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On Environmental Education

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Introduction

Environmental Education teaches the workings of nature (often in nature) in an effort to develop life-long learning skills and foster sustainable human use of the environment. It has served as a blanket term for any education relating to the environment, but in this paper the term Environmental Education refers to the more specific former definition. The term is often applied broadly in the literature, and can mean almost anything from playing with a view of nature, holding any class discussion outside, or directly educating students about climate change (Stapp 1969, UNESCO 1975, UNESCO 1978). The conception of teaching in and about nature was first formulated in the writings of ancient Greek philosophers, and expounded upon by classical philosophers. In modern society, the concept of Environmental Education was revived in the 1960's in tandem with the beginning of the environmental movement, and incorporated many of its principles (UNESCO 1977). Individual schools incorporate the basic principles of Environmental Education, but it has not become widespread in the American school system. However, private schools and select public schools have adopted Environmental Education teaching styles, or even incorporated Environmental Education as an integral component of their curriculum. This paper will examine Environmental Education, explore its historical roots, investigate and review the science and pedagogy that underlies it, critique it, and offer suggestions for a specific curriculum and Environmental Education.

The conception of teaching in and/or about nature appeared in the writings of Aristotle[1] and Plato. Plato, who in his dialogue *The Republic* speaks on the topic of education at length, made the argument that all children, both male and female, should have the same education so that they would be equal.[2] Contained in this education was also an equality of academic disciplines - Plato advocated for all subjects to be taught to students so that their minds would be well rounded and so they would be versed in a variety of subjects. He included learning about the environment and outdoor activities on that list of subjects.[3] A key part of his Platonic ideal of education was the idea that a student's learning should encompass a multitude of subjects so that their unique, individual talents could be unearthed:[4]

> Do not train a child to learn by force or harshness; but direct them to it by what amuses their minds, so that you may be better able to discover with accuracy the peculiar bent of the genius of each.
>
> -Plato, on how to teach children

Jean-Jacques Rousseau in his work "*Emile, or On Education*" (published in 1752) has been influential in the field of education to this day (Wokler 1995). [5] Rousseau writes about the "denaturing" property of civilization upon man in his natural state; postulating that taking man out of the natural world and placing him into an artificial one created by civilization takes something away from the uniqueness of the individual, and lessens him. Rousseau speaks at length in *Emile* about the benefits of being in the natural world vis-à-vis an individual's

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[1] Aristotle was a teacher throughout his life. The remnants of his treatise *On Education*, and his most famous treatise, *Nicomachean Ethics* dealt extensively with how people could develop their intellect and wisdom, which he believed to be an important pursuit.
[2] *The Republic, Book III*
[3] *The Republic, Book III*
[4] *The Republic, Book VI*
[5] *Emile, or on Education was one of the first texts since Plato's to provide an image of how a public education should benefit individuals and communities.*

education and personal growth.[6] His writings are hugely influential because of the questions that he raised about the best ways to educate children. Rousseau concluded that an education based upon exposure to the natural world and exploration of that world is an ideal way for children to be educated, because the individual explores simultaneously his own conduct and the workings of the surrounding world. His work revolutionized the manner in which children were taught, and inspired new methods of teaching, including the later Montessori and Waldorf methods, which place a heavy emphasis upon the inclusion of the outdoors in students' educational experiences.

Emile was also one of the first texts which advocated physical training in the outdoors as a way to "serve as foundation for the reason of the intellect," a topic to which Rousseau devoted many pages.[7] The emphasis on natural experience led in the late 19th Century to the formation of Muscular Christianity, a religious commitment to an ideal of masculinity which held that health and exercise were an important to Christian religiosity. Fear of urban environments affecting the virility of the white races also spurred the creation of the movement. Muscular Christianity originated in the literature of mid-18th and 19th century Europe, and quickly became popular. The creation of movements advocating a return to nature unsurprisingly occurred during the century in which many natural scientists explored ideas and theories, such as the concept of ecology and Darwinism. The idea that the many species of the world are part of a larger web of life was proposed in 1735 by Carl Linnaeus, and advanced by influential naturalist Gilbert White in his seminal book *The Natural History of Selbourne (1752),* in which he observed animals and their apparent ecological niches. Many early naturalists, such as Henry Thoreau, observed phenomena such as ecological succession in forests, and pondered the interconnectedness of life that they

[6] *Emile, or on Education, p. 6 – 18.*
[7] *Emile, or on Education, p. 24, 86 - 89, 91 - 93, 113 – 119.*

saw around them. During this period of early ecological discovery, Charles Darwin wrote the groundbreaking "*On The Origin of Species" (1859)* speculating about how environment affected organisms and their development over time. The discovery of the interconnectedness of life with the environment around it by these early scientists laid the foundation for the nature studies movement, and its direct descendant, Environmental Education.

A more secular proto-Environmental Education movement also began in America around the same time that Muscular Christianity appeared, a movement which gained the appellation of "nature studies". Begun by an American plenipotentiary named George Marsh, the movement arose from his book entitled "*Man and Nature*" published in 1864, which espoused conservationist values and humanity's link to the natural world. The nature studies movement can be understood to be a direct ancestor of Environmental Education (Bodzin et al. 2010). It emerged from the ecological investigations of scientists such as Darwin, Thoreau, and White. Botanist Liberty Hyde Bailey and educator Anna Comstock were both fascinated with the natural world in the late 19th century (partially due to their own upbringing in nature), helped found the nature studies movement. In nature studies they preached learning about the natural world through direct immersion rather than by proxy (Disinger 1985, Bodzin et al. 2010). It normally did not involve any intensive scientific study, instead advocating observation while in nature. Bailey wrote some of the first proto-curriculums and handbooks for nature studies, and Anna Comstock was one of the first educators to bring her students outdoors to learn and study nature. The movement arose in part from concerns with mankind's increasing negative impact on the world; an impact that was readily observed by Thoreau and other natural historians of the time in the forests and fields surrounding regions of the world that were undergoing rapidly industrialization. Fearful that urbanization would remove children from nature, nature studies

sought to prevent that divorce. The movement was active until the mid-20th century, when it was succeeded by its offspring, environmentalism and Environmental Education.

The nature studies movement laid the foundation for almost all other naturalistic educational movements. Nature studies promoted many concepts and techniques that were used by later environmental movements and teaching methods. It essentially taught an appreciation of nature via observation and direct interaction, and occasionally involved aspects of science. A natural succession took place over the 20th century, as academic successors of nature studies came about after the discovery and exploration of the concept of ecology, and allowed proponents of such successors (such as environmentalism) to use empirical discoveries and facts to advocate and support their cause. Early proponents of nature studies, such as Comstock and Bailey, were using nature in the hopes that it would be a demonstrator for students and would teach them about the natural underpinnings of the world. The environmental movement successfully wed the outdoors and modern knowledge to accomplish this.

Another influential figure in the history of Environmental Education is philosopher, psychologist, and educational reformer John Dewey. Dewey, a prolific author whose surprisingly modern philosophical musings upon the goal of education heavily influenced later philosophies of education, wrote many books about the subject. His most relevant books about education are *Democracy and Education* (1916) and *Experience and Education* (1938), in which he discussed what he saw as an ideal education. His views were similar to those of nature studies, which preached learning about the natural world via direct immersion in it.

The nature studies movement flourished for most of a century and was a powerful influence upon individuals such as such as Rachel Carson, who inspired the modern

environmental movement and incorporated many principles of nature studies in it. [8] Environmental Education can be considered a direct continuation-cum-successor of nature studies and the offspring of environmentalism, as both have similar goals and philosophies. With the advent of environmentalism and global concern about the health of the environment, the first nascent forms of modern Environmental Education emerged in the 1960's.

Even more attention was paid to Environmental Education in the 1970's. In 1972, the United Nations Conference on the Human Environment was held in Stockholm. That particular conference called for the specific implementation of Environmental Education that addressed worldwide environmental issues such as resource management and species preservation (UNESCO 1972). In 1975, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) met in Belgrade. Delegates ratified the Belgrade charter, which listed objectives and goals for Environmental Education including awareness of environmental issues, understanding of the environment as a whole, and participation in appropriate actions to fix environmental issues. This charter was an antecedent to the 1978 Tbilisi Declaration, which created a definition of Environmental Education. It is as follows:

> 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.
>
> -UNESCO, 1978

[8] Her book *Silent Spring* (1962) spurred the creation of the movement.

