UNIVERSITY OF WISCONSIN-LA CROSSE

Graduate Studies

# ENVIRONMENTAL EDUCATION: AN EDUCATIONAL NECESSITY

A Chapter Style Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Education-Professional Development

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May, 2012

ENVIRONMENTAL EDUCATION: AN EDUCATIONAL NECESSITY

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We recommend acceptance of this thesis in partial fulfillment of the candidate's requirements for the degree of Master of Education-Professional Development.

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ABSTRACT

Farrell, G.J. Environmental education: An educational necessity. Master of Education-Professional Development, May 2012, 71 pp. (G. Willhite)

This quantitative study investigated the impact of environmental learning programs on the environmental worldview (attitudes, beliefs, and values) of secondary school aged students. In order to research the effect that environmental learning programs have on the environmental orientation of individuals, 41 high school students who were currently taking an A.P. Environmental Science class were given New Ecological Paradigm (NEP) survey which is designed to measure the student's environmental orientation. The data was analyzed using a 95% confidence t-interval, which allowed the researcher to collect data from a sample population and apply the statistical analysis of the results to the larger population of which the sample came from. The population to which this particular sample came from would be the entire population of secondary students who have taken a semester-long environmental science course. The results supported the research hypothesis that students who participate in environmental learning programs during the course of their secondary education will have a pro-environmental worldview (attitudes, beliefs, and values). However, in order to determine the extent to which the results support the hypothesis further research is needed.

ACKNOWLEDGMENTS

I have much gratitude for those who helped make this thesis possible. I would like to thank the members of my thesis committee, Dr. Robert Haworth and Dr. K.T. Willhite, for their incite, motivation, guidance, and help in preparing this thesis. Their teaching and mentoring has helped me become a better researcher and educator. I want to thank my thesis chair and program advisor, Dr. Gary Willhite. Without his expertise, guidance, assistance, and belief in me, the process of completing this research would have been a much more difficult and daunting task. He is also directly responsible for my growth as a researcher and educator. Mr. Mark Ziegler was kind enough to allow me to take invaluable classroom time with his students in order to administer surveys, without him this research would not have been possible. I would also like to thank the Statistical Consulting Center at UW-La Crosse for its assistance with the statistical analysis of my research data; however, any errors of fact or interpretation remain the sole responsibility of the author.

Finally, I want to thank my family and friends who have always believed in me and especially my parents, Joe and Michele Farrell, who have been continuously supportive of my many endeavors and are responsible for the person I am today.

TABLE OF CONTENTS

PAGE

LIST OF APPENDICES

# CHAPTER I

# INTRODUCTION

## Introduction

Environmental education is a topic I have grown increasingly passionate about and I began this research project with the idea that, environmental education is a necessary and essential component of curriculum within today's school systems. I was brought up as a very outdoorsy child and because of that have always had very strong ties to the environment around me. As I grew older and moved further along in my education I realized the disconnect that was present between a large number of people and the nature around them. More and more this issue began to concern me, especially with the environmental issues that we are now facing due to the lack of respect we have shown for the environment over the past 100 years. This lack of respect has lead us to the plethora of environmental problems we are now facing which include, but are not limited to: loss of biodiversity, climate change, ozone depletion, pollution caused health issues, water scarcity, and the buildup of green house gasses (Barry, 2010).

As I began my education, as a teaching professional, it became more apparent to me that this disconnect between people and the nature/environment around them was often due to a lack of education. The school setting should to be used as the vehicle to solve this lack of education, and environmental education should be highly considered as an avenue for development of environmental worldview (attitudes, beliefs, and values).

With this in mind I decided that I would do research on the necessity of having environmental education as an essential part of curriculum for students.

## Purpose of Environmental Education Curriculum

As defined by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1977, environmental education is a process aimed at developing a world population that is aware of, and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively toward solutions of current problems and the prevention of new ones.

Scientific literacy is the ability to utilize scientific knowledge, to pinpoint questions and to form comprehensive fact-based conclusions in order to better understand the world around us as well as help to make decisions regarding the natural world and the changes going on within it do to human activity (OECD, 2003). Environmental education and scientific literacy go hand in hand; the scientifically literate, as well as those versed in environmental education, are able to understand and evaluate the day to day science they encounter. They are able to use these day to day encounters as well as draw from prior knowledge of scientific concepts to form conclusions and make educated decisions with regards to the natural world and the effect of human actions on it.

Scientific literacy also involves making connections, comparing, contrasting, and overlapping ideas from different science avenues. A scientifically literate individual not only understands environmental issues but is able to make connections, compare, contrast, and overlap ideas with other content areas such as biology, chemistry, math, physics, and so forth. The goal of creating scientifically literate individuals through the

teaching of environmental education along with all other areas of science is one that requires an organized approach where the end result is an interconnected and organized knowledge base.

## Environmental Orientation

The world's environmental problems (e.g., loss of biodiversity, climate change, ozone depletion, pollution caused health issues, water scarcity), are grounded in the disconnect that exists between the current world population and the environment (Barry, 2010). If we do not understand the problem, we feel very little, if any, responsibility to take action to solve the problem. Our environmental orientation influences our environmental ethic (Knapp, 1999). As cooperative members of a community it is essential that we have environmental ethics to be used as a guide for our lifestyle choices (Leopold, 1949).

## Factors Affecting Environmental Orientation

Many different factors that affect environmental orientation exist but I will address only the three most relevant to my particular study: anthropocentrism, ecocentrism, and exemptionalism.

*Anthropocentrism*. Anthropocentrism is the belief that humans are at the center and the top of a hierarchy made up of both living and nonliving things (Martusewicz, Edmundson & Lupinacci, 2011). In this worldview human beings are dominant over nature and nature is viewed as nothing more than a resource to be used for human consumption. The anthropocentric view places humans both separate from and above all of nature (Barry, 2010).

The only reason that nature is perceived as valuable is because it helps enhance human lives (Attfield, 2008). The natural world is viewed as a resource used to provide for mankind and exist solely for the sake of humanity. The idea of preserving both individual species and complete ecosystems is warranted on the basis of the interest of mankind (Attfield, 2008).

*Ecocentrism*. Ecocentrism can be thought of as the opposite of anthropocentrism. The prefix eco means ecology therefore, the term ecocentrism is used to denote a nature-centered, as opposed to human-centered, system of values (Attfield, 2008). This worldview places large value on the ecosystem as a whole, and shared value between component individuals which make up the ecosystem (Attfield, 2008). Thus, rights are extended to all parts of an ecosystem including, but not limited to: rivers, lakes, mountains, dirt, plants, animals, insects, and humans. Humans are viewed as an equal part of nature, not dominant over it.

*Exemptionalism*. The exemptionalism viewpoint is that the human/environment relationship is unimportant because mankind is exempt from the forces of the environment via our own cultural enhancement (Catton & Dunlap, 1978). Humans are above nature and are able to surpass any limitations placed on them by nature due to their own ingenuity. It is these ideas of superiority over nature that empowers mankind not be governed by natural conditions and be in complete control of their own fate (Catton & Dunlap, 1978). Exemptionalism separates humans from nature on the basis of supremacy and ingenuity which in turn creates a disconnect between humans and the environment on the basis that the environment is not an important asset to humankind.

The aforementioned three factors that affect environmental orientation also exist as the counter part of all three factors. The three counter parts are also important factors affecting and individual's environmental orientation. For example while anthropocentrism is known as the tendency of humans to view themselves as the central entity in the universe, antianthropocentrism is known as the tendency of humans not to view themselves as the central entity in the universe. The same idea can be applied to ecocentrism and exemptionalism.

## Components of Environmental Education

As defined by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1977, "environmental education as the process aimed at developing a world population that is aware of, and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively toward solutions of current problems and the prevention of new ones". It is important to also remember that proper environmental education does not promote a single particular solution to anyone of our current environmental problems. Environmental education should be used as a tool to create a pro-environmental orientation within students in order to minimize the destructive impact humankind has on the environment. Ultimately, environmental education must aim to change the environmental worldview (attitudes, beliefs, and values) of students in order to promote a change in behavior and knowledgeable scientifically grounded action (Short, 2010).

Environmental learning programs need to actively engage learners as well as use methods that are the most likely to translate into everyday life in order to better prepare

students for a lifelong commitment to pro-environmental thinking and actions (Short, 2010). It is imperative that pedagogy used promotes critical thinking instead of passive knowledge transmission, as well as collaborative problem solving (Short, 2010).

In order for environmental learning programs to truly have a positive impact on the environment students must gain knowledge, confidence, experience, and skills that are necessary to identify, correct, and fix the environmental problems of today and the future (Short, 2010). "When people understand which behaviors are pro-environmental, why they should engage in those behaviors, and how to engage in those behaviors, they feel more competent about the environment and are more likely to engage in pro-environmental behaviors" (Darner, 2009).

