, environmental affect, cognitive skills, and environmental behavior) of middle school students who have attended a school with an embedded environmental education focus at the elementary school level and middle school students who have not attended a school with an embedded environmental education focus at the elementary school level?
2. To what extent and in what manner do the variables of time (years attending a school with an embedded environmental education focus and years of post completion attendance of a school with an embedded environmental education focus) explain the variation in the environmental literacy score?
3. What role in the development of environmental literacy skills is played by social variables related to family, culture, and community?

Research methods and Procedures:

This study utilizes an explanatory sequential mixed methods design. The quantitative portion is a causal comparative design and the qualitative portion is a case study design. One group will be selected based on attending a school with an embedded environmental education focus at the elementary school level. Students in the comparison group will be a convenience sample selected from both middle schools and who have not attended a school with an embedded environmental education focus at the elementary school level. A total of approximately 135 students will be invited to compose Group One. An equal or greater number will be invited for the comparison. All students invited will be age appropriate for sixth, seventh, and eighth grade. Quantitative data will be collected using the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth, and Bluhm, 2009). The MSELs is designed to be given within one period of the school day. Section one of the MSELs (2009) obtains basic demographic data such as grade and gender. Additionally, the *School Attitude Assessment Survey (Revised)* will be administered. The data will be scored and analyzed. After permission has been secured, interviews will be conducted with six students with the highest environmental literacy scores representing both testing groups (three students from each group). Quantitative and qualitative data will be analyzed and interpreted.

Sample and setting:

This research study will be conducted with students attending the two middle schools within the district. One group will be selected based on attending a school with an embedded environmental education focus at the elementary school level. Students in the comparison group will be a convenience sample selected from both middle schools and have not attended a school with an embedded environmental education focus at the elementary school level. A total of approximately 135 students will be invited to compose Group One. An equal or greater number will be invited for the comparison. The demographic data for the students will be analyzed in relation to the district demographic. All students invited will be age appropriate for sixth, seventh, and eighth grade.

Approximately how many individuals will be surveyed? (How many survey booklets will you need?)

Approximately 250 Booklets are needed.

Approximately when (dates) you wish to use the MSELs?

The researcher would like to administer the MSELs in late February 2013.

Any other pertinent information about your use of the MSELs in your research?

In consideration of the use of the MSELs, we would like to receive a report of your findings.

How soon (date) do you expect to have results to share with us?

The timeline for data collection and results is between February 2013 and November 2013.

2. Please read the following statement. If you agree to these conditions, please print out this statement, and sign and date it. You can either fax it to us at 618-351-6120 or mail it to us at the address below.

Statement of Agreement to Usage of the MSELS

I would like to use all or part of the Middle School Environmental Literacy Survey in my research. I agree to the following conditions of my use of the instrument:

- I will take steps to insure the security of the instrument. Access to the MSELs will be limited to those parties who are involved in the research and no copies of the instrument will be distributed without written permission from the developers.
- Modifications to or adaptations of the instrument may compromise validity and reliability claims. I agree that the instrument will not be modified or adapted in any manner without the written permission of the developers.
- I will credit the developers of the instrument in all reports, presentations, and publications of the research (e.g., developed by Hungerford, Volk, McBeth and Bluhm, 2006 or 2009).
- I agree to provide the Center for Instruction, Staff Development and Evaluation with a final report of the research, along with feedback on the administration of the instrument

Signature:



Date: February 4, 2013

Mail to The Center for Instruction, Staff Development and Evaluation, 1925 New Era Road, Carbondale, IL 62901 USA or fax to 618-351-6120.

<p>If you have questions or need additional information, please email or call Trudi Volk or Harold Hungerford at cisde@midwest.net or 618-351-6120.</p>
--

***Center for Instruction, Staff Development and Evaluation
1925 New Era Road
Carbondale, IL 62901***

cisde@midwest.net

PH: 618-457-8927

Fax: 618-351-6120

February 8, 2013

Ms. Helena Nitowski
12 Starr Lane
Bethel CT 06801

Dear Ms. Nitowski:

This letter constitutes permission for you to use the Middle School Environmental Literacy Survey in your doctoral study. We are pleased to learn that your pilot of the instrument was successful.