This was one of the first explicit declarations of the goals and overarching philosophy of Environmental Education. This 1975 charter also marked the beginning of the widespread use of the term Environmental Education.

The volume of peer-reviewed academic research produced about Environmental Education has markedly increased since the mainstream use of the phrase began in the 1970's, while a variety of organizations and conferences have come into existence since. In more recent history (1990-present), Environmental Education has become increasingly popular in the United States due to widespread awareness of climate change, and other ways that humanity is affecting the environment. It placed greater emphasis on sustainability, because teaching about the machinations and cycles of the natural world segued seamlessly into teaching about humanity's impact upon it (and how to mitigate that impact). Since the modern formulation of Environmental Education came into existence, research efforts have closely investigated the variety of social, psychological, and educational effects that this form of education can have upon students. It has been found to have a variety of beneficial effects that can widely impact children's minds and behavior. In the following literature review I will explore and discuss peer-reviewed literature on the subject, and will attempt to show that Environmental Education has empirical evidence supporting its ideas and philosophy throughout the literature, while displaying facets of it that are better than traditional education. Many of the articles cited or discussed here are often broad in their implications, and an argument can be made that they could be placed in any of the psychological, social, or educational categories discussed. Articles have been placed in their specific categories because their findings are considered more relevant (or provide more benefits) in that particular area than another

Benefits of Environmental Education

Psychological and Social

The twin goals of learning are to acquire knowledge and gain skills such as problem solving, consensus building, information management, communication, and critical and creative thinking.

-National Science Foundation report (2000)

Before delving into the psychological benefits of Environmental Education, I should address specifics about terminology. Defining words such as "nature," "outdoors," "outside," etc. is problematic as there is still widespread debate as to what constitutes nature. Can Central Park, in New York City, be considered nature or natural? Can merely stepping out of a structure qualify as being in nature or outdoors? Where humanity ends and where the natural world begins (if there even is a difference between man and the natural world) has been long debated. In this paper, the definitions of "nature" and "outdoors" will follow those in the current edition[9] of *Merriam-Webster's Dictionary*; with "nature" defined as "the physical world and everything in it that is not made by people" and "outdoors" defined as "outside a building". Fortunately, academic literature is normatively precise in its terminology and has explored the many gradients of being “outdoors” and “in nature,” and the differences between them and their effects on people in the context of Environmental Education. The papers studied in this senior project often delineate distinctions such as “outside of a building in a city,” or “outside of a building in rural areas” and often rigorously describe what is considered a natural versus non-natural scene in the context of that particular paper.

[9] Eleventh edition.

Education seeks to sculpt children's developing world-view. Environmental Education, by teaching children about nature (often in nature) attempts to instill a broader perspective that includes investigation and exploration of the workings of nature and the impact of humans upon it. Examples include having class discussions of different subjects (such as English, Social Studies, Earth Science) while sitting in a patch of grass, investigating riverbanks to learn more about ecological webs, or walking local trails. Field trips to botanical gardens or farms, simply having recess in a natural environment, and even group activities conducted outside (such as physical education classes) constitute forms of Environmental Education. A typical way that schools use it is exemplified by Green Woods charter school's environment based education strategy of:

> Purposefully using the environment as a context for weaving together instruction into a sound academic framework…teachers create a seamless integration of indoor and outdoor learning opportunities in locations near the school - this ensures that students learn about the environment by being in the environment and captivates their awareness of and interest in their surroundings
>
> -Green Woods Charter School

An education's purpose is not primarily to provide children with a value system, but to provide them with the mental tools and skills that they will need to succeed in life. [10] A report released in 2000 by the National Science Foundation, "Environmental Science and Engineering for the 21st Century" stated that "changes should be made in the formal educational system to

[10] This statement is highly debated. However, according to the most recent statistics from the National Center for Education Statistics, 88.7% of American children attend a public school. The public school system by law (*McCollum v. Board of Education Dist. 71, 333 U.S. 203 (1948*)) cannot provide any religious instruction in public schools as it is a violation of the establishment clause in the Constitution. While the validity of the fundamental moral attitudes commonly included in public education, such as do not steal, do not hurt fellow students, etc, can be debated morality is not a subject taught in public schools. It is normatively passed from teachers to students through everyday interactions and is normally not a primary topic of study in the manner that the sciences and arts are; moral attitudes are in an attribute of culture and not an attribute inherent to education.

help all students, educators, and educational administrators learn about the environment, the economy, and social equity as they relate to all academic disciplines and their daily lives". Environmental Education can help children develop the mental tools they need to succeed and further develop, because it emphasizes critical thinking, learner achievements, and interdisciplinary teaching (Stapp 1969, UNESCO 1975, UNESCO 1978).

In order to teach children optimally, a stress free environment is needed for them to learn. For many children, schools strive to provide a safe environment in which they can learn and thrive.[11] Schools additionally provide support for many children in a variety of other ways, whether it is hot meals or extracurricular activities. To maximize the utility of learning, students should be exposed to the most conducive environment, and green spaces have an assortment of qualities that make them propitious for learning, especially in the interpersonal domain. The psychological and social benefits of Environmental Education that have been uncovered through research are illustrated in the papers explored throughout this section; many of them have been influential and highlight the benefits that being outdoors can have upon the mind.

A cornerstone of the philosophies underlying Environmental Education is the idea that allowing individuals to realize that broader perspective provides them with more powerful tools that will help them throughout their lives, tools that are rarely realized within the conventional education system.[12] In this chapter I will show what the many negative and positive physiological and psychological impacts of Environmental Education are while reviewing the relevant literature. The many studies reviewed in this chapter often have similarities, but the

[11]The environment often providing vital services such as a hygienic and danger free environment, trusted teachers, reliable social services such as counseling, etc.

[12] The failure of modern education is discussed later in this paper, but for a background on the subject the following articles are recommended: "The Failure of American Public Education" (published by The Foundation for Economic Education), "Why American Education Fails" (Foreign Relations), "What's holding back America's teenagers?"(Slate), "The failure of American schools" (The Atlantic), "The Real Reason Why American Education Stinks" (Bloomberg).

studies have been carefully chosen to comprehensively and fully review Environmental Education.

A key component of Environmental Education is simply being outside. While children *can* be taught about the environment while inside, they experience many more positive psychological benefits when taught outside. Nature is mankind's original home, and an abundance of evidence demonstrates the positive effects that being outside has upon the human body. In a groundbreaking 1984 paper, psychologist Roger Ulrich demonstrated that simply being exposed to nature scenes (either pictures of nature, or a view of trees out of a window) while recovering from illness had a dramatic effect upon recovery times for patients. He wrote, "patients with the tree view had shorter postoperative hospital stays, had fewer negative evaluative comments from nurses, took fewer moderate and strong analgesic doses, and had slightly lower scores for minor postsurgical complications". Ulrich went on to state that "the findings suggest that the natural scene had comparatively therapeutic influences" (Ulrich 1984).

Giving credence to the calming, healing effect that nature has upon human beings is a paper published in 2013 titled "The urban brain: analyzing outdoor physical activity with mobile EEG". That particular research utilized novel portable EEGs to measure physiological parameters as a proxy for an individual's inner state. That paper found that "analysis showed evidence of lower frustration, engagement and arousal, and higher meditation when moving into the green space zone; and higher engagement when moving out of it" (Aspinall et. al. 2013).