Furthermore, it is essential that all environmental education programs include aspects of awareness, knowledge, skills, attitude, and participation. A common short coming of many environmental education learning programs is the idea that if students become more knowledgeable about the environment they will automatically develop a pro-environmental orientation in turn calling them to action (Darner, 2009). Environmental education, when properly taught and understood develops a lifelong commitment to education, which can be used as a tool when dealing with the rapidly changing environmental issues worldwide (GDCR, 2008). The Global Development Research Center (2008) defines the components of environmental education as the following: awareness, knowledge, skills, attitude, and participation.

## Research Hypothesis

As previously mentioned I began this research project with the idea that, environmental education is a necessary and essential component of curriculum within

today's school systems. From this idea stemmed the hypothesis that students who participate in environmental learning programs during the course of their secondary education will have a pro-environmental worldview (attitudes, beliefs, and values). This study will help determine the impact of an environmental learning program on the environmental orientation of secondary school aged students.

# CHAPTER II

# LITERATURE REVIEW

## Key Terms

*Climate Change*: A significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years.

*Environmental Education*: Refers to organized efforts to teach about how natural environments function and, particularly, how human beings can manage their behavior and ecosystems in order to live sustainably.

*Pedagogy*: The study of being a teacher or the process of teaching. The term generally refers to strategies of instruction, or a style of instruction.

*Curriculum*: The set of courses, and their content, offered at a school or university.

*Anthropogenic*: Human impact on the environment or anthropogenic impact on the environment includes impacts on biophysical environments, biodiversity and other resources.

*Fossil Fuel*: Fuels formed by natural processes such as anaerobic decomposition of buried dead organisms.

*Green House Gas*: A gas in an atmosphere that absorbs and emits radiation within the thermal infrared range.

*Biodiversity*: The degree of variation of life forms within a given ecosystem, biome, or an entire planet.

*Conservation*: Preservation, protection, or restoration of the natural environment, natural ecosystems, vegetation, and wildlife.

*Environmentalism*: A broad philosophy, ideology and social movement regarding concerns for environmental conservation and improvement of the health of the environment, particularly as the measure for this health seeks to incorporate the concerns of non-human elements.

## Introduction

There are five main topics in this literature review: Global Climate Change, Environmental Education, Essentials of Environmental Education, Environmental Education Curriculum, and Bringing Pedagogy and Curriculum Together. I chose to include global climate change as part of my research because it plays a vital role in why we need to be including environmental education as part of our curriculum. In the environmental education section I present a brief introduction to environmental education as well as a brief history of environmental education. The essentials of environmental education portion of my literature review focuses on the pedagogical framework that is associated with environmental education. The environmental education curriculum section is a brief overview of some curriculum and ideas that pertain to environmental education. Finally, the section of the literature review titled bringing pedagogy and curriculum together focuses on Research Experience for Teacher (RET) programs and how they are designed in a way which promotes experiential learning for both students and teachers and how research done by teachers alongside scientists can translate to improved quality of curriculum.

## Global Climate Change

Climate, by definition, is a description of a long-term weather pattern and can be applied either globally, or in a particular area (Solomon et al., 2007). Therefore, climate change refers to an identifiable change in the properties and/or means of a specific climate. Climate by definition is a longer-term weather pattern, hence, in order to be considered climate change conditions must persist for an extended period of time, typically decades or more (Solomon et al., 2007). Climate change occurs, and has always occurred, naturally due to internal and external processes. Some examples of naturally occurring external influences would be the sun's brightness, and major volcanic eruptions. Other external influences of change can be human caused, or anthropogenic (non-naturally occurring).

Just prior to the beginning of the industrial revolution to the present day, concentrations of $CO_2$, $CH_4$, and $N_20$ (greenhouse gasses) have risen by over 31 percent, 151, percent, and 17 percent respectively (Cunningham & Cunningham, 2006). Carbon dioxide, which is undoubtedly the leading cause, of anthropogenic climate change is at its highest atmospheric levels in 800,000 years (Lindsey, 2010). Many human activities are responsible for releasing $CO_2$ into the atmosphere: making cement, burning fossil fuels (the major contributor), and burning grasslands and forests. These activities alone input nearly 30 billion tons of $CO_2$ into the earth's atmosphere every year, (Cunningham & Cunningham, 2006) and if these trends continue in the direction they are headed atmospheric $CO_2$ concentrations could reach 500ppm by the end of the 21$^{st}$ century (Lindsey, 2010). This is nearly twice the preindustrial level of 280ppm (Cunningham & Cunningham, 2006).

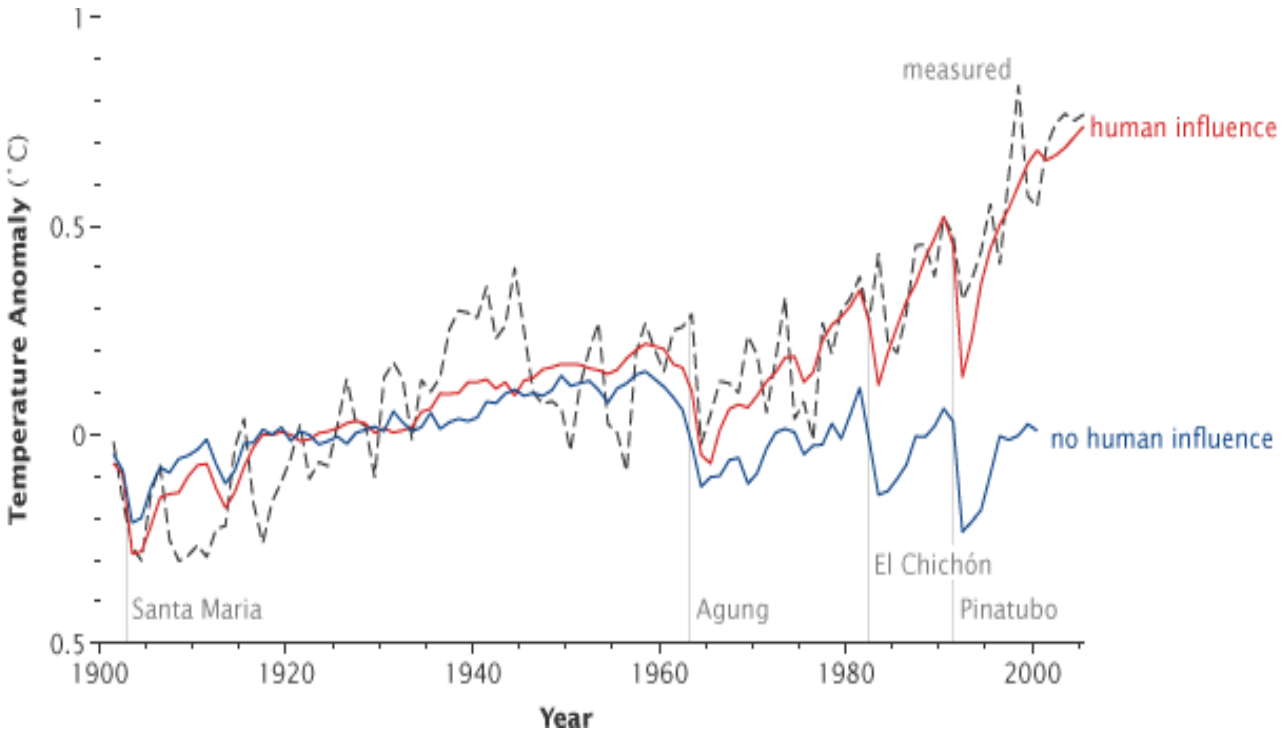


Figure 1. Projected versus Actual Temperature Change

Figure 1 is a representation of when models are used to predict temperatures, over a period of time, based on natural and anthropogenic influences combined (red line) you end up getting very closely related temperatures to what was actually measured over the same time period (dashed line). When the anthropogenic influences are taken out of the models, and predictions are made for the same time period, you end up with a trend of cooling (blue line). Based on actual measured temperatures for the given time period we know that a trend of cooling was not present. Figure 1 which was adapted from Hegerl and Zwiers et al. (2007), confirms that human caused influences on anthropogenic green house gasses are largely responsible for the warming experience over the last 100 years.

A large amount of compiled evidence from around the world suggests that global climate change is a direct result of human actions. The Intergovernmental Panel on

Climate Change (IPCC) (1996) concluded that, "the balance of evidence suggested that there had been a discernible human influence on the climate of the 20th century". Even more evidence was found in the five years after IPCC 1996. At the IPPC 2001, "the panel was able to draw a much stronger conclusion, not just on the detectability of human influence, but on its contribution to climate change during the 20th century" (Solomon et al., 2007). The IPCC (2001) also concluded "in light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in anthropogenic greenhouse gas concentrations".