I understand that your study will investigate the environmental literacy skills of students who have attended a school of international and global studies with an embedded environmental focus and the environmental literacy skills of students who have participated in traditional curriculum at the elementary level, along with school- and family-related variables. You have indicated that you will restrict access to the MSELs to those who are involved in the study or otherwise closely associated with your study. Thank you for that consideration. We prefer that you not include a copy of the instrument in any report. Rather, please indicate that the instrument cannot be distributed or used without permission from the Center for Instruction, Staff Development and Evaluation (CISDE), and provide the contact information contained in our letterhead (land address, telephone and email address).

We wish you continuing success as you carry out your study. Please do not hesitate to contact us if you have questions, or if there is some other way that we may be of help. We look forward to receiving a copy of your research report.

Sincerely,



Dr. Trudi Volk, Executive Director
Center for Instruction, Staff Development and Evaluation

Appendix B: IRB Approval



DPS Mail
powered by Google

Helena Nitowski [REDACTED]

FW: I.R.B. approva.l

2 messages

Helena Nitowski <nitkowski001@connect.wcsu.edu>
To: "nitowh@danbury.k12.ct.us" <nitowh@danbury.k12.ct.us>

Thu, Jan 3, 2013 at 2:27 PM

From: Carol O'Connor [oconnorc@wcsu.edu]
Sent: Tuesday, December 18, 2012 12:56 PM
To: Helena Nitowski
Cc: WCSU IRB; Karen Burke
Subject: I.R.B. approva.l

Dear Helena,
I am pleased to inform you that your I.R.B. protocol number 1213-89 has been approved by full review. Your approval copies will be sent to Dr. Burke. The WCSU I.R.B. wishes you all the best with your research.

Thank you,

Appendix C: Letter and Consent Form (Superintendent)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Dear Superintendent:

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a research study. The purpose of this study is to investigate the factors that influence students' long-term application of environmental literacy skills.

One quantitative instrument the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth and Bluhm, 2009) and a brief *School Attitude Assessment Survey* (McCoach, 2002) will be used in the study. The MSELs is designed to measure aspects of environmental literacy and includes subtests within four major domains of environmental literacy: knowledge, affect, skills and behavior. The MSELs contains multiple-choice and Likert-type items and is completed in one middle school class period. The SAAS is a five-minute survey that assesses attitudes towards school. Approximately 270 students will be recruited to participate in the survey. The researcher will be present during administration and will collect and score all of the surveys. Students will take the survey via paper and pencil once at their school during April of 2013.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-89. This study is valid until December 18, 2014. Participation in this study is completely voluntary. Students who agree to participate will submit all information to the researcher. Privacy will be protected. Student names will be numerically coded and schools will not be identified. All student identities will be maintained in a secure location to protect confidentiality. The results will be analyzed and reported only in aggregate form.

A description of the final project will be available upon completion.

I wish to thank you for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to environmental education. If you have any questions, please feel free to contact me.

Sincerely,
Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University

BurkeK@wcsu.edu

nitowh@danbury.k12.ct.us

I agree that the study described above can be conducted in the Danbury Public Schools.

Please Print Name

Signature

Date

Appendix D: Letter and Consent Form (Principal)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Dear (Principal):

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a research study. The purpose of this study is to investigate the factors that influence students' long-term application of environmental literacy skills.

One quantitative instrument the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth and Bluhm, 2009) and a brief *School Attitude Assessment Survey* (McCoach, 2002) will be used in the study. The MSELs is designed to measure aspects of environmental literacy and includes subtests within four major domains of environmental literacy: knowledge, affect, skills and behavior. The MSELs contains multiple-choice and Likert-type items and is completed in one middle school class period. The SAAS is a five-minute survey that assesses attitudes towards school. Approximately 270 students will be recruited to participate in the survey. The researcher will be present during administration and will collect and score all of the surveys. Students will take the survey via paper and pencil once at their school during April of 2013.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-89. This study is valid until December 18, 2014. Participation in this study is completely voluntary. Students who agree to participate will submit all information to the researcher. Privacy will be protected. Student names will be numerically coded and schools will not be identified. All student identities will be maintained in a secure location to protect confidentiality. The results will be analyzed and reported only in aggregate form.