Such findings suggest that Environmental Education has positive psychological benefits. Significantly, the authors of the 2013 paper wrote that "happiness, or the presence of positive emotional mindsets, broadens an individual's thought-action repertoire with positive benefits to physical and intellectual activities, and to social and psychological resources. This occurs

through play, exploration or similar activities" (Aspinall et al. 2013). This finding is relevant, especially concerning the field of Environmental Education because the paper found evidence that when in green areas, subjects experienced beneficial psychological and physiological effects that were absent when they were in urban areas. Those findings support the idea that there are beneficial implications for people while learning in a natural environment. Further evidence corroborates the findings of Aspinall et al. In 2005, researchers from the University of Essex conducting a study investigating the benefits of exercising outside discovered that exposure to nature while exercising "produced a significantly greater positive effect on self-esteem than the exercise control" (Pretty et al. 2005). In essence, being exposed to greenery can have beneficial effects on the human mind. Adding to the body of research confirming the favorable mental and physiological effects that exposure to nature has on the human body is a study conducted at the University of Delaware that concluded "there was also a consistent pattern for nature, especially water, to have more positive influences on emotional states" (Ulrich 1981). Ulrich's paper is one of the earlier papers to explore links between an individual's emotional states and nature. Another early study, "Restorative Effects of Natural Environment Experiences" had findings similar to the 1981 Ulrich paper. It found that "convergent self-report and performance results obtained in both studies offer evidence of greater restorative effects arising from experiences in nature" (Hartig et al. 1991).

These earlier studies assisted researchers and proponents of Environmental Education by showing that nature can have a measurable psychological effect upon humans, while also demonstrating that the subject was worth further investigation. However, the methodologies used by the earlier studies were not as rigorous as the techniques used in later papers to accurately demonstrate causation. This outcome is likely because the effect that nature has upon the human

mind was not a matter studied in great depth until these earlier papers showed that it was a measurable, significant phenomenon.

In the early research article published by Hartig et al., the subjects of the study used self - report inventories to catalogue how they felt in different settings. Basic physiological parameters such as heart rate were also used. While the study did report significant correlations between nature and one's mood, it is notable that self-reports are not the most accurate way to obtain data, and are notoriously unreliable. Later papers took more rigorous approaches, such as a 2012 study undertaken by the Medical University of Vienna. Researchers distributed questionnaires to over 500 students, and used two different tools within each questionnaire to evaluate their findings. That study also utilized statistical methods that controlled for extraneous factors, and found that "Psychological well-being, meaningfulness and vitality were found to be robustly correlated with CN [Connectedness with Nature]" (Cervinka et al. 2012).

Over time extant literature investigating the effect of nature on humans has followed a trend. The methods used within studies have become more rigorous. Better, more accurate evaluatory tools (such as self-reports and inventories) have been formulated or refined, and administered to subjects. Researchers subject the data collected from the newer studies to exacting statistical analysis' that strip away irrelevant noise or confounding factors that could bias or skew the results. This scientific rigor is seen in a meta-analysis of relevant literature published in 1999. The objective of the paper, titled "Demographic Effects in Environmental Aesthetics: A Meta-Analysis," provided urban planners and architects with empirical evidence they could incorporate into their work to improve user experiences. One of the first papers of its kind in the subject area, the paper surveyed 107 relevant studies and stated that "these references covered more than 19,000 respondents and 3,281 environmental scenes". The meta-analysis also

found that "if the stimuli were of nature or of ordinary architecture, then the agreement between designers and other people was very high (r = .89)" (Stamps 1999). This vast dataset allowed the researcher to accurately determine that environmental preferences were very similar across demographic groups, a piece of data that would allow researchers to broaden the purview of future research. The similar respondents' natural preferences suggest that the appeal of nature and natural scenes is similar for all humans, and is not merely a response from certain subsets. This seemingly universal human preference for nature is advantageously used as a cornerstone principle for Environmental Education.

The difference between past research and current research is readily apparent and is analyzed in a recent research paper, "Embedment in the environment: A new paradigm for well-being?" The paper investigated how the current paradigm concerning humans, their environment, and healthcare has changed. The authors reported a shift, supported by research, in theories concerning how individuals regard their relationship with their environment. Once considered separate (i.e., an environment and its components are considered distinct from a person), the way that the relationship between individuals and their environment has changed over time is from one centered upon individuals regardless of their physical surroundings and place to a dynamic, interconnected relationship between people and their environment (Stevens 2010). As the paper puts it, people are embodied and embedded in their physical surroundings, suggesting that "perhaps we can fundamentally change ourselves by changing our location" (Stevens 2010). This idea, with a substantial amount of research backing it, implies that a healthy, green environment is needed for a healthy mind. Environmental Education takes advantage of this concept.

Children also score better on tests when exposed to greenery. The "greener" their environment is, the higher their scores are (Wells 2000). Wells hypothesizes that there is a

nontrivial difference between being able to merely view greenery from an indoor space (i.e. through a window) or viewing greenery in an outdoor environment. She argues, “Outdoor vegetation plays multiple beneficial roles for children. First, by providing a green view, it contributes to the restoration of attentional capacities”. It has been theorized[13] that attention is a mental resource that can be exhausted. Wells continues, stating another benefit quite distinct from her first. “...By drawing people outside, vegetation may further contribute to the restoration of attention as well as to play behavior and connection to adults”. Attention restoration allows people to de-stress and restore a faculty vital for learning. The learning process is not expedited or enhanced if the learner is mentally exhausted and bored.

A 1998 study conducted at the University of Toronto also observed a greater gain in cognitive learning in students taught outside versus inside.[14] A more recent survey of the literature ascertained, "we found substantial evidence to indicate that fieldwork, properly conceived, adequately planned, well taught and effectively followed up, offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom" (Dillon et al. 2006).

The findings of these various studies identify a positive influence upon mental and physical health from simply being outside. The time humanity has spent out of nature (i.e., a non-nomadic, sedentary lifestyle) is far outweighed by the time our species has spent in nature.[15] As a result, it can be assumed that the human mind and body function best when in nature as it is

[13] First by Kaplan & Kaplan in the seminal 1989 book "The Experience of Nature: A psychological perspective", which was followed up in a 1995 paper "The Restorative Benefits of Nature: Toward an Integrative Framework”.
[14] From the study: "Both the control and treatment groups made gains in cognitive learning. However, the programme offered by the Nonquon Outdoor and Environmental Education Centre made a greater contribution to cognitive learning compared to the classroom programme" (Eaton 1998).
[15] Depending upon the evolutionary model for the emergence of *Homo sapiens* (there are two: the replacement model & regional continuity model), the modern extant example of the genus *Homo* has existed for 100,000 - 200,000 years. The agricultural revolution (when man began to live inside of permanent settlements) began roughly 12,000-8,000 years ago, with 10,000 years ago being commonly cited.

the true "natural environment" of man. Author Ken A. Graetz, in his book "*Learning Spaces"* (2006), states that there are three fundamental concepts that drive the environmental psychology of learning. One of those concepts is that "the physical characteristics of learning environments can affect learners emotionally, with important cognitive and behavioral consequences" (Graetz 2006). Given the plentiful amount of research confirming that being in nature can have a positive influence on emotions and self-esteem, and that happiness broadens an individual's intellectual activities, it can be said that being taught outside can be more effective than teaching in an artificial environment. In addition to the generally positive effect that nature has upon humans, exposing children to natural environments has specific psychotherapeutic benefits. Those positive psychological benefits importantly include (but are not limited to) alleviation of depression and depressive symptoms, and anxiety. Importantly, attention deficit disorders can be ameliorated in children by being in green spaces, and children are generally more receptive and in better moods when outside, which is a state especially conducive to learning (Wells 2000, Earnest & Monroe 2004).

Exposure to nature can also improve the quality and quantity of children's social interaction, which is vital in the social climate engendered by contemporary society. A paper published in the journal "Current Problems in Pediatric and Adolescent Health Care" bluntly states that "A shift toward a sedentary lifestyle is a major contributor to the decline in children's health. Children spend more time indoors using electronic media and less time engaged in outdoor unstructured play". The authors of that study go on to state that there are "mental and physical health benefits associated with unstructured, outdoor activities and time spent in a natural environment such as a park or other recreational area". Of note is that early childhood is a vital developmental period for children. Exposing children to more than three hours of screen

time every day “significantly increases the odds of having social or emotional problems such as low self-esteem,” problems that can negatively affect children's social development. This coincides with a lack of outdoor exploration and play over the past several decades, which has also been noted to negatively influence cognitive and physiological outcomes in children. To combat the deleterious influence that modern society can have upon children, the authors hypothesize that being near or in nature can provide social support (McCurdy et al. 2010).