Not only has there been an increase in temperatures but also in precipitation. There has been an estimated precipitation increase of 1% around the world in the last 100 years (Solomon et al., 2007). Although this amount may not seem significant, that amount of added moisture combined with warmer temperatures is expected to greatly increase the number, and severity, of weather events that occur: rainstorms, hurricanes, flooding, typhoons, and tornados. An example of one such extreme weather event occurred in 2003 when more than 30,000 people died during Europe's hottest summer since 1540 (Cunningham & Cunningham, 2006).

Humans are not the only ones impacted by climate change. Habitats, wildlife, and the biodiversity of earth's ecosystems are potentially taking the hardest hit from climate change. The ice in the Arctic sea has thinned by 40% over the last 100 years which has caused a major loss in habitat, and therefore population size, of many of the arctic animals: ice fox, polar bears, walruses, caribou, beluga whales, and musk oxen (Cunningham & Cunningham, 2006). If we continue on this current trend, all of the

glaciers that are now present at Glacier National Park, Montana, will be extinct by 2070 (Cunningham & Cunningham, 2006). Between Europe and North America alone there has already been an extinction of 57 species of butterflies due to the change in climate of their natural habitats (Cunningham & Cunningham, 2006). As illustrated above global climate change is a serious problem that has potentially deadly risks for humans, wildlife, and all living beings on the earth.

## Environmental Education

### Introduction to Environmental Education

UNESCO (1977) defines environmental education as, "the process aimed at developing a world population that is aware of, and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively toward solutions of current problems and the prevention of new ones".

Environmental education, when properly taught and understood develops a lifelong commitment to education, which can be used as a tool when dealing with the rapidly changing environmental issues worldwide (GDCR, 2008). It should inform the learner of past problems, current problems, and project issues of the future. When armed with this information and a personal commitment the learner will be equipped with the skills and attributes needed to have a positive influence on protecting the well being of the environment and all that is associated with it. This positive influence is a combination of conservation, preservation, and repair of the entire spectrum of the environment. The Global Development Research Center (2008) defines the components of environmental education as the following:

1. Awareness and sensitivity to the environment and environmental challenges
2. Knowledge and understanding of the environment and environmental challenges
3. Attitudes of concern for the environment and motivation to improve or maintain environmental quality
4. Skills to identify and help resolve environmental challenges
5. Participation in activities that lead to the resolution of environmental challenges

These components are directly correlated to the goals of environmental educators, which are defined by James Neill (2006):

1. Help students develop factual knowledge about the natural environment, particularly with regard to how ecosystems work and human impacts on the natural environment.
2. Foster more positive perceptions about the value of the natural world.
3. Develop eco-friendly habits, such as getting people to recycle and to produce less waste.
4. Engage students in environmental rejuvenation projects and action.
5. Develop students' psychological and spiritual relationship with nature.

**History of Environmental Education**

Jean-Jacques Rousseau is considered to be one of the founders of environmental education with his 18$^{th}$ century work stressing the importance of education that focused on the environment (Cronon, 2010). A number of years later Swiss naturalist Louis Agassiz closely mimicked the teachings of Rousseau. Agassiz's philosophy prompted students to "Study nature, not books" (UCMP, 2010). The work and teaching of these

scholars directly influenced “Nature study”, the environmental education program which took place in the late 1800’s and early 1900’s.

Nature study education used stories and moral lessons to teach students to both appreciate and embrace the world of nature (Cronon, 2010). Another influential figure in the nature study movement was Anna Botsford Comstock. Comstock was the head of the Department of Nature Study at Cornell University and wrote *The Handbook for Nature Study*, which used the ideas of the natural world to teach about values (Stapp, 1970). Comstock’s book and teachings played a significant role in gaining support for Nature Study from scientists, teachers, and students. Comstock, and other figures in the Nature Study movement, also played a significant role in changing curriculum of environmental education for students across the United States (Stapp, 1970).

The Great Depression of the 1920’s and 1930’s had a significant impact on the course of environmental education in the United States. The hard times and financial situations of many in the U.S. sparked a new direction in environmental education: Conservation Education (Cronon, 2010). “Conservation Education dealt with the natural world in a drastically different way from Nature Study because it focused on rigorous scientific training rather than natural history. Conservation Education was a major scientific management and planning tool that helped solve social, economic, and environmental problems during this time period” (Cronon, 2010).

Environmentalism, the modern environmental education movement, took shape in the 1960’s and 1970’s. Environmentalism’s roots stem from a combination of both Conservation Education as well as Nature Study (Palmar & Neal, 1994). The 60’s and 70’s were a time of much turmoil for U.S. citizens. Events like the Vietnam War, Civil

Rights Movement, the Kennedy Assassination, Three Mile Island, and the Cold War caused many Americans to view each other in a negative way. However, as citizens began to understand and fear the consequences of radiation, pollution, waste disposal, and the use of pesticides which were mentioned in Rachel Carson's *Silent Spring*, Environmentalism became a unifying agent for U.S. citizens (Mobley et al., 2010).

The first Earth Day, which took place on April 22, 1970, was implemented on a national level in an attempt to teach about current environmental problems. This event signified a major step towards modern environmental education. In the wake of the first Earth Day, President Nixon passed the National Environmental Education Act (NEEA) the same year. The NEEA was put in place to incorporate environmental education into K-12 schools (EETP, 2002). The following year, 1971, the North American Association for Environmental Education (NAAEE) was created; the goal of the association was to "improve environmental literacy by providing resources to teachers and promoting environmental education programs" (NAAEE, 2010). The programs and acts, such as the NEEA and NAAEE, which were created during this time period, are the foundation for our current systems of environmental education.

## Essentials of Environmental Education

Environmental education is a phenomenon of the last 30-40 years. It is now uncommon to find a school district lacking some type of environmental education not present in their curriculum. The major concern regarding environmental education pedagogy is not that it is lacking but the way in which the content presented within has changed, while the pedagogy has not. In other words, we are much more informed both scientifically and socially about the environmental crisis than we were 50 years ago.

However, most curriculum created around environmental education is being presented using the same methodology and ideology that were being used 50 years ago. In this regard Stevenson's (1987) words of over twenty years are just as true today as they were when he spoke them. "Teachers, to a large extent, are still continuing to carry out pedagogical practices or transmitting discrete disciplinary-derived factual information and unproblematic truths" (Stevenson 1987).

As with any structurally sound pedagogical practice, environmental education and education for sustainable development (ESD) pedagogy needs to be multifaceted and multilayered. Eliam and Trop (2010) placed the pedagogical essentials of environmental education into a model containing four layers. The first of these layers, in regards to academic learning pedagogy, was termed by Orion (2003) as "non-natural." As the model progresses through the layers other necessary pedagogical components are added in order to reorient and improve environmental education teaching practices. The setup of the four levels, or layers, starting with layer one and ending with layer four is an attempt to include all essentials of environmental education pedagogy. At each new layer a different component is added. Each of the new layers is essential but not exclusive and must be implemented together to achieve the overall objectives of environmental education.

**Layer One**

The first step of Eliam and Trop's (2010) model is described as a traditional academic style of teaching and learning. This is a starting point because this is what Orion (2003) described as "non-natural" learning, because this is the level of much of the current environmental education curriculum being used today. Orion (2003) describes this stage as

> "Taking place in a closed space that has no relation to any learnt subject; only rarely includes real life concrete experiences with the subject to be learnt; has no immediate relation between the subject to be learnt and learner's relevant world; verbal communication replaces the experience through description of imaginative situations; the learning is carried out among a large group; and it is very difficult to adjust the learning for individuals' (specific needs)." (p. 58)

An example of this type of learning pedagogy would be something similar to the following: An earth science teacher stands in front of the class and lectures about the effects of greenhouse gasses and pollution on the atmosphere and the relationship with global climate change. The teacher would list certain gasses and their characteristics and the students would take notes on them. This type of environmental education curriculum would be classified as factual teaching and would support analytical-rational modes of intelligence (Eliam & Trop, 2010).

**Layer Two**

The second step is labeled as multidisciplinary teaching-learning. This step along with the following two (steps three and four) would be a classification of "natural" learning as described by Orion (2003). Natural learning is the on the exact opposite end of the spectrum of non-natural learning. An example of this type of pedagogy could be described as: The earth science teacher teaches the students about the chemical makeup of the different levels of the atmosphere and the individual effects that certain greenhouse gasses have on the different layers. The chemistry teacher would then teach about certain

chemical reactions that have end products the same as, or similar to, greenhouse gasses. The students would then go into the laboratory to test different chemical reactions and the amount of gas that is released by them. Finally, the economics teacher would present about how the changing climate has affect the local economy.