A description of the final project will be available upon completion.

I wish to thank you for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to environmental education. If you have any questions, please feel free to contact me.

Sincerely,
Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University

nitowh@danbury.k12.ct.us

BurkeK@wcsu.edu

I agree that the study described above can be conducted in (name of school).

Please Print Name

Signature

Date

Appendix E: Letter and Consent Form (Parent)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Dear Parent,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a research study. The purpose of this study is to investigate the factors that influence students' long-term application of environmental literacy skills.

One quantitative instrument the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth and Bluhm, 2009) and a brief *School Attitude Assessment Survey* (McCoach, 2002) will be used in the study. The MSELs is designed to measure aspects of environmental literacy and includes subtests within four major domains of environmental literacy: knowledge, affect, skills and behavior. The MSELs contains multiple-choice and Likert-type items and is completed in one middle school class period. The SAAS is a five-minute survey that assesses attitudes towards school. Approximately 270 students will be recruited to participate in the survey. The researcher will be present during administration and will collect and score all of the surveys. Students will take the survey via paper and pencil once at their school during April of 2013.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-89. This study is valid until December 18, 2014. Participation in this study is completely voluntary. Students who agree to participate will submit all information to the researcher. Privacy will be protected. Student names will be numerically coded and schools will not be identified. All student identities will be maintained in a secure location to protect confidentiality. The results will be analyzed and reported only in aggregate form.

A description of the final project will be available upon completion.

I wish to thank you for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to environmental education. If you have any questions, please feel free to contact me.

Sincerely,
Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University

nitowh@danbury.k12.ct.us

BurkeK@wcsu.edu

I agree that my child may participate in the study described above. My signature below also verifies that I am over the age of 18.

Please Print Name

Signature

Date

Appendix F: Assent Form (Student)



Student Information Form to Participate in a Research Study

Dear Student,

I am in a doctoral program at Western Connecticut State University. I am doing an exciting research study on what students know about the environment. I would like you to be a part of my study. I will send a permission slip home with you. But first, I would like you to know more about my project.

The study is about the ways you think about the environment. I will ask you to complete a multiple-choice survey. This survey will ask you questions about your thinking on environmental issues. I will ask you to complete this information one time during a class period. The survey will take one class period and will be given at your school. Your classroom teacher knows about my work. I will be at the school while you take the survey.

I will not use your name or school in the study; I will use numbers. The survey will have nothing to do with any grades. All of the information will be kept private. If you have any questions, please ask me.

If you would like to be in my study, please print and sign your name below:

Print student name

_____ Date: _____

Student signature

Thank you,

Mrs. Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University
BurkeK@wcsu.edu

nitowh@danbury.k12.ct.us

Appendix G: Test Administrator Script

SURVEY ADMINISTRATION PROTOCOL

(Student answers directly in booklets)

Have students find a place to sit and prepare everyone for administration.

My name is Mrs. _____ and I'd like to thank you for agreeing to participate in this exciting work. Today you will be responding to an Environmental Literacy Survey. Each of you has parent permission to participate and have also agreed to be here. We will be working together to complete the survey. I will read each of the questions and provide you an opportunity to complete your answers.

When you're completing the questions, it's important that you give answers that show how you feel, what you think, or what you do. While some of the questions call for correct answers, many ask about you and your feelings, so please be completely honest.

All answers will be kept strictly confidential. You're not going to put your name on the booklet, so nobody, not even I, will know what answers you gave.

Your answers will not affect grades in any way. If you have any questions, you can certainly ask me. When you finish, you may leave your booklet on the table and I will collect them.

After administration: I want to thank you for participating today.

Appendix H: School Mission Statement

Mission Statement

At the [REDACTED], students become socially responsible global citizens who use technology to access the world.

An emphasis on International Studies and World Languages facilitates critical thinking and broadens mastery of the district curriculum.

Our school community creates a supportive climate where students practice collaborative problem solving and understand other's perspectives while valuing and respecting diversity.

Students value that global citizenship begins with responsible citizenship in one's own world.