One of the striking effects upon mental health, and consequently learning, is the manner in which exposure to nature helps children with ADHD concentrate. A landmark study published in 2009 carefully examined the impact that exposure to the environment has upon children (Faber Taylor & Kuo 2009). Researchers led children clinically diagnosed with ADHD through different environments (an urban area and a park). Using multiple established surveys (such as the widely used Digit Span Backwards test), psychologists assessed the children’s concentration before and after they were lead through the respective areas. They found that the children were better able to concentrate on tasks after walking through the park. The “children rated the park setting as both more relaxing and more fun than the other two [urban] settings,” the authors stated. They also found that the “children’s attention performance was best after the park setting” (Faber Taylor & Kuo 2009). Discussing the implications of their results, the authors postulate that “the marked fluctuations in performance typical of ADHD may reflect differential exposure to attentionally fatiguing and restorative environments”. Essentially, their research discovered that when children with ADHD move between indoor and outdoor environments, their attention span differs significantly. The paper has broader implications. Faber Taylor & Kuo only exposed the children with ADHD to the differing environments for 20 minutes, and saw a marked

increase in their attention span and performance on memory tests. The effect that that exposure to nature had upon them wore off over time, but was substantial while it lasted.

One of the tests the researchers used (the DSB) measures academic performance, and the children rated highly on that test after the nature walks. In the face of this evidence, the authors conclude, “we suggest that the potential for using doses of nature to help treat ADHD deserves prompt attention” (Faber Taylor & Kuo 2009). An earlier paper published by the same authors investigating the effect that exposure to nature has on lessening the severity of the symptoms of ADHD supports their conclusion. In that paper, the researchers “indicated that green outdoor activities significantly reduced symptoms [of ADHD]” (Faber Taylor & Kuo 2004). Environmental Education can be broadly applied; even spending free periods or recesses in parks or natural areas versus blacktop provides psychological benefits for children. Given the high incidence of ADHD over the past several decades, Environmental Education is in a position to help alleviate the effects of the disorder and expedite, if incrementally, children's ability to learn.

Some social and physiological repercussions are a direct result of the lack of time children spend outside. The more time that people spend outside, the more active they are. Modern humans are so sedentary that we have been called "the most sedentary generation of people in the history of the world" by the United States surgeons general. Because of this sedentary lifestyle, people are less likely to develop stronger bones and have good blood pressure, have an increased chance of developing heart disease, and even have an increased risk of early death (Patel et. al 2010, Rowland 1998, Warren 2010, Katzmarzyk et al. 2009, Dunstan et al. 2010, Tremblay et al. 2010, Zerwehk et al. 1998, Hamilton et al. 2004, Bauman et al. 2011, Owen 2012).

Additional physiological benefits result from being outdoors. Artificial indoor lighting has been shown to cause nearsightedness in children, and "the number of hours of sports and outdoor activity per week in third grade was the only variable significantly associated with future myopia" (Jones et al. 2007). Multiple studies have shown that contemporary humans, especially children, are spending less and less time outside even though there are many benefits to be gained. When exercising outdoors, people will exercise harder, and will enjoy the act of exercising more than they would inside (Jones et. al 1996, Thompson et al. 2011). Those who like to exercise will also likely do so for longer periods of time (Thompson et al. 2011, Kerr et al. 2012). Even sleep cycles and the circadian rhythms that regulate them are affected by the lack of time spent outdoors, because of the absence of natural light cues (Espezel et al. 1996). The amount of time that children spend in their dwellings versus outside in a communal area also affects their social development. One of the most important benefits children receive in the outdoors is the opportunity to apply what they are taught by their teachers to a real world environment. This problem is compounded by similar limitations placed upon outdoor play by educators, who, like parents, are fearful of the safety of the children and possible litigation. The decreasing amount of time spent outside presents a large obstacle to the success of Environmental Education, and should be addressed by parents and schools.

The list of studies that indicate the benefits of the outdoors for children and indicate the outdoors as the preferred environment of children is comprehensive. Many studies that have reviewed the preferred environments for children have found that they have special preferences for unstructured and unbuilt spaces (Hart 1979). Similar studies have found that when children play in natural environments, their play is more imaginative and creative, and also fosters language skills and teamwork (Moore & Wong 1997, Prescott 1987). There are all positive social

benefits that Environmental Education offers, and contemporary children are not exposed to social situations as often as they should be.

The amount of greenery provided in urban environments can have profound effects on the way that people socialize. A study published in 1997 by Coley et al., “Where Does Community Grow? The Social Context Created by Nature in Urban Public Housing,” researched the effect that natural elements have on social behavior. After observing apartment buildings with varying levels of greenery, the results of the collected data indicated that humans in general gravitate towards public spaces that have trees versus those that do not. More people would meet in areas that had elements of nature such as trees, and people from different age groups mingled more readily. The study also found that "the adage of 'the more the better'” seemed to hold true in this context - the greater number of trees found in a space, the greater the number of people who used the space together (Coley et al. 1997). The authors thought that the presence of greenery, especially in urban areas, had important implications concerning the sociality of residents, and that "the presence of trees in public housing outdoor space might contribute to the social cohesion of the community (Coley et al. 1997).

Another study conducted in 2002 found that being in natural environments encourages social interaction between children (Bixler et al. 2002), and a paper exploring the social role of school grounds found that playing in natural environments can reduce bullying (Mallone & Trantor 2003). Bullying is a problem in the American school system, and reducing instances of it will only improve the quality of experience and education for all. Learning how to properly socialize with peers is a key skill developed in schools, and a greener environment encourages social interactions and increased communal use of spaces. From the evidence amassed here it should be apparent that Environmental Education can take advantage of being in or near nature

and natural elements, and that many of these benefits would not be realized in a conventional educational system. Learning how to properly socialize with peers is a key skill developed in schools, and if a greener environment encourages social interactions or increased communal use of spaces, than children who are exposed to Environmental Education stand to greatly benefit.

Educational

The benefits of Environmental Education in the classroom have been traditionally observed in small studies. It is only in the past two decades that larger scale studies have been conducted. A major longitudinal study conducted by the State Education & Environment Roundtable (SEER) for the Californian Student Assessment Project made a notable discovery in 2000 that has had important ramifications for schools contemplating the use of an Environmental Education curriculum. Thirteen Departments of Education, each from a respective state including over sixty schools participated and contributed to the investigational study. According to the report, "the purpose of this project was to study the educational efficacy of using the environment as an integrating context for learning when compared to traditional education methods".

Students in public schools were taught using the environment as an integrating context for learning, and were observed and tested over a period of years. Groups formed within the many schools that participated in the study, with some schools assigning half of their pupils to Environmental Education while the other half were taught using traditional methods.

The SEER report additionally explicitly stated what was considered an environmentally focused curriculum: "EIC [Environment as an integrating context for learning] based learning is not primarily focused on learning about the environment nor is it limited to developing environmental awareness. It is about using a school's surroundings and community as a framework within which students can construct their own learning, guided by teachers and administrators using proven educational practices". SEER utilized differences between the

groups within schools and the schools' overall performance to investigate the effectiveness of its Environmental Education programs. The types of activities schools used included participation in local projects such as stream stabilization, as well as visits to tree farms. Speaking to local businessmen, using school gardens, holding discussions involving multiple classes outdoors, and visiting nearby nature are only a few of the other methods utilized by the schools.

In California, SEER found that Environmental Education was particularly effective. Scrutinizing a secondary school that utilized an experimental environmentally focused curriculum revealed surprising results. The students who employed such a curriculum scored higher than their peers attending schools with typical curriculums in the majority (72%) of academic assessments that they completed. The academic areas that the students scored highly in are important core areas of scholarship: Science, Reading, and Mathematics. Other positive benefits observed were significant improvements in attendance rates and grade point averages.

The SEER study is of importance, but as one British article published in the *School Science Review* admits, "such comparative studies, though important, are rare and very difficult to carry out" (Dillon et al. 2006). The SEER study additionally found important social benefits of Environmental Education, calling the results "broad ranging and encouraging". Increased engagement and enthusiasm for learning, lessened discipline issues, and lessened classroom management difficulties, as well as greater pride in scholastic accomplishments were all observed in students that were exposed to Environmental Education (SEER 2000). Many schools used group projects with a local theme and community service, as well as 'on the ground' experiences of a variety of different outdoor locations.