The above example includes acquisition of knowledge from a variety of different subjects or disciplines: earth science, biology, chemistry, and economics. In many examples from published literature multidisciplinary approaches to learning are thought to be strong source of attaining systematic thinking and the understanding of cause and effect relationships within systems. The importance of systemic thinking with regard to environmental education is highly emphasized in the literature (Breiting et al., 2005; Fien & Tilbury, 2002; Hopkins & McKeown, 2002; Mogensen & Mayer, 2005). As reported by Mogensen and Mayer (2005) "multiperspective analysis is needed if students are to gain in-depth knowledge of environmental problems".

**Layer Three**

Step one is traditional academic learning, step two is multidisciplinary learning. If you consider taking the combination of steps one and two and adding time and space you have step three: multidimensional learning. The example of step three continues as such: Students do research on the changing Environmental Protection Agency (EPA) standards for emissions of a variety of pollutants (the same pollutants they learned about and did laboratory testing on in steps one and two) and how they have changed in the last 50 years. The students then compile all of the information they have thus far on their pollutant of choice (biological, chemical, environmental, and economical) and create a

presentation, which includes a timescale of sorts based on the changes reported by the EPA for their pollutant.

Looking at systems in ways that include both time and in space (multidimensional), facilitates the development of contextual ways of thinking (Breiting et al., 2005; Hopkins & McKeown, 2002), and acquisition of abilities to think "out of the box" and investigate systems in their relations to other systems, other spaces, and other times (Eliam & Trop, 2010). This ability to learn, analyze, and piece together information from multiple disciplines as well as multiple dimensions in a systematic way is a critical skill in relation to environmental education.

**Layer Four**

The fourth and final step of this model is emotional learning. Just as with all the preceding steps this is a combination of steps one through three with the addition of emotional learning. The example continues as follows: The children are encouraged to express their emotions/feelings about their research and findings during an all class discussion. They are then assigned the task of going home and teaching someone in their family about the effects of their pollutant on the atmosphere, but would be instructed to do it in a way that didn't show any of their emotions regarding the material. After they have taught the material to a family member they must next interview the family member about the emotions/feelings they experienced while learning about the issue. The next day students would share these interviews with the class and would have the opportunity to again speak about how they felt.

When emotions are included in any type of learning situation an individual's values and ethics also become tied to the issue that is being taught. When incorporated

with one another you are left with both cognitive and emotional processes (De Sousa, 1987). Emotional ties to a learning activity are particularly important when it comes to environmental education. While all steps of the model are important, emotional learning is the biggest encourager of action and commitment. Even without the fourth and final step the model is a great representation of complete cognitive curriculum but more often than not will lack responsible environmental action or commitment from the students. Incorporating emotional learning in schools is a very important aspect of the school experience. Unlike rigid intelligence quotients, emotional intelligence is not determined genetically nor is it fixed at any point in our lives. (Eliam & Trop, 2010)

In the above section the four essential steps of environmental education pedagogy were explained and dissected layer by layer. Elaim and Trop (2010) argue that when traditional academic learning, multidisciplinary learning, multidimensional learning, and emotional learning are implemented together, as a model for environmental education pedagogy, the combined outcome will be far superior when compared to the outcome if one or more of the steps are not present. Two of the expected pieces of this outcome are ethics and values with regards to environmental education. "In recent environmental education discourse, ethical and value clarification has evolved as a highly desired outcome of the education process" (Eliam & Trop, 2010).

## Environmental Education Curriculum

Defining the content involving environmental education can be problematic. The issue often lies in the ambiguous nature of the definition of environment.

> "Since the environment is all embracing then it must, to some extent at least, be considered in its totality to include aspects

> which are urban and rural, technological and social, aesthetic and ethical: Throughout primary and secondary education, the human environment, both rural and urban should be regarded as a continuum from the wilderness, through the productive country side, small settlements and suburbs, to the heart of the inner city" (NAEE, 1975).

The all encompassing nature of the term environment can be seeing as both a benefit as well as a burden when related to developing curriculum. In one case, environmental education may become related to the broad spectrum of education, which often causes a loss of identity, or very specific individualized aspects may be taken out to enhance both teaching and learning exercises (Palmer & Neal, 1994). The danger in either of these cases is the possibility of missing out on the fundamental aspects and ideologies of environmental education. However, there is a way to combat the issue, by "recognizing that an environmental dimension can be found in most aspects of education—the environmental education may be considered to be an approach to education which incorporates considerations of the environment, rather than being a separate part of education" (Palmer & Neal, 1994).

Regardless of the sometimes-ambiguous nature of environmental education there are certain necessities of content that must be present to ensure both productive and valuable teaching and learning. Palmer and Neal (1994) identify three threads which should be present; education *about*, *from*, and *for* the environment.

1. Education ABOUT the environment is a heavily cognitive measure. This thread revolves around analytical learning of information regarding the environment and environmental issues.
2. Education FROM the environment requires that the educator use the environment as a resource for teaching. The educator should use the environment both as a source for material, as well as a source of enquiry.
3. Education FOR the environment deals with developing concern for the environment. This theme deals with the emotional aspect, which is needed to have a truly inclusive environmental education curriculum. The goal of education for the environment needs to go beyond general knowledge and into involvement. This involvement should be such that values are developed which eventually influence behavior.

The three threads presented above attempt to provide a framework for which environmental education curriculum can be built upon. Although the content, style, and situation may be very diverse depending on where the curriculum is being implemented, the three above themes present a scaffold on which to build solid environmental education curriculum.

## Bringing Pedagogy and Curriculum Together

### Research Experience for Teachers (RET)

As described in previous sections current scientific textbooks along with current methods of teaching science materials are a far cry from the type of educational practices that are needed to promote science literacy. These books and teaching practices often times stress the importance of learning answers, not the importance of the pursuit of

finding answers to scientific questions through experiential learning, research, teamwork, and modern technology (Rutherford & Ahlgren, 1989). Research Experience for Teachers (RET) is a professional development platform in which elementary and secondary teachers are placed in a laboratory or research setting for six to eight weeks during the summer where they are provided with the opportunity to work side by side with scientists and be involved in real world scientific research. Engagement in real world science research is task that gives teachers the opportunity to use and further develop procedural knowledge which they can then pass on to students in their own classrooms (Driscoll, 2005). As stated by the National Research Council (1999), creating meaningful opportunities for teachers of all levels to develop science knowledge, while also participating in well-developed professional development programs should be common goal of all educators.

Previous research on designing effective professional development programs for teachers of science has concluded that there are seven necessary components to a quality professional development program (Loucks-Horsley et al., 2003).

1. Is driven by a well-defined image of effective classroom learning and teaching
2. Provides opportunities for teachers to build their content and pedagogical content knowledge and examine practice
3. Is research based and engages teachers as adult learners in the learning approaches they will use with their students
4. Provides opportunities for teachers to collaborate with colleagues and other experts to improve their practice
5. Supports teachers to serve in leadership roles

6. Links with other parts of the education system
7. Has a design based on student learning data and is continuously evaluated and improved

The RET platform was designed in such a way to incorporate these components and therefore provides a viable system of learning for K-12 teachers (Loucks-Horsley et al., 2003). "The RET program features are specifically designed to encourage reflective planning based on teachers' understanding of inquiry, experimental design, the nature of science, process skills and communication" (Grove et al., 2009).

As is the case with any learning experience that teachers provide for their students the goal is not only to acquire new information, but to be able to use that information and apply it to future situations (Woolfolk, 2007). "As a professional development program, the RET program also supports this transfer of knowledge for teachers to enrich their own science instruction in their classrooms" (Pop et al., 2010). The RET platform gives participating teachers ample opportunities to experience the reality of what takes place on the front lines of science research while working side by side with scientists. During this time teachers take on the role of students with regards to the learning process in order to obtain the knowledge and skills that are necessary to practice the science they are involved with (Pop et al., 2010). These experiences give participating teachers the opportunity to be directly involved in science research which translates to the ability to cultivate their own beliefs about scientific research (Grove et al., 2009). These feelings and beliefs become very useful and important to incorporate into their own teaching and classrooms (Pop et al., 2010).

Over the past few decades RET programs have gained support and popularity as the platform has proven to be a successful form of professional development. As reported by Pop et al. (2010), the majority of teachers involved in an RET program felt that the RET program provided a valuable platform with which they could work in collaboration with other teachers, build a support network, and share learning experiences. These are the reasons that the National Science Foundation (NSF) has chosen to support RET programs over the last twenty years. NSF feels that the programs "meet stated objectives to provide teachers with real world research strategies" (Evaluation of RET Program, SRI International 2007). Through funding from the NSF there are now over seventy RET programs nationwide and these programs have remained a consistent part of NSF funding for the last twenty years (Pop et al., 2010).