Strategic Goal 1: Socially responsible global citizens

At the academy, students learn to be environmentally aware through participation in activities such as food composting in our cafeteria, community garden activities, school and home recycling efforts and bonds with organizations such as Roots and Shoots.

Our school philosophy encourages students to look outside themselves and be part of a larger community. Students develop skills in communication, conflict resolution, and social advocacy via effective modeling practices throughout their school day as well as instruction during community time.

Strategic Goal 2: Technology

[REDACTED] offers a state of the art facility affording children accessibility to technology throughout many daily routines.

Having a class set of laptops per grade level and a wireless environment offers children the opportunity to enhance and enrich their education through independent and guided learning explorations.

Children gain real world experiences that can be transferred to the community while interacting and learning about themselves and others.

Strategic Goal 3: International Studies

Our International Studies theme is centered on the concept of peace and our role as peacekeepers in the world. The development of a progressive International Studies Curriculum fosters a greater appreciation of how we live, work, and play around the world. Students examine elements such as geographic location, language, economy, climate and cultural similarities and differences.

Through the use of critical thinking skills, students are better able to understand their place/role in the community and in the world.

Strategic Goal 4: World Language

World Language instruction in Spanish is provided daily to all students. Instruction is aligned with the Connecticut World Language Frameworks and reinforces district and school goals of improving literacy and numeracy.

Students gain a better understanding of English as they foster a love for foreign language learning.

Teachers and staff create a trusting environment that encourages the use of Spanish in and out of the classroom as well as an increased sensitivity to different cultural practices within the Spanish-speaking world and beyond.

Strategic Goal 5: District Curriculum

The Danbury Public School Curriculum is rigorous, aligned to state and national standards, and built upon research based instructional practices. The symbol of a living tree exemplifies the components of the curriculum. The roots of the tree depict the attitude and attributes of learners.

The trunk represents lifelong learning skills, and the leaves represent the content standards. Students become critical thinkers and independent problem solvers while mastering core curriculum.

Strategic Goal 6: School Community

Inquisitive learners, dedicated staff and involved parents together create a vibrant learning community. We at AIS strive to be productive members of society by creating and establishing relationships amongst ourselves and others.

Strategic Goal 7: Climate

AIS fosters students to be inquisitive risk takers who are allowed and encouraged to explore their ideas in a safe and supportive environment. The respectful relationship between parent and staff is the bridge that joins us in our common goal to challenge and nurture the growth of each and every child.

Strategic Goal 8: Collaborative Problem Solving

Throughout the school, students are encouraged and taught to use communication skills to articulate and resolve conflicts and choices. A major component of our Peace Curriculum is the development of strong listening skills and a respect for another's point of view.

Strategic Goal 9: Diversity

Beginning in the early grades, students will develop an awareness of themselves and realize they are an important part of their community. Staff models and encourages students to develop an understanding that they are part of a global society where an appreciation and respect for the similarities and differences across cultures and ethnicities is necessary in the development of a peaceful worldview.

Appendix I: Letter and Consent Form (Interview) Parent



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Dear Parent,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. Recently your child participated in this study, which is investigating the factors that influence students' long term application of environmental literacy skills. I am happy to report that your child received a very high environmental literacy score on the *Middle School Environmental Literacy Survey* (Hungerford, Volk, McBeth and Bluhm, 2009). The next step in the study is to look more closely at any additional variables that affect environmental literacy.

I am inviting the top six scoring students to participate in a short interview. The purpose of this interview is to better understand any additional factors that contribute to the development of environmental literacy skills in students. The interview will take place at their school in a location designated by the school administrator. The questions are open-ended and will be completed in approximately thirty minutes. I have enclosed some sample questions for your review.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-89. This study is valid until December 18, 2014. Student identities are protected and the results will only be reported in aggregate form.

I wish to thank you for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to environmental education.

Please feel free to contact me nitowh@danbury.k12.ct.us should you have any questions.

Sincerely,
Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University
BurkeK@wcsu.edu

nitowh@danbury.k12.ct.us

I agree that my child may participate in the interview described above. My signature below also verifies that I am over the age of 18.