While all of the aforementioned results can be considered beneficial in their own right, they have broader implications. Improving school effectiveness and making learning more

effective allows students to acquire knowledge and retain it for a longer period of time. A paper presented by researcher Peter Mortimere at the International Congress for School Effectiveness and Improvement in 1993 titled “School Effectiveness and the Management of Effective Learning and Teaching” investigated the ideal way to impart knowledge to students.

Mortimere reported that management in schools, especially management figures such as the superintendent and principal, were found to have a greater influence than expected on learning. Mortimere additionally identified important mechanisms that influence a student's ability to learn effectively: complexity rather than simplicity is ideal, as learning is an active activity (not passive), and it is influenced by a variety of contexts, such as location (Mortimere 1993). Environmental Education embodies these mechanisms. For example, schools that participated in the SEER study employed a multidisciplinary approach to teaching, often focusing on natural resources as a way to integrate the body of knowledge that the children were being taught over the course of the school year. Those teachers also used sociological knowledge of their students to better relate while effectively imparting information, a tactic Mortimere embraced as “extremely important” (Mortimere 1993). The schools that participated in the SEER study used many forms of Environmental Education, including the use of field studies, outdoor community service, farms, and locally based student inquiry projects. There were also partnerships between some schools and the US Forest Service, as well as exploration of nearby timber and ranching industries. The study observed multiple investigations of nearby wetlands and student neighborhoods, with thematic teaching units combining the two with current events in the classroom.

A study published in 2006 by a group of researchers supported Mortimere's findings, stating that teachers would need to anticipate and integrate a variety of complex factors when

teaching, especially when outdoors (Dillion et al. 2006). The teaching techniques introduced for the duration of the SEER study did integrate complex factors, such as mentorships and the integration of nearby nature into lessons. The study states that "interdisciplinary units help students connect learning in science and language arts to the study of the local economy and the history of the community," further supporting Mortimere (SEER 2000).

The data SEER collected indicates the benefits of an Environmental Education. Students receiving such an education as an integrating framework for learning did better than their peers not receiving a similar education. The results are startling:

- 84% of the students in the experimental condition (i.e., were taught using Environmental Education) had higher scores in attendance and discipline assessments.
- 67% of the students had scored higher on science assessments.
- 65% of the students scored higher on math assessments.
- 80% of students scored higher on language arts assessments.
- 77% of students scored higher on social studies assessments (SEER 2000).

The success of the SEER study has prompted many states to begin their own studies investigating the efficacy of using Environmental Education in their classrooms. States including Washington, Florida, and Colorado are running SEER studies of their own, and have "indicated a strong desire to participate" in future SEER programs (SEER 2000). The benefits of Environmental Education in the classroom extend beyond novel teaching techniques.

Nature as a restorative environment has been a hotly researched topic for the past three decades because of the simplicity and ease by which attention (thought to be a mental resource vital for education) can be restored. In essence as we have seen, being exposed to a natural environment is hypothesized to reduce the stress and mental fatigue that intense use of one's mental faculties can result in and restore (Kaplan 1995). Remedial exposure to nature would be conducive for children's mental faculties, thus making it easier to teach children while

simultaneously making it easier for them to learn. The 1991 study "Stress Recovery during Exposure to Natural and Urban Environments" (Ulrich & Simons et al. 1991), explored the theory of environmental restoration postulated previously in a 1981 paper by Ulrich (discussed earlier). The researchers extensively measured effects of nature upon stress levels using physiological and psychological measures. They "conjectured that strong attention holding properties of natural phenomena play a critical role in stress recovery or restoration".Similar hypotheses about attention restoration have been stated in the literature, one of the first historical examples being published by Olmstead in 1865, and later by Kaplan and Kaplan in their seminal 1989 book *The Experience of Nature: A Psychological Perspective*. The heavily researched theory of attention restoration is highly applicable in Environmental Education, as Ulrich and Simons state in their 1991 study on stress that "restoration or recovery from stress involves numerous positive changes in psychological states, in levels of activity in physiological systems, and often in behaviors or functioning, including cognitive functioning or performance". After exposing 120 participants to a stress inducing movie graphically showing workplace injuries, the researchers used a battery of commonly used physiological response measures[16] from the subjects to monitor stress levels over time. In addition to the monitored physiological responses, self-reports were taken from the subjects concerning their stress levels before and after exposure to the stressful movie, after which participants were shown a variety of natural and urban scenes. The results from this study, seen in figure 1, highlight the drastic effect that nature has upon reducing stress in individuals. After a mere four minutes of exposure to nature

Figure 1, from Ulrich and Simons et. al. 1991, shows the marked difference between responses to nature scenes vs. urban scenes. This figure is one of four; the remaining figures are in the appendix and all show a similarly dramatic response across physiological measures.

[16] Measures used including EKG (electrocardiogram), PPT (pulse transit time), SCR (spontaneous skin conductance, and EMG (frontalis muscle tension), all well established measures of stress routinely used in research.

scenes, the subjects stress levels drastically fell. Conversely, exposure to urban scenes and environments (such as traffic and cities) accelerated the subject's heartbeat and had a considerably smaller effect on decreasing muscle tension. This study illustrates the effect that living in an urban environment can have upon children's mental and physical health in urban settings. There are many similar studies linking urban childhood environments with negative mental and physical effects over long periods of time. A list of studies that study the effects of childhood environments are listed below. Studies include:

- Children in low-income, urban settings: Interventions to promote mental health and well-being. (Black & Krishnakumar 1998)
- Nearby nature: A Buffer of Life Stress among Rural Children (Wells & Evans 2003)
- Urban neighborhoods and mental health: Psychological contributions to understanding toxicity, resilience, and interventions (Wandersman & Nature 1998)
- Children's judgments of event upsettingness and personal experiencing of stressful events (Brown & Cowen 1988)
- The Rochester Child Resilience Project: Overview and summary of first year findings (Cowen & Wyman et al. 1990)

Children in general greatly enjoy outdoor spaces, the preferred environment for many age groups, bar none. A paper by researchers Fjùrtoft and Sageie succinctly summarizes the generally accepted views of published literature upon the subject: "Previous studies have explained children's experience of place and their special preferences for the unbuilt and unstructured environment" (Fjùrtoft & Sageie 2000). That same paper goes on to review "how children consider the traditional playground and how they find the natural playscape more attractive and exciting". Fjùrtoft went on to further implicate the outdoors's important experiential role in children's development. A later paper by Fjùrtoft showed that the outdoors

could provide children who play regularly outside with advanced motor skills, a marker of further future cognitive development (Fjùrtoft 2001).[17] This effect has been further researched, most significantly in a 2008 paper by Piek et al., which stated that "analysis showed a significant predictive relationship for gross motor trajectory information and the subtests of working memory and processing speed" (Piek et. el. 2008).[18]

The wealth of extent peer reviewed literature overwhelmingly indicating that being outside has substantial positive effects on one's mind and body has lead educators to advocate Environmental Education. Environmental Education often does involve teaching children about the mechanics and sustainability of the world around us, but this is a more literal approach drawn from the broader oeuvre of the literature. It can also refer to teaching children in natural settings with the purpose of maximizing the benefits that children receive. A synthesis of this line of thought can be summarized by a quote from an article published by two researchers at the School of Education, "Children's Environmental Learning and the Use, Design and Management of School Grounds".

School grounds can provide access to real life natural experiences (e.g., conceptual exploration of living and non-living things, interdependence, biodiversity, life-cycling, recycling and food webs). As well as these obvious connections with the "natural" world, a diverse and well-designed play environment provides an opportunity to develop important lessons on cooperation, ownership, belonging, respect and responsibility. School grounds also convey messages to children about school ethos that can influence their attitude and behavior (Johnson 2000).

-Malone & Trantor 2003

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[17] Literature supporting the connection between motor skills and cognitive development is extensive and includes "Close Interrelation of Motor Development and Cognitive Development and of the Cerebellum and Prefrontal Cortex" (Adele 2000),"Imaging the developing brain: what have we learned about cognitive development?" (Casey et. al 2005), "Experiential learning: experience as the source of learning and development" (Kolb 1984)

[18] This paper provides further credence for the etiology of motor development and *future* cognitive function, which was previously not researched in depth and emphasizes the important of such development. Outdoor play, as shown by Fjortoft 2001, provides such important motor skills.