## Conclusion

Ever since the time of the industrial revolution we have been blatantly disregarding the way in which we have treated the environment. The effects of the disrespect and disregard of the past 100 years are now coming full circle in a phenomenon known as global climate change. Although a large majority of the damage has already been done we need to use our history of mistakes in order to educate for the future. If we use or mistakes as a tool for learning we have the possibility to contain the negative effects they will have on our environment. We will also be able to eliminate the possibility of making the same mistakes in the future.

"Environmental education at its core is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills

to work individually and collectively toward solutions of current problems and the prevention of new ones" (UNESCO, 1977). Although the term may have any number of different meanings to any number of different people, the basis of environmental education is respect. If we start treating the environment as the living being that it really is we will be more likely to make better decisions when it comes to matters surround the natural world.

The pedagogical framework for environmental education includes four necessary steps: traditional academic learning, multidisciplinary learning, multidimensional learning, and emotional learning. While each of the steps plays a significant role in the overall process of environmental education, if any one of them is removed from the pedagogical framework both the individual step and the overall process becomes weaker. Increased emphasis needs to be put on the emotional learning step of the process. The factual knowledge and skill set are necessary but the emotional investment is what will spark behavior change. Without behavior change it will be impossible to tackle the environmental issues of the present.

In spite of the ambiguous nature of defining environmental education curriculum there are certain necessities of content that must be present to ensure both productive and valuable teaching and learning experiences. These include three threads which should be present, education *about*, *from*, and *for* the environment. Regardless of content, style, or educational situation these threads provide solid scaffolding on which to build environmental education curriculum that will be both inclusive and strong.

Strong environmental education pedagogy and curriculum are a must in today's world. We are in a period of environmental crisis and we need to make changes that

reflect the severity of that crisis. Knowledge is power, and education is the bridge between them. RET programs are one example of ways in which to modernize and improve environmental education. The experiential learning that teachers involved in RET programs are subject to often translates in to improved science curriculum and meaningful experiential learning for their students. The knowledge gained by students gives them the tools they will need to solve the environmental issues and problems of the future. Therefore, environmental education is an educational necessity and needs to start being treated as such.

## Research Hypothesis

I began this research with the idea that, environmental education is a necessary and essential component of curriculum within today's school systems. From this idea stemmed the hypothesis that students who participate in environmental learning programs during the course of their secondary education will have a pro-environmental worldview (attitudes, beliefs, and values). This study will help determine the impact of an environmental learning program on the environmental orientation of high school aged students.

# CHAPTER III

# METHODOLOGY

## Introduction

This research study was designed to assess the impact of environmental learning programs on the environmental worldview (attitudes, beliefs, and values) of high school aged students who were near the completion of an A.P. Environmental Science course. The goal of this research was to examine if students who participate in environmental learning programs during the course of their secondary education will have a pro-environmental worldview (attitudes, beliefs, and values).

## Population

There were 41 individuals who comprised the group of students surveyed for this study. All of the students surveyed are of high school age (14-18 years old) and all of the students who completed the survey were registered $12^{th}$ grade students at the time they participated in the survey. This particular population was chosen due to the fact they were already enrolled in an environmental learning program and they fall within the age range of secondary education students.

All of the students who participated in the survey were enrolled in an A.P Environmental Science course. As outlined by the district science curriculum Environmental Science is designed to provide the students with the most basic ecological concepts which will be supported by laboratory and field work. The goals of this course are to provide the student with:

- An awareness of economic, social, political, and ecological interdependence.
- Opportunities to acquire the knowledge, values, attitudes, and commitment and skills needed to protect and improve the environment.

The units of study for this course include: social and biological background, populations, resource and energy, land and water use, and pollution. This course is designed to prepare the student for continued advanced study.

In order to protect the identity of the students and the answers that they provided to the survey anonymity was given priority over identifying demographic characteristics. The survey involved little identifying information. Students were given a letter and number combination that was placed on the survey but was only used for identification and tracking of student responses over the period of the study by the researcher. The responses of specific students were kept completely confidential and any reporting of data was done using non-identifiable codes.

## Research Design

To construct an understanding of the high school student's environmental orientation, the researcher collected data through the administration of the New Ecological Paradigm (NEP) survey. The survey used in this study was quantitative and required individuals to respond to a series of statements about the environment and environmental issues on a scale ranging from strongly agree to strongly disagree (strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree).

Quantitative research was the most appropriate method for this research study because it gave the researcher the ability to collect a substantial amount of data from an average sample size in a relatively short amount of time. The survey that the researcher

chose to use, the New Ecological Paradigm (NEP), is a form of a self-completion survey. Self-completion surveys are an effective tool to use when there is a strong connection or familiarity between the respondent and the subject matter ("Chapter 6: Introduction," 2006). The connection or familiarity between the subjects and the survey content leads to genuine responses and a high response rate ("Chapter 6: Introduction," 2006).

**Survey**

The survey administered to the students near the completion of their A.P. Environmental Science course is known as the New Ecological Paradigm (NEP). Developed by Dunlap and Van Liere (1978) the New Environmental Paradigm became the most widely used instrument to measure environmental ethics. Over many years of use the meaning and structure of the New Environmental Paradigm were challenged. In response to this Dunlap and Van Liere revised their scale by altering word choice in an attempt to clarify and update items (Cordano et al., 2003). The revised scale is now known as the New Ecological Paradigm (NEP). This survey has become widely used as a measure of pro-environmental orientation. The survey consisted of a series of statements designed to measure the student's pro-environmental orientation. Research participants were asked to respond to statements on a scale ranging from strongly agree to strongly disagree (strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree). The eight odd-numbered items were worded so that agreement indicates a pro-environmental orientation, and the seven even-numbered ones so that disagreement indicates a pro-environmental orientation. Research participants were asked to respond to the following fifteen statements:

- We are approaching the limit of the number of people the earth can support.

- Humans have the right to modify the natural environment to suit their needs.
- When humans interfere with nature it often produces disastrous consequences.
- Human ingenuity will insure that we do NOT make the earth unlivable.
- Humans are severely abusing the environment.
- The earth has plenty of natural resources if we just learn how to develop them.
- Plants and animals have as much right as humans to exist.
- The balance of nature is strong enough to cope with the impacts of modern industrial nations.
- Despite our special abilities humans are still subject to the laws of nature.
- The so-called "ecological crisis" facing humankind has been greatly exaggerated
- The earth is like a spaceship with very limited room and resources
- Humans were meant to rule over the rest of nature.
- The balance of nature is very delicate and easily upset.
- Humans will eventually learn enough about how nature works to be able to control it.
- If things continue on their present course, we will soon experience a major ecological catastrophe.

Surveys taken by participants were completed under the direct supervision of the science teacher in the student's normal classroom. Direct instructions for administration of the survey were provided to the teacher by the primary researcher prior to administering the survey. Administration of the survey by the teacher was done due to time constrains as well as an attempt to remove any unease that may have come from an

unfamiliar face (the primary researcher) being in the classroom and therefore affected student responses.

## Assumptions

The major assumptions regarding the research methodology is that the content of the A.P. Environmental Science course affected student answers to the survey statements and that the design and proven usage of the NEP survey that make it a viable single-use survey to address student environmental worldview.

# CHAPTER IV

# RESULTS AND DISCUSSION

## Introduction

At the end of an environmental science course data was collected from a group of students enrolled in the course. This was done in an attempt to assess the impact of environmental learning programs on the environmental worldview (attitudes, beliefs, and values) of individuals who participate in such programs. Upon the near completion of the course students responded to a series of statements directly related to environmental worldview. As the focus of this research study these students' answers were statistically analyzed as a way of determining whether or not being involved in an environmental learning program correlates with a pro-ecological worldview.

## Survey

To construct an understanding of the individual's environmental orientation, data was collected through the administration of the New Ecological Paradigm (NEP) survey. A complete representation of the NEP survey given to the students is represented in Appendix A. The survey was administered to a group a 41 high school age (14-18 years old) students enrolled in A.P Environmental Science class in a mid-west school district of moderate size. Administration of the survey took place on January 13, 2012, exactly two days before the conclusion of semester long environmental learning program which they participated in. The survey used in this study was quantitative and required individuals to respond to a series of statements

about the environment and environmental issues on a scale ranging from strongly agree to strongly disagree (strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree).

The following table provides a breakdown of the students' responses on the scale ranging from strongly agree to strongly disagree. The table is broken down according to survey statement and student response. The bolded numbers indicate the number of students who selected a specific response to a specific survey statement. The number of responses in each category corresponds to the number of students who selected that response out of the 41 students surveyed.