Please Print Name

Signature

Date

Appendix J: Assent Form (Interview) Student



Student Information Form to Participate in a Research Study

Dear Student,

I am in a doctoral program at Western Connecticut State University. I am doing an exciting research study on what students know about the environment. I would like you to be a part of my study. I will send a permission slip home with you. But first, I would like you to know more about my project.

The study is about the ways you think about the environment. You have taken the environmental survey and scored in the top six students. I would like to invite you to interview with me so that I can learn more about you and any other factors that have influenced your views. The interview will last about thirty minutes and will be semi-structured. I will speak with you at school in a location that your principal sees as appropriate.

I will not use your name or school in the study; I will use numbers. All of the information will be kept private. If you have any questions, please ask me.

If you would like to be in my study, please print and sign your name below:

Print student name

_____ Date: _____

Student signature

Thank you,

Mrs. Helena Nitowski

Karen Burke, CSJ, EdD

Professor
Instructional Leadership Doctoral Program
Western Connecticut State University
BurkeK@wcsu.edu

nitowh@danbury.k12.ct.us

Appendix K: Semi-structured Interview Questions

Semi-structured Interview Questions

Family

1. Do you think your family has shaped any of your views towards the environment? If so how?
2. Would you be willing to share information about your family with regard to your environmental feelings?

Community

1. Do you know of any organizations in your community that take action on environmental issues? Any world organizations?
2. Can you think of someone you know or admire as a model for your views on the environment?
3. Has school been a major factor? Why or why not?

Follow Up Questions

1. When I say the word environment, what are some things that come to mind?
2. What environmental issues are you most worried about and why?
3. When adults say they are worried about the environment, what do you think they are referring to?
4. When you think of your friends, would you say they share similar views? Tell me more....
5. Are there any actions that students can take to change some environmental issues? If so, what are they?
6. What do you think helped shape your attitudes on environmental issues?

Culture

1. When you think of your extended family, are there any values that come to mind related to the environment?
2. What kinds of things do you do or see your family do that may promote your interests in the environment?

Follow Up Questions

1. Do you think that saving the environment requires sacrifice? Tell me more.
2. Do you feel that you have opportunities to get involved? What kinds? If not, would you like to be more involved? What would you do?
3. Can you share your feelings when you found out you were a top scorer on the environmental literacy survey?
4. Where have you gotten most of your information on the environment?
(media, tv, social media??)

Appendix L: Reliability Estimates for MSELs

Reliability Estimates MSELiv9: Field Test (65 sixth, seventh, and eighth grade students from Molokai, HI and Steelville, IL.)

Ecological Knowledge;	$\partial = .794$
Verbal Commitment;	$\partial = .843$
Actual Commitment;	$\partial = .778$
Environmental Sensitivity;	$\partial = .764$
Issue Identification;	$\partial = .389$
Issue Analysis;	$\partial = .701$
Action Planning;	$\partial = .869$
Total Instrument:	$\partial = .817$

Reliability Estimates of MSEL scales using 6th and 8th grade data from the national baseline study, 2008.

Part II. Ecological Knowledge:	6th, $\partial = .717$	8th, $\partial = .737$
Part III. Verbal Commitment:	6th, $\partial = .847$	8th, $\partial = .843$
Part IV. Actual Commitment:	6th, $\partial = .781$	8th, $\partial = .758$
Part V. Environmental Sensitivity:	6th $\partial = .749$	8th, $\partial = .764$
Parts V. and VI. (combined)	6th, $\partial = .778$	8th, $\partial = .783$

Appendix M: Qualitative Audit Information

Qualitative Audit for Helena Nitowski

I conducted a qualitative audit for Helena Nitowski on June 4, 2014. Prior to the meeting with Helena, she emailed the draft of her dissertation, and I was able to read chapters three and four. Helena also forwarded a code dictionary, providing descriptive statements of each code. Additional supporting documents included a frequency table generated from HyperResearch software which identified each code and the frequency of occurrence of each code as they appeared within transcripts, and a source document that identified the source of each code. Participants' transcripts were also received and reviewed prior to our meeting date. Helena and I met for approximately ninety minutes. During this time, we discussed the following:

- **Overview of methodology** – To gain a better understanding of her study's methodology, I asked Helena to provide an overview of how she conducted the interviews and coded the data. Helena was able to describe how she used coding strategies. In her research she does not identify the coding strategies of any particular theorist. I suggested the following step be taken:
 - Identify the specific theorist(s) coding methodologies followed.
- **Logical sequence of coding** – In general, Helena described a very logical approach to coding. She used a line-by-line coding system. The initial codes generated became her initial codes. She collapsed these into final codes and then into themes.
- **Meaning of the coding terms** – I asked Helena to state, in her own words, the meaning of each of her main codes as described in the coding dictionary. She was able to do so. I suggested that she re-name a few of her terms to be more specific. Several of her codes were very descriptive and specific. For example, "Knowledge of environmental issues" is fairly easily understood. On the other hand, the term "Family activities" may mean many things. I suggested that the following step be taken:
 - Clarify the names of a few of the codes that are currently unclear;
- **Coding agreement** – I randomly selected ten instances of data to code. I was in complete agreement with how Helena had coded the data.

In summary, Helena's data and her methodologies appear sound and rigorous. I suggest the following as options to improve the study:

1. Review the list of codes and clarify any that may be misunderstood.
2. Identify a specific theorist(s) coding methodologies followed.

Respectfully Submitted,



Anna M. Rocco Ed.D

Principal

Ellsworth Avenue School

Danbury, CT 06810
(203) 885 2540

Appendix N: Qualitative Interview Transcript (Sample)

HELENA NITOWSKI: So we're going to begin interview number two with an eighth grader. So one of the things that we talked about was that you were a top scorer on the environmental survey. So I'm interested a little bit in maybe just to start off by asking you do you consider yourself environmentally friendly.

STUDENT: I do consider myself environmentally friendly. I try not to waste things and I like to recycle like we use recyclable water bottles and not the plastic ones.

HELENA NITOWSKI: Do you think that...one of the things I'm looking at is whether or not family has any role in sort of creating kids that are environmentally friendly. So I'm just wondering if you would be willing to tell me a little bit about your family and whether or not your family has...if you feel your family has contributed to that in any way.

STUDENT: I think they definitely have. When I was in third grade my grandmother started composting and we helped a lot with that so that was a big thing for me. We also...I'm trying to think of some for you. (laughter)

HELENA NITOWSKI: Not that's alright like I said it's casual so do worry about it.

STUDENT: Just part of life, we don't leave water running a lot. We just do like the things that you always see on the posters that you should do.

HELENA NITOWSKI: Ok so you mentioned like a second ago you mentioned like a grandmother right? So tell me maybe a little bit about your extended family. How do you feel like have they...do you think that they have any kind of a role in?

STUDENT: Well my grandmother wastes NOTHING, NEVER.

HELENA NITOWSKI: Ok. (laughter)

STUDENT: (laughter)You don't leave the table until you've finished your food kind of. So

she's always kind of help me to not waste things and to be conscious of how much I actually am taking, and it's not just with food it's with everything. Like I look at things and I think, "Do I really need to...like do we need to buy this thing or can we get something else that might use a little bit less plastic or something like that."

HELENA NITOWSKI: Ok so it's sort of like a mindset...now do you get to spend a lot of time with your grandmother?

STUDENT: Not as much as I'd like to.

HELENA NITOWSKI: Yea, ok. When you were younger?

STUDENT: Definitely, every day.

HELENA NITOWSKI: Ok so I think what I hear you saying is that you had a grandmother who kind of was very aware and sort of passed that onto you. How do you think that happened? Like how do you think that you got sort of some of that stuff?

STUDENT: Well she used to pick me up after preschool every day so I'd be with her for a long time and I have six little cousins who aren't so little anymore. But we would all be together. She would just tell us this over and over again and we would...it was just kind of how we lived and how she would raise us almost.

HELENA NITOWSKI: Ok. That's really interesting. So I hear grandma is pretty significant in there. Do you feel that any other parts of your family or any parts of extended family or anything?

STUDENT: My mom is really big on recycling and we have a big garden and she loves the outdoors so I always kind of got that from her and from my dad.