That particular article examined school grounds in their context as sites for environmental learning, and play in eight to ten year old children. In a three year study, Malone and Trantor investigated how the different natural environments of a broad variety of schools affected learning and play. The researchers also investigated the schools' philosophies concerning use of outdoor spaces. While their research did uncover large differences in the type of learning and play that the children were engaged in, Malone and Trantor did find that "school philosophies concerning the use and management of the outdoor school environment are equally or more important" (Malone & Trantor 2003).

Notably, the researchers went on to state that "School Grounds have potential as a rich resource for formal learning; they are outdoor classrooms that can be explored by children outside classroom time" (Malone & Trantor 2003), a position which medical doctors and many other researchers accept. The potential of the outdoors as a catalyst for better learning and a better education for children is large.

Societal Impact of Environmental Education

The environment in which a child is raised profoundly affects their development and is equally (if not more) important as any education, including Environmental Education. There are environmental factors that affect the social and cognitive development of children that Environmental Education can remedy, as culture and socioeconomic status can have an effect upon the learning attitudes of children that is as profound as any biological factors.

For many children born in poverty (more than 16 million in the United States alone in 2013[19,20]), the environments into which they are born are inimical to healthy development. Living conditions including rodent and bug infestations, crowded environments, poor nutrition, and a lack of heating or plumbing is common, even though many families spend more than 50% of their income on housing. The urban environment has additional detrimental effects upon the development and performance of children, regardless of status. Research has shown that the increased ambient noise levels caused by living near a highway or major roadway retards development of critical reading skills (Cohen et al. 1973). Crowding, a phenomenon that occurs with great frequency among low-income families, has been shown to increase interpersonal tension among all members of a family, a condition which is not conducive to learning or development (Evans et al. 1998). Environmental conditions inside of homes such as the presence of lead, has been shown to cause mental retardation and a spate of illnesses including cognitive disorders (Needleman 1994, Spreen et al. 1984). Additionally, a lack of stimulation and attention from those around children (as often experienced by children in low income families, for a variety of reasons) has been shown to result in lower IQ scores, antisocial behavior, and greater frequency of illness (Spitz 1945). Environmental Education can help alleviate these negative conditions.

[19] According to the National Center for Children in Poverty, poverty being defined as incomes less than $23,550 a year.
[20] UNICEF (United Nations Children's Fund) estimates that around half (1 billion) of the world's children live in poverty.

Studies evaluating the effectiveness of Environmental Education programs have shown that they can have substantial impacts beyond the schools in which they are implemented. A study conducted in 1998 found that an Environmental Education program had a positive impact upon the children enrolled in it. Children in the experimental condition (receiving a curriculum incorporating Environmental Education) scored higher on the tests administered to them by researchers than children in the control condition. The tests investigated the effect upon critical thinking skills, issue analysis, and knowledge of issues among the student body as well as other measures. Students who had Environmental Education incorporated into their curriculum scored higher on tests evaluating critical thinking skills, ecological knowledge, knowledge of environmental issues, action planning, issue identification, and issue analysis than peers who had not been exposed to the same curriculum. The study also noted, "the Environmental Education students significantly outscored the non-Environmental Education students on portions of the environmental literacy instrument, which measured knowledge of issues and ecological foundations" (Volk and Creak 1998).

Studies commissioned by state governments to study the effectiveness of Environmental Education (such as SEER, discussed earlier) have found similar, significant results. One such study commissioned by the state of Washington with the intent of providing "empirical evidence, exemplary models, and recommendations" of the impact of Environmental Education bluntly stated, "Environmental Education is an effective means of achieving a number of desirable student outcomes...and allows for the ready integration of many techniques that are thought to define good education (Wheeler et al. 2007)". The report also directly identified the multifaceted nature of Environmental Education as a crucial reason for its success. The American Institute for Research, for the education department of the state of California, has also investigated real world

impacts. Just as in other reports, the research done by the institute found that incorporating Environmental Education into the curriculum increased science scores by 27%, and that this "increase in science knowledge" did not fade away after 6-10 weeks (Parrish et al. 2005). This same report also noted that parents of the students who participated noted a dramatic gain in environmentally oriented behaviors at home, while students in the control group did not realize such a gain. The Chesapeake Bay Foundation (CBF), an organization dedicated to cleaning up and maintaining the Chesapeake Bay area, publicly states that it believes Environmental Education to be important because it fosters environmental literacy and awareness.

The CBF states that "Environmental Education increases student engagement in science... and employs and enhances critical thinking and basic life skills". Simply put, Environmental Education can improve student achievement in core subject areas such as math, science, and reading. This is of importance, especially for the United States, as this is an area of achievement that this country has long struggled with, as "some studies have found that although civic scientific literacy in the US has improved since 1970, only about 20% of the public is considered scientifically literate" (Blumstien & Saylan 2007). An index ranking countries from across the world in terms of academic achievement and outcome ranked the United States in spots 14 and 20 for overall score and educational attainment, respectively.[21] Given that Environmental Education improves scholastic performance as well as other invaluable cognitive skills such as critical thinking and problem solving, the application of Environmental Education could be invaluable in remedying the educational deficits of the United States. Additionally (and perhaps crucially) Environmental Education promotes awareness of environmental issues.

[21] Other studies, such as The Program for International Student Assessment (PISA) report more dismal results, ranking the United States in 23rd place for overall proficiency in key areas such as reading, math, and science.

American citizens routinely score abysmally on tests of environmental awareness compared to other countries, even though environmental issues are having an increasing impact. In this way, Environmental Education can have a significant real world impact if properly implemented.

Educators and policy makers have long been interested in the efficacy of Environmental Education; one of the main goals of Environmental Education is to raise awareness of the human impact upon the environment. In this way, Environmental Education could be an investment. If students learn about the human impact upon the planet then the knowledge of that impact and its deleterious effect upon humanity as a whole could spur them to act in a more ecologically responsible manner. Essentially, it may be an investment that could pay off over decades.

Environmental Education frequently investigates and/or utilizes real world environmental issues in its educational techniques, *ipso facto* there will be questions raised about the purpose of Environmental Education similar to those raised about the teaching of sex education or climate change: is teaching these subjects indoctrination or education? Just as teaching sex ed. or climate change, teaching Environmental Education is the application of facts acknowledged and accepted by the scientific community at large that are used to improve and add to the classroom experience. Ideally implemented, Environmental Education does this not to advance political agendas, but as a means to provide a real world context to the knowledge and skills that students are taught. In the environmental sciences, the phrase "diversity is resiliency is strength" is used as shorthand for why diversity in systems such as biospheres is general a good attribute. This aphorism is also used in many other fields. The same quote can be applied to Environmental Education. The more diverse the learning experiences and learning environments, the more resilient a person (and their skills) will become. This is the approach generally used by schools

worldwide; children are taught a variety of subjects in order to provide a well-rounded (or, 'liberal') education, the very kind of education that has been advocated since the time of Plato. And the range of classroom environments, surroundings, and topics covered by an Environmental Education is significantly more diverse than that offered by a typical western education.

It is also important to mention the applicability of Environmental Education in a conventional classroom based education. It is applicable in all disciplines, but in some disciplines (such as Physics, Math) there are conventions that restrict its use as a natural consequence of the area of study, creating varying degrees of exposure for Environmental Education. For example, field trips (a commonly used form of Environmental Education) can add context to many classes. A visit to the Grand Canyon by an earth sciences class may help elucidate previous geology lessons, while the same field trip taken by a literature class may not have the same relevance to the subject. A student of biochemistry whose classes focus on objects at molecular scales may not be able to be taught or understand the subject without the tools available in a laboratory setting, precluding the settings sought for by Environmental Education. The biochemistry student may be taught about chlorofluorocarbons and the injurious effects that that compound produces when exposed to ozone, but being taught about this compound outdoors instead of in a laboratory setting may adversely affect that student's knowledge of the subject. Other classes such as Literature or Social Studies may not have the same restrictions for teaching as some of the sciences, and students in those classes may have a more complete experience with Environmental Education because of the flexibility of teaching environment it offers.