Table 1. NEP Survey Response

| Survey Statement | Survey Response **Student Responses Bolded** | | | | |
|---|---|---|---|---|---|
| | Strongly Agree | Mildly Agree | Unsure | Mildly Disagree | Strongly Disagree |
| We are approaching the limit of the number of people the earth can support. | **14** | **20** | **4** | **3** | **0** |
| Humans have the right to modify the natural environment to suit their needs. | **3** | **7** | **5** | **18** | **8** |
| When humans interfere with nature it often produces disastrous consequences. | **6** | **20** | **9** | **4** | **2** |
| Human ingenuity will insure that we do NOT make the earth unlivable. | **2** | **7** | **20** | **10** | **2** |
| Humans are severely abusing the environment. | **15** | **23** | **0** | **2** | **1** |
| The earth has plenty of natural resources if we just learn how to develop them. | **17** | **13** | **10** | **1** | **0** |
| Plants and animals have as much right as humans to exist. | **32** | **9** | **0** | **0** | **0** |
| The balance of nature is strong enough to cope with the impacts of modern industrial nations. | **0** | **2** | **10** | **21** | **8** |
| Despite our special abilities humans are still subject to the laws of nature. | **11** | **20** | **8** | **2** | **0** |
| The so-called “ecological crisis” facing humankind has been greatly exaggerated. | **0** | **2** | **11** | **17** | **11** |
| The earth is like a spaceship with very limited room and resources. | **7** | **22** | **5** | **7** | **0** |
| Humans were meant to rule over the rest of nature. | **0** | **6** | **5** | **14** | **16** |

| | Strongly Agree | Mildly Agree | Unsure | Mildly Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| The balance of nature is very delicate and easily upset. | **11** | **20** | **5** | **3** | **2** |
| Humans will eventually learn enough about how nature works to be able to control it. | **4** | **13** | **9** | **9** | **6** |
| If things continue on their present course, we will soon experience a major ecological catastrophe. | **22** | **13** | **4** | **0** | **2** |

## Results

Upon completion of the NEP survey by the students, the student's responses to all fifteen statements were converted to a scale ranging in value from 4 to 1. A complete representation of the conversion of scores is included in Appendix B. These values are based on a scale ranging from strongly agree to strongly disagree and were different for odd and even numbered items. Development of this scale was essential due to the fact the eight odd-numbered items were worded so that agreement indicated a pro-ecological view and the seven even-numbered items so that disagreement indicated a pro-ecological view.

An example of this scale would be as follows; if a student answered strongly agree to an odd numbered item that particular item would receive a score of four. If the student answered mildly agree, that particular item would receive a score of three, mildly disagree would receive a score of two, and strongly disagree would receive a score of one. The opposite would be true of an even numbered item; if a student answered strongly agree to an even numbered item that particular item would receive a score of one. If the student answered mildly agree, that particular item would receive a score of two, mildly disagree would receive a score of three, and strongly disagree would receive a score of four. For each item present on the survey the students had the opportunity to avoid responding to the item by responding unsure. If a student responded unsure to any of the fifteen items present on the survey no score would be assessed to that item and it would not be taken into account when calculating the overall score for that particular student. This precautionary measure is significant because if a student were to not

understand a particular item they were not forced to give and answer by which they may unknowingly misrepresent their true orientation towards that specific item.

With a scale ranging from 4 to 1 any score above 2.5 would indicate a pro-ecological view, meaning that any score below 2.5 would indicate the opposite. Analysis of these scores resulted in average scores for each item, student, class, and complete sample. All of which are reported in Appendix B. Of the 15 items present on the survey only one item (item 6) had an average score below 2.5 (1.57). The highest average score for an individual item was 3.78 (item 7) and the combined average for all items was 3.03. Of the 41 students surveyed 40 students scored in the range indicating a pro-ecological orientation. The high and low student scores, when combining the scores for all 15 items were 3.92 (student A13) and 2.14 (student B11) respectively. The combined sample average for all students surveyed was 3.07.

Using the sample mean (3.07) a statistical analysis was done to establish a 95% confidence t-interval for the mean score of the entire population. The analysis resulted in a calculated threshold of [2.97, 3.16] for the mean score of the entire population.

## Discussion

The combined sample average for all students surveyed was 3.07, indicating a sample score well within the established range for pro-ecological orientation. Within the sample of the 41 students who participated in the survey only one student scored below the established pro-ecological orientation minimum of 2.5. This indicates that 98% of students within the sample indicated a pro-ecological orientation after being enrolled in a semester long environmental learning program.

Using the sample mean (the average score of all students surveyed) to establish 95% confidence t-interval for the mean score of the entire population is useful because it allows the researcher to collect data from a sample, that is a part of a larger population, and apply the results and analysis of the data collected to the entire population of which the sample comes from. In the case of the NEP survey results the sample is made of up all 41 students who completed the survey. The population to which this particular sample comes from would be the entire population of secondary students who have taken a semester long environmental science course. Hence, it can be said with 95% confidence that the mean score of the entire population of secondary students who have take an environmental science course would fall somewhere within the threshold of [2.97, 3.16]. It should be noted that the entirety of this threshold is above the minimal margin of 2.5 that was previously established to indicate a pro-ecological orientation.

It should be noted that this study does have limitations and assumptions. The short time frame given to complete the study, due to delays in getting the needed approval, resulted in a relatively small sample size. It is also assumed that the content of the A.P. Environmental Science course affected student answers to the survey statements and that the design and proven usage of the survey make it a viable single-use survey to address student environmental worldview. Despite these limitations and assumptions the author feels the results of the study provided evidence that the research and analysis completed provided an accurate representation of the effect that a semester long environmental learning program can have on the environmental orientation of any individual involved.

# CHAPTER V

# CONCLUSION

## Summary

The idea and motivation for this research project began with the researcher's idea that, environmental education is a necessary and essential component of curriculum within today's school systems. The planet that we call home is changing. The effects of thousands of years of anthropogenic influence are now beginning to present themselves. This plethora of environmental problems we are now facing include, but are not limited to: loss of biodiversity, climate change, ozone depletion, pollution caused health issues, water scarcity, and the buildup of green house gasses (Barry, 2010). Personal experience and formal education as a teaching professional lead the researcher to believe that the disconnect between people and the nature/environment around them was often due to a lack of education. Because students spend about seven hours a day in school, the researcher feels that environmental education should be highly considered as an avenue for development of environmental worldview (attitudes, beliefs, and values). The culmination of these interests, experiences, and education resulted in the hypothesis that students who participate in environmental learning programs during the course of their secondary education will have a pro-environmental worldview (attitudes, beliefs, and values).

This study was designed to help determine the impact of an environmental learning program on the environmental orientation of secondary school aged students.

The researcher collected data through the administration of the New Ecological Paradigm (NEP) survey to a group of secondary students who had participated in an environmental learning program. The results and statistical analysis of the data indicate that the research study and design are pertinent. The results, which were derived from the statistical analysis of the data, support the research hypothesis. However, in order to determine the extent to which they support the hypothesis further research is needed.

## Implications

Enlarging the sample size, extending the time frame over which the research takes place, and revamping the research design would provide more reliable results with regards to determining the extent to which they support the research hypothesis. Because of the statistical analysis that was used the results of the sample group were applied to the entire population with which the sample came from. The sample size of 41 was large enough to determine statistically significant results; however, a larger sample size would increase the accuracy and reliability of the results. One of the assumptions of the study was that the design and proven usage of the NEP survey make it a viable single-use survey to address student environmental worldview. Having the opportunity to administer the survey on multiple occasions (beginning, middle, and end) over the course of the environmental learning program would eliminate any discrepancy whether or not the content of the environmental learning program affected student answers to the survey statements. Finally, a longitudinal study would better determine if participation in an environmental learning program now, will still affect the environmental orientation of students as young adults and into adulthood. Future researchers should ask: does the participation in an environmental learning program during secondary schooling influence

the environmental orientation of participants 20 to 30 years later? This question is important because ultimately the decisions we make during early adulthood and adulthood with regards to environmental impacts will have a lasting effect on the world we leave to the future generations. Being able to answer the aforementioned question would make it possible to determine if environmental learning programs for school aged children are a viable option for eliminating the disconnect between people and the nature/environment around them and therefore a viable option for addressing the plethora of environmental issues our world now faces.

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# APPENDIX A

# NEP SURVEY

**New Ecological Paradigm (NEP) Survey**

For each of the following questions please your answer (whether you strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree) in the corresponding box below.