HELENA NITOWSKI: So what do you think...when you mention outdoors what does that mean to you like what do you mean by that?

STUDENT: Well I live near Richter Golf Course and we go hiking there a lot and...my dad and I do that. And I just think it's really beautiful and we walk around outside. We're very sporty and outdoorsy.

HELENA NITOWSKI: Ok it sounds like one part of this is that you spend a lot of time outdoors. Now I'm curious about...do you do that with family activities or with friends...like how do you...is it a mix?

STUDENT: It's mostly family. Sometimes my friends and I will go on hikes and stuff but it's a big thing for me and my father, like we've been doing this ever since I was little.

Appendix O: Codes and Code Descriptions

List of All Codes

The list of all codes in this study were:

Careers in Science/Math

Description: *This code was used to identify student talk relative to what they were interested in pursuing as a career in the future.*

Community Service/ Service Learning

Description: *This code was used if a student referenced some kind of community service or service learning project that they had participated in.*

Elementary School Experiences

Description: *This code was used when a student spoke to a school experience related to the topic. To be coded in this category, it would have been an experience during the elementary school time (Kindergarten through fifth grade)*

Environmental Action Hindrances

Description: *This code was used when reference was made to sacrifices or obstacles to doing the right thing environmentally.*

Environmental Behaviors

Description: *This code was used when students identified their own personal environmental behaviors. They were coded separately if they were spoken together.*

Environmental Issues and Knowledge

Description: *This code was used to reference talk regarding environmental issues that were knowledge based. Topics such as global warming, air quality etc.*

Environmental Sensitivity

Description: *This code was used when reference was made to an environmental issue that may not necessarily be knowledge based but rather an extension of knowledge. For example, using only fallen branches for walking sticks rather than breaking one.*

Extended Family Influence /Background

Description: *This code was used when students referenced extended family or background information about their parents.*

Family Activities and Experiences

Description: *This category was used when family was explicitly referred to in the verbiage. It consolidated experiences and activities but cited them only when it was specifically mentioned or implied within the family context. This could include extended family.*

Family Practice

Description: *This code was used to identify discussion around what happened within the family as it related to environmental practice.*

Friends that share views/practice

Description: *This code was used to record friendships where reference was made specifically to how those relationships existed with regard to common views on the environment.*

Gardens

Description: *This was coded based on gardening relative to the student.*

Interests

Description: *This category referenced interests that the student expressed that connected to the high level of environmental literacy.*

Knowledge Sources

Description: *This code was used when a source of knowledge was explained or referenced by the student that did not fall under schooling or media.*

Living Location

Description: *References were made to where a student lived as related to the topic. Purposes of accessibility.*

Media Information Sources

Description: *This code was used when media sources were identified by the student as an aid to their overall environmental sensitivity.*

Organizational Activities

Description: *This code was used when a student referenced an activity in which they participated because of their involvement in an organization or club.*

Outdoor Activities

Description: *These were those activities that were referenced which are outdoor activities but not done with family. They might have been for an environmental purpose but they didn't have to be.*

Participation in an Organization

Description: *This code identified when a student made reference to participating in some organization or club.*

Personal Environmental Connection

Description: *This code was used if a student talked about how the environment connected to them on a deeper more personal level.*

Personal Environmental Connection and Commitment

Description: *This code was used if a student talked about how the environment connected to them on a deeper more personal level and also when a student identified an aspect of personal commitment to a situation related to environmental issues*

Positive Family Influence

Description: *This code was used when reference was made to how family had shaped or helped them in a positive way.*

Secondary School Experiences/Projects

Description: *This code referenced those school based experiences and or schoolwork projects that occurred at the secondary level. In this case grades 6,7, and 8.*

Spirituality

Description: *This code was used when a student specifically addressed religion or spirituality.*

Suggestions

Description: *This code was referenced when students made recommendations about what they would see as appropriate for all students. It could include both home, community, and school recommendations.*

Values/Beliefs/ Feelings

Description: *This code is used when a student talks about a behavior that demonstrates an underlying value or belief system. Those recognized by the standard population.*

_____ (End list of codes)