In a departure from the blanket use of the term "Environmental Education" to refer to any teaching related to the outdoors, educators allow individuals to examine all dimensions of

environmental issues. The Environmental Protection Agency, in a document explaining the effect that Environmental Education has upon general education states that it is intended to "increase knowledge and awareness about the environment...to enable responsible decisions and actions that impact the environment". In this same document, the EPA goes on to explain that Environmental Education is important because it can be used to assist in educational reform. Such reform is a process that has occurred slowly over time. As more information concerning the educational systems of America has been created and examined, the education system in the US has tried to use that information to slowly enhance overall learning to little avail. Environmental Education as a learning process can "be used as a vehicle to advance reform goals," according to the EPA. This is because of its multifaceted nature. Reform goals are stated in the document, and it is easy to see how Environmental Education pairs with as seen below.

- Provide a real world context for learning and linking the classroom to the needs of the community.
- Move away from textbook driven, teacher-led instruction by using "hands on," learner centered cooperative learning approaches where students are actively engaged in their own learning process.
- Focus on the need to develop the learner's critical thinking, problem-solving, and decision making skills.
- Replace the traditional, compartmentalized academic subjects with an interdisciplinary curriculum that more authentically connects fields of knowledge.

This list interestingly echoes the reformative educational philosophies explored by John Dewey. Environmental Education fully addresses each and every one of those reform goals. Educational reform has had an enormous impact upon society and the individuals within it. From introducing the students of a classroom to the biosphere to bringing academic disciplines together in the study of the webs of ecology, Environmental Education embodies many

educational reform goals. There are concerns about the political nature of it which will be discussed in a later section

A 2004 study in the *Journal of Contemporary Issues in Early Childhood* found that the vast majority (82%) of parents with young children do not let their children play outside due to crime and safety concerns. Both parents are often employed and cannot supervise their offspring after they are let out of school; as a consequence the children are often put into extracurricular programs that typically do not emphasize outdoor activities, mainly because of liability and safety concerns. Compounding the matter is the structure and supervision that has been added to children's lives. The activities added to children's schedules in contemporary times are often added by adults because of the belief that a music lesson or sport will make their children more successful and provide a competitive edge later in life. This is a mistaken belief, and is discussed in multiple papers (Moore & Wong 1997, White & Stoecklin 1998). Schools, especially if they incorporate Environmental Education into their curriculums, can give children the outdoor time they would benefit from. Field trips to parks, and projects that involve nature (such as the stream stabilization projects seen in SEERs study) allow children to participate in outdoor activities outside of time spent in school.

Environmental Education can have a larger impact outside of schools than is typically thought. While children spend on average less time in nature and have fewer outdoor experiences than their historical peers, access to nature by children has a racial component. Many impoverished minority populations live in densely populated urban areas, which have drastic social and physiological effects upon their lives. While there are a variety of deleterious health consequences, Environmental Education could be used to remedy some of the educational consequences of living in impoverished urban areas by introducing children to environments

they wouldn't normally encounter, tailoring classroom activities (especially for younger students) to include natural elements and by providing access to nature during recess and field trips. An abundant amount of literature focuses on the effects of environmental inequality in reference to child development; teaching outdoors or learning about nature in class could increase the amount of time spent outdoors by at risk children. It is known from studies that minorities and impoverished populations experience unequal exposure to pollutants, suffer diseases such as asthma at rates that are statistically significant, and are often disparately located near toxins that have contaminated the environment. Inspiring interest in the local environment through exploration and information learned in class, as is often attempted through Environmental Education, could help reduce such unequal exposure.

Research also connects limited exposure to nature with long-term developmental consequences. This mounting evidence led researchers to investigate children's contrapositive exposure to nature as a form of inequality. Discovering the long lasting impact of differential exposure to nature proved of importance to a variety of fields of study, but as it is a burgeoning area of interest, there have been few papers published about the topic. However, the studies and research that have been conducted all indicate that racial environmental inequality is a problem.

Compounding this unfortunate situation is the physiological fact that children in general are more sensitive to environmental toxins due to factors such as the constant state of organ development, and qualities inherent to children such as their low skin area to body mass ratio, which compounds the effect that toxins have upon their bodies. A statement issued by the Center for Health, Environment, and Justice underscores the seriousness of environmental inequality, stating that "children absorb, metabolize, detoxify, and excrete poisons differently from adults" (CHEJ 2002). Given that minority children often live near hazardous sites and thus have an

increased risk of exposure to environmental hazards, environmental inequality has profound long lasting consequences for a significant percentage of the population. Environmental Education can educate students who live in polluted areas through field trips or talks with local environmental officers, can raise awareness of environmental hazards, and can play a role in the reduction of their presence over time.

A remedy for correcting such inequality can be found in Environmental Education. In an article examining the state of the research, the authors state that the stress caused by living in urban environments can be mitigated by exposure to nature. This is important as a 2003 study found that "the protective impact of nearby nature is strongest for the most vulnerable children, those experiencing the highest levels of stressful life events" (Wells & Evans 2003). Many Environmental Education curriculums purposefully include nearby nature, including activities such as working in class gardens and using different biomes as *in situ* demonstrators for class discussions and projects. For very young children, the presence of plants in a classroom can have a calming effect, and the plants can be occasionally used for activities or lessons, especially for younger children. As mentioned earlier in this paper, a study published in 1997 by Kuo et al. found that outdoor spaces with greenery enhanced opportunities for social interaction. Revisiting this study, it is notable that poor African American families were the overwhelming demographic of the area (Kuo et al. 2007).

The authors of the study examining the state of inequality research also stated, "schools that use local natural areas in their curricula have been shown to encourage cooperative learning and civic responsibility among students across diverse geographical settings and socioeconomic groups". It is likely due to the wide incidence of locally involved group projects incorporating the environment used in an Environmental Education, as "the evidence indicates that nature- and

environment-based education enhances youth academic performance" (Strife & Downey 2011). There is also a noteworthy component of Environmental Education that could have a real world benefit, especially in impoverished urban areas.

Studies published in 2005 and 2006 found that there are social and cultural barriers to simply accessing nature (which is crucial for development) such as racial discrimination, unfamiliarity with nature, and cost barriers (Elmendorf et al. 2005, Hong & Anderson 2006). A similar study by the prestigious journal *Organization & Environment* discovered that the findings of many studies on environmental inequality indicated that a key reason as to why minorities and the impoverished did not experience as much nature as the rest of the population "may result from a lack of cultural diversity among environmental education participants, staff, and programs that may make minority and low-income youth and families feel unwelcome" (Strife and Downey 2009).

Environmental Education could introduce students to areas they may have never visited of their own volition through field trips and exploration of nearby nature. It could assist in breaking down these barriers by integrating nature into the experience of education that is a fundamental human right.[22] By introducing students who would otherwise not have the opportunity to explore and engage nature to natural environments, students are exposed to new opportunities and areas of interest that they would never otherwise be able to access or even know of. Field trips to farms or parks may inspire a future geophysicist or veterinarian, and the way that those students would view nature in the future could be influenced. Environmental Education can be the 'great equalizer' that Horace Mann, the father of American education, thought it could be by assisting those whom society has disadvantaged in other ways.

[22]One of the reasons the United Nations regards education as a human right is because a lack of education leads to a lower quality of life.

While this paper has primarily discussed immediate and short-term effects, Environmental Education can have a long lasting impact upon individuals and the environment. It can be thought of as a form of investment with returns reaching far beyond the mere social investment of an education. Research has found that social stratum and ethnicity have an effect upon children's attitudes and behaviors toward the environment (Kahn & Friedman 1995). As American youth have been spending less time in nature (Hofferth & Sandberg 1995), it has become a growing concern of individuals involved in all aspects of child development that this will have a detrimental effect upon how children think and experience the natural world. To put it bluntly, it is important that future generations of children take a vested interest in the well-being of the environment. Successive generations will live (barring catastrophe) and have an increasingly larger impact upon the natural world with each passing year.[23] In order to maximize the utility of environmental protection via awareness, the greater the numbers of individuals who are aware of environmental issues and have learned about the disproportionate impact they have on the world, the broader the beneficial impact will be. Many researchers have considered such separation from the natural environment "a systematic barrier for a decisive shift of civil society towards sustainable development" (Matteo et al. 2014).