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will insure that we do NOT make the earth unlivable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated
11. The earth is like a spaceship with very limited room and resources
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

| Question Number | Strongly Agree | Mildly Agree | Unsure | Mildly Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |

# APPENDIX B

# SURVEY RESULTS AND DATA

| SAMPLE POPULATION | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Question /Student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Average | Sample Average |
| A1 | 4 | 4 | | 2 | 3 | | 4 | 3 | 3 | 3 | 2 | 4 | 1 | 4 | 3 | 3.08 | 3.07 |
| A2 | 3 | 4 | 1 | | 3 | | 4 | | | | 3 | 4 | 3 | 4 | 1 | 3.00 | |
| A3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 2.93 | |
| A4 | 3 | 2 | 3 | 1 | 4 | | 4 | 3 | 4 | 3 | | 3 | 2 | | 3 | 2.92 | |
| A5 | 3 | 3 | 3 | | 3 | 2 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | | 3.23 | |
| A6 | 4 | 3 | 3 | 3 | 3 | 1 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | | 4 | 3.36 | |
| A7 | 4 | 4 | | 2 | 3 | | 4 | 3 | 3 | 3 | 2 | 4 | 1 | 4 | 3 | 3.08 | |
| A8 | 3 | 4 | 1 | | 3 | | 4 | | | 3 | 4 | 3 | 4 | 1 | | 3.00 | |
| A9 | 4 | 3 | 4 | | 1 | 2 | 3 | 4 | 4 | 3 | 3 | 4 | 3 | 2 | 4 | 3.14 | |
| A10 | 4 | 3 | | 2 | 3 | 1 | 4 | | 4 | 3 | 3 | 3 | | 3 | 3 | 3.00 | |
| A11 | 3 | 3 | | 3 | 2 | | 4 | | 3 | | 3 | 3 | | 3 | 4 | 3.10 | |
| A12 | 3 | 3 | 4 | 3 | 4 | 1 | 4 | | 4 | 4 | 3 | 4 | 2 | 1 | 4 | 3.14 | |
| A13 | 4 | | | 4 | 4 | | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3.92 | |
| A14 | 3 | 3 | 3 | 3 | 4 | 2 | 4 | | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 3.29 | |
| A15 | 4 | 3 | 3 | | 3 | 2 | 4 | 4 | | 3 | 3 | | 3 | 2 | 4 | 3.17 | |
| A16 | 3 | 3 | | 3 | 4 | 1 | 4 | 3 | 4 | 3 | | 4 | 3 | 3 | 4 | 3.23 | |
| A17 | 3 | 3 | | 1 | 3 | 2 | 4 | 4 | 2 | 4 | | 4 | 3 | | 4 | 3.08 | |
| A18 | 3 | 4 | 3 | | 4 | 2 | 4 | 3 | 3 | | 3 | 3 | | 1 | 4 | 3.08 | |
| A19 | 3 | | 3 | 2 | 3 | 2 | 4 | 3 | 3 | | | 3 | 3 | 2 | 3 | 2.83 | |
| A20 | | 4 | 2 | | 4 | 3 | 4 | 3 | | | 2 | 3 | 3 | 3 | 3 | 3.09 | |
| A21 | 3 | 3 | 3 | | 4 | | 4 | 3 | 3 | 3 | 4 | 3 | 4 | | 3 | 3.33 | |
| A22 | 3 | | 4 | | 4 | 1 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 2 | | 3.25 | |
| A23 | 4 | 4 | 3 | 3 | 4 | 1 | 4 | 4 | 3 | 4 | 3 | 4 | | | 4 | 3.46 | |
| A24 | 3 | 3 | 3 | | 3 | | 4 | 2 | 4 | 3 | 3 | | 3 | 4 | 3 | 3.17 | |
| B1 | 3 | 4 | 3 | | 3 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | | 2 | 4 | 2.69 | |
| B2 | 4 | 2 | 3 | 2 | 3 | 2 | 4 | 3 | 3 | 2 | 4 | 2 | 3 | 1 | 3 | 2.73 | |
| B3 | 4 | 2 | 2 | | 4 | | 4 | 3 | 4 | 4 | 3 | | 3 | | 3 | 3.27 | |
| B4 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | | 4 | 2 | 4 | 2 | 4 | 2.79 | |
| B5 | | 1 | 4 | 4 | 4 | 1 | 4 | 3 | | 4 | 3 | 3 | 2 | 3 | 4 | 3.08 | |
| B6 | 4 | 3 | 4 | 3 | 3 | | 4 | 4 | 3 | 3 | 3 | 2 | 4 | 3 | 4 | 3.36 | |
| B7 | 2 | 2 | 2 | | 3 | 1 | 4 | 3 | 3 | | 2 | 2 | 3 | 2 | 4 | 2.54 | |
| B8 | | 2 | 3 | 3 | 3 | 1 | 3 | | | 3 | 3 | 3 | 3 | 2 | 4 | 2.75 | |
| B9 | 2 | 3 | 3 | 2 | 3 | 2 | 4 | 3 | | 3 | 3 | 3 | 3 | 2 | | 2.77 | |
| B10 | 3 | 3 | 4 | | 3 | 3 | 3 | 4 | 4 | | 3 | 3 | 4 | | 4 | 3.42 | |
| B11 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | | 3 | 2 | 2 | 3 | 3 | 2 | 1 | 2.14 | |
| B12 | 3 | 3 | 3 | | 3 | 2 | 3 | | 3 | | 2 | | 3 | 2 | 3 | 2.73 | |
| B13 | 4 | | 3 | | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3.46 | |
| B14 | 4 | | 3 | | 4 | 1 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 3.38 | |
| B15 | 3 | 1 | | | 4 | 2 | 4 | | 3 | | | | 3 | 2 | 4 | 2.89 | |
| B16 | 4 | 3 | 3 | | 3 | 1 | 3 | 3 | 3 | | 3 | 3 | 3 | 2 | 4 | 2.92 | |
| B17 | 3 | 2 | | | 4 | 1 | 4 | 4 | | 3 | 2 | 3 | 4 | | 3 | 3.00 | |
| Average | 3.29 | 2.86 | 2.94 | 2.57 | 3.27 | 1.57 | 3.78 | 3.19 | 3.27 | 3.30 | 3.00 | 3.22 | 3.11 | 2.53 | 3.49 | | |
| | | | | | | | | | | | Item Average | | | | 3.03 | | |

| CLASS 1 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Question /Student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Average | Class Average |
| A1 | 4 | 4 | | 2 | 3 | | 4 | 3 | 3 | 3 | 2 | 4 | 1 | 4 | 3 | 3.08 | 3.16 |
| A2 | 3 | 4 | 1 | | 3 | | 4 | | | | 3 | 4 | 3 | 4 | 1 | 3.00 | |
| A3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 2.93 | |
| A4 | 3 | 2 | 3 | 1 | 4 | | 4 | 3 | 4 | 3 | | 3 | 2 | | 3 | 2.92 | |
| A5 | 3 | 3 | 3 | | 3 | 2 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | | 3.23 | |
| A6 | 4 | 3 | 3 | 3 | 3 | 1 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | | 4 | 3.36 | |
| A7 | 4 | 4 | | 2 | 3 | | 4 | 3 | 3 | 3 | 2 | 4 | 1 | 4 | 3 | 3.08 | |
| A8 | 3 | 4 | 1 | | 3 | | 4 | | | 3 | 4 | 3 | 4 | 1 | | 3.00 | |
| A9 | 4 | 3 | 4 | | 1 | 2 | 3 | 4 | 4 | 3 | 3 | 4 | 3 | 2 | 4 | 3.14 | |
| A10 | 4 | 3 | | 2 | 3 | 1 | 4 | | 4 | 3 | 3 | 3 | | 3 | 3 | 3.00 | |
| A11 | 3 | 3 | | 3 | 2 | | 4 | | 3 | | 3 | 3 | | 3 | 4 | 3.10 | |
| A12 | 3 | 3 | 4 | 3 | 4 | 1 | 4 | | 4 | 4 | 3 | 4 | 2 | 1 | 4 | 3.14 | |
| A13 | 4 | | | 4 | 4 | | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3.92 | |
| A14 | 3 | 3 | 3 | 3 | 4 | 2 | 4 | | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 3.29 | |
| A15 | 4 | 3 | 3 | | 3 | 2 | 4 | 4 | | 3 | 3 | | 3 | 2 | 4 | 3.17 | |
| A16 | 3 | 3 | | 3 | 4 | 1 | 4 | 3 | 4 | 3 | | 4 | 3 | 3 | 4 | 3.23 | |
| A17 | 3 | 3 | | 1 | 3 | 2 | 4 | 4 | 2 | 4 | | 4 | 3 | | 4 | 3.08 | |
| A18 | 3 | 4 | 3 | | 4 | 2 | 4 | 3 | 3 | | 3 | 3 | | 1 | 4 | 3.08 | |
| A19 | 3 | | 3 | 2 | 3 | 2 | 4 | 3 | 3 | | | 3 | 3 | 2 | 3 | 2.83 | |
| A20 | | 4 | 2 | | 4 | 3 | 4 | 3 | | | 2 | 3 | 3 | 3 | 3 | 3.09 | |
| A21 | 3 | 3 | 3 | | 4 | | 4 | 3 | 3 | 3 | 4 | 3 | 4 | | 3 | 3.33 | |
| A22 | 3 | | 4 | | 4 | 1 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 2 | | 3.25 | |
| A23 | 4 | 4 | 3 | 3 | 4 | 1 | 4 | 4 | 3 | 4 | 3 | 4 | | | 4 | 3.46 | |
| A24 | 3 | 3 | 3 | | 3 | | 4 | 2 | 4 | 3 | 3 | | 3 | 4 | 3 | 3.17 | |
| Average | 3.35 | 3.29 | 2.88 | 2.50 | 3.29 | 1.67 | 3.92 | 3.17 | 3.40 | 3.42 | 3.00 | 3.50 | 3.00 | 2.78 | 3.43 | | |

| CLASS 2 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Question /Student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Average | Class Average |
| B1 | 3 | 4 | 3 | | 3 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | | 2 | 4 | 2.69 | 2.94 |
| B2 | 4 | 2 | 3 | 2 | 3 | 2 | 4 | 3 | 3 | 2 | 4 | 2 | 3 | 1 | 3 | 2.73 | |
| B3 | 4 | 2 | 2 | | 4 | | 4 | 3 | 4 | 4 | 3 | | 3 | | 3 | 3.27 | |
| B4 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | | 4 | 2 | 4 | 2 | 4 | 2.79 | |
| B5 | | 1 | 4 | 4 | 4 | 1 | 4 | 3 | | 4 | 3 | 3 | 2 | 3 | 4 | 3.08 | |
| B6 | 4 | 3 | 4 | 3 | 3 | | 4 | 4 | 3 | 3 | 3 | 2 | 4 | 3 | 4 | 3.36 | |
| B7 | 2 | 2 | 2 | | 3 | 1 | 4 | 3 | 3 | | 2 | 2 | 3 | 2 | 4 | 2.54 | |
| B8 | | 2 | 3 | 3 | 3 | 1 | 3 | | | 3 | 3 | 3 | 3 | 2 | 4 | 2.75 | |
| B9 | 2 | 3 | 3 | 2 | 3 | 2 | 4 | 3 | | 3 | 3 | 3 | 3 | 2 | | 2.77 | |
| B10 | 3 | 3 | 4 | | 3 | 3 | 3 | 4 | 4 | | 3 | 3 | 4 | | 4 | 3.42 | |
| B11 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | | 3 | 2 | 2 | 3 | 3 | 2 | 1 | 2.14 | |
| B12 | 3 | 3 | 3 | | 3 | 2 | 3 | | 3 | | 2 | | 3 | 2 | 3 | 2.73 | |
| B13 | 4 | | 3 | | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3.46 | |
| B14 | 4 | | 3 | | 4 | 1 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 3.38 | |
| B15 | 3 | 1 | | | 4 | 2 | 4 | | 3 | | | | 3 | 2 | 4 | 2.89 | |
| B16 | 4 | 3 | 3 | | 3 | 1 | 3 | 3 | 3 | | 3 | 3 | 3 | 2 | 4 | 2.92 | |
| B17 | 3 | 2 | | | 4 | 1 | 4 | 4 | | 3 | 2 | 3 | 4 | | 3 | 3.00 | |
| Average | 3.20 | 2.27 | 3.00 | 2.71 | 3.24 | 1.47 | 3.59 | 3.23 | 3.08 | 3.09 | 3.00 | 2.79 | 3.25 | 2.21 | 3.56 | | |

# APPENDIX C

# STATISTICAL ANALYSIS

| SAMPLE POPULATION | Statistic | Standard Error |
|---|---|---|
| Mean | 3.0683 | 0.04718 |
| 95% Confidence Interval for Mean—Lower Bound | 2.9729 | |
| 95% Confidence Interval for Mean—Upper Bound | 3.1637 | |
| 5% Trimmed Mean | 3.0741 | |
| Median | 3.0800 | |
| Variance | 0.091 | |
| Minimum | 2.14 | |
| Maximum | 3.92 | |
| Range | 1.78 | |
| Interquartile Range | 0.35 | |
| Skewness | -0.060 | 0.369 |
| Kurtosis | 2.064 | 0.724 |
| Standard Deviation | 0.30212 | |

# APPENDIX D

# IRB APPROVAL

UNIVERSITY of WISCONSIN
LA CROSSE

To: Gregg Farrell

From: Bart Van Voorhis, Coordinator
Institutional Review Board (IRB) for the
Protection of Human Subjects
bvanvoorhis@uwlax.edu
5-6892

Date: November 17, 2011

Re: **RESEARCH PROTOCOL SUBMITTED TO IRB**

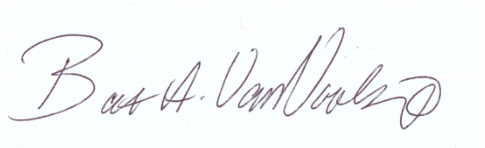
The IRB Committee has reviewed your proposed research project entitled: ***"Assessment of the Impact of Environmental Learning Programs on High School Students."***

The Committee has determined that your research protocol will not place human subjects at risk. **The attached protocol has been approved and is exempt from further review per 45CFR46, 46.101(b)(2).**

However, it is strongly suggested that Informed Consent always be used. Remember to provide participants a copy of the consent form and to keep a copy for your records. Consent documentation and IRB records should be retained for at least 3 years after completion of the project.

Since you are not seeking federal funding for this research, the review process is complete and you may proceed with your project.

Good luck with your project.



cc: IRB File
Gary Willhite, Faculty Advisor

**Graduate Studies and Research & Sponsored Program**
220 Morris Hall, University of Wisconsin-La Crosse
1725 State Street, La Crosse, WI 54601
Phone (608)785-8124 and (608) 785-8007
An affirmative action/equal opportunity employer

# APPENDIX E

# RESEARCH INTRODUCTION LETTER

Dear Student(s),

You have been selected to participate in a research project regarding the necessity of environmental education within school settings. You will be given New Ecological Paradigm (NEP) survey which is made up of 15 questions and should only take about ten minutes. The research is being conducted for the benefit of UW-La Crosse student Gregg Farrell and will be used in completion of his Masters of Education thesis work. Thank you in advance for your time and cooperation.

Gregg Farrell
Masters of Education-Professional Development Candidate
UW-La Crosse

# APPENDIX F

# INFORMED ASSENT

**Informed Assent Form (Required)**
**Assessment of the Impact of Environmental Learning Programs on High School Students**

I have been informed that:

- The purpose of this research is to assess the impact of environmental learning programs on the environmental worldview (attitudes, beliefs, and values) of high school aged students.
- This study will take approximately 10 minutes.
- I can withdraw from the research once the participation has begun. There will be no consequences of withdrawing or declining.
- There are no foreseeable risks or effects of participating in this study.
- My responses are confidential.
- Results from the study will be presented in a grouped format where individual responses are not identified.

Questions regarding study procedures may be directed to Gregg Farrell (920-810-7814), the principal investigator, or the study advisor Dr. Gary Willhite, Department of Education, UW-L (608-785-8130). Questions regarding the protection of human subjects may be addressed to the UW-La Crosse Institutional Review Board for the Protection of Human Subjects, (608-785-8124 or irb@uwlax.edu).

---

Child/Adolescent Understanding:

Have all of your questions been answered regarding how the research study might affect you?
Yes / No (circle one)

If you want to be part of the study, please sign your name. If you do not want to be part of the study, then do not sign your name. **You can say no to being in the study, and you will not be disliked or treated differently.**

Child/Adolescent Name: _____

Child/Adolescent Signature:_____
Date:_____

---

Parent/Court Appointed Guardians Understanding:

Have all of your questions been answered regarding how the research study might affect your child and/or yourself?
Yes / No (circle one)

I believe my child is fully informed and is willing to participate in this study.

Parent or Legal Guardian Name: _____

Parent or Legal Guardian Signature:_____
Date:_____

---

Investigator/Presenter:

I have discussed this study and the possible risks and benefits of the study with the child, and I believe he/she is fully informed and is willing to participate in this study.

Investigator/Presenter Name: Gregg Farrell

Investigator/Presenter Signature:_____
Date:_____

---

What does signing this consent form mean?

A signature indicates that:
• You or your child has read the above.
• You or your child has freely decided to take part in the research study described above.
• The studies general purposes, details of involvement and possible risks and discomforts have been explained to you and your child.

You and your child will receive a signed copy of this consent/authorization form.

Name of the Participant:_____

Signature of Participant:_____ Date:_____
(If 18 or older and able to give informed consent)

----------OR----------

Parent or Legal Guardian Name: _____

Parent or Legal Guardian Signature:_____
Date:_____