How/Where Environmental Education does not work (or has not lived up to expectations)

[23] This is because the current economic paradigm requires constant growth - i.e, steadily increasing amount of annual resource consumption.

For all its benefits Environmental Education does have its flaws. Several areas involving its implementation and planning need improvement. For example, Environmental Education programs are often complex and require detailed planning for lessons, and more care should be paid by educators to the outdoor settings in which some classes are conducted. Additionally, because of the politically charged issues that Environmental Education often discusses or involves (such as climate change)great care must be taken to ensure that programs (whether intentionally or not) do not indoctrinate students or alienate parents and community members due to differing beliefs. Why indoctrination is not preferable will be explained. In this section the ways in which Environmental Education programs do not work, do not live up to expectations, or are flawed will be discussed, as well as what can be done to address those problems.

Environmental Education is inherently *not* apolitical (because of its roots in environmentalism), which is an issue.[24] The research at its foundation has always been of a pure scientific inclination and the research advising ways to improve it over the decades is of the same impartial bent. The wealth of research on the subject has not produce one piece of advice or research advocating any political viewpoint. However, the results of those scientific studies indicate that human activities are negatively impacting the environment, and the natural progression of those investigations inevitably raises political issues. As a result, environmentalism itself is intrinsically a political movement, and environmentalism contributions to Environmental Education cannot be overstated. The application of

[24] The Declaration of the United Nations Conference on the Human Environment, or the Stockholm Declaration which explained what the guiding principles of Environmental Education should be, states "developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment," tying Environmental Education closely with Environmentalism, thus making it not apolitical.

Environmental Education in the classroom and the academic research of the subject are two different though parallel concerns, and delineating indoctrination and teaching in the classroom is demarcated in the realm of the philosophy of education rather than the political realm. However, just because modern science and its findings are controversial does not mean that they should not be taught.[25] It is elementary that Environmental Education includes basic, undeniable facts[26] in its curriculum, just as facts such as "the world is spherical" are included. This naturally leads to a discussion of where the blame for climate change lands, which is in the lap of the human species and its policies. Other controversial issues include economic, political, and agricultural paradigms, population control, the use of genetically modified organisms, pesticide bans, and the validity of science itself.

Environmentalists and others concerned with the environment rather than teachers may be more likely to start Environmental Education programs. This is an issue because it is likely that those who create programs and curriculums have a vested interest (personal or otherwise). Such programs are likely to veer into indoctrination, but the bigger issue is that environmentalists are not necessarily educators.[27] They are experts at conveying information and ideas from their field, but because of the inherently political stance they take they do not always make good *teachers*. While environmentalists would undoubtedly be able to add important information to a curriculum in the way that advice from any expert would when properly applied,

[25] An article titled "Pluralism and criticism in environmental education and education for sustainable development: a practical understanding" (Öhman 2006) thoroughly discusses the divisions in modern education over teaching modern science.
[26] Joint statements released over the past decade admitting humanities complete culpability for climate change have been signed by the national academies of science of the following countries: Indonesia, Australia, Belgium, Brazil, Italy, Canada, nations of the Caribbean, New Zealand, China, France, Mexico, India, Germany, Indonesia, Ireland, Malaysia, Sweden, Britain, Russia, United States, South Africa, and Japan. In addition to this, 97% to 99% of scientists believe that human activity is causing climate change. Many other nations have released their own independent reports affirming this, and the list of organizations and societies that agree with this assessment would require several dozen additional pages to list.
[27] According to Merriam-Webster's dictionary (Eleventh Ed), the definition of environmentalism is "Advocacy of the preservation or improvement of the natural environment, especially the social and political movement to control environmental pollution". This definition clearly implies that the profession is one infused with politics.

they are not the ideal candidates to disseminate that information because of their biases. Similarly, unless a class is explicitly about politics vis-à-vis the environment, politics should be sidestepped or presented in an impartial manner.

Some parents and individuals have objections to the study of controversial topics like those often explored using Environmental Education, and the question of "what is the legitimate impartial position?" arises. The reason why Environmental Education (and the field of education) should investigate climate change, population control, and other topics despite outcry or protest against it is because doing so is consistent with the type of education that it wants to impart on its students. It is in the spirit of the Socratic Method that these topics are investigated, regardless of what students (or their guardians) believe is the truth. These oft globe spanning issues, almost all of them relating to the environment, are very relevant given the scope of Environmental Education. They are ripe targets for the kind of issue analysis that educators try to inspire in students. These issues and their concerns and allegations, facts and sources of facts, ramifications and incentives for differing viewpoints, allows students to objectively evaluate major issues and their perspectives. Teaching critical thinking and 'due process' for ideas and different issues is an important tool in an individual's life, and is a goal that is achieved by Environmental Education through investigation of these issues.

Many teachers and environmental educators do believe that changing behavior is one of their primary goals. However, one of the biggest mistakes educators make is to think that their goal is to change student behavior rather than focus on the development of critical, independent thinking that will be of utility to the learner long after they leave the classroom. While this may seem like another way to alter behavior, the goal in this case is to teach people how to gather correct information so that they can decide for themselves what their behavior will be.

Behaviorist teaching methods are deeply flawed[28] as they implicitly devalue the capacities and agency of the learner, suggesting that the single viewpoint of the teacher is beyond reproach while simultaneously taking on aspects of vocational training and minimizing the independent thinking that Environmental Education values and strives for. Behaviorist teaching does not encourage students to explore or develop their own modes of thought or comprehension. It treats students as if they are empty vessels that need to be filled by someone else, when they really need to fill it themselves with guidance. Teaching behavior can too swiftly become indoctrination, and in addition to the problem of straying too near to indoctrination it can encourage a host of other undesirable traits in students subjected to this teaching method that ultimately erodes the purpose of teaching, such as mimicking desired behaviors, having a chilling effect upon students curiosity, boring students, or discouraging students in general from making inquiries into the subject as they know that they only need to memorize rote information.

Prominent educational philosophers such as John Dewey have inveighed against utilizing a behavioral approach. Students are sensitive to behavior changing goals, and once they catch on to the perceived goal of their curriculum they can become inured to that goal. This realization can result in several negative outcomes, including student cynicism and contempt towards the subject matter and the teacher as a reliable source of knowledge. This in turn can lead to bad attendance or students dropping out; neither of which are desirable goals. It is just as likely students will simply learn to emulate the attitudes and behaviors that teachers want to see, a façade that does not benefit either party and is a type of learning that many philosophers and

[28] Behaviorism itself is a theory in psychology created by noted psychologist B.F. Skinner. There has been much criticism of the theory and the science underlying in, notably that the theory is based on animal models. Skinner makes an assumption that the general rules relating to the behavior of the animals he tested and observed to make the theory can be used to describe the incredibly complex realities of being human. If those rules are not transferable (as is likely the case) then his theory has little merit, especially concerning education. Skinner also had issues with the validity of the scientific method, making his 'science' more dubious.

educators have vehemently argued against. Such mimicry is exactly what Environmental Education attempts to reverse. Care must be taken to teach students what composes environmentally responsible behavior, and the best way to accomplish this goal is to give students the tools they need to do this, such as critical thinking and independent thinking and reasoning skills.

Multiple studies have shown that the more people experience nature as a child, the more likely they are later in life to have positive views (Wells & Lekies 2006, Dettmann-Easler & Detra-Pease 1999). Identifying wild flora and fauna, clambering over logs and stones, and exploring the many niches of nature diversify the opportunities for children to use skills such as observation and logical thinking, skills that Environmental Education values. By denying children these chances to develop and grow, the potential of Environmental Education is wasted. Introducing children to the complexities of nature leads to exploration and knowledge of those complexities, which assists the development of the critical thinking skills.

The complexity of nature should not be understated, as organized complexity is literally what nature is.[29] A major problem within Environmental Education is the "dumbing down" of this complexity. The inner workings of nature, whether they are cellular apparatus or the carbon cycle, are often explained in specialized classes (as they should be). Environmental Education takes a broad view of the environment and talks about the earth as a single, biosphere with multiple ecologies replete with niches. Too often Environmental Education shallowly focuses upon that larger perspective. Examining entire ecologies and global cycles shows learners the interconnectedness of everything, and highlights that interconnectedness by focusing upon the

[29] An extremely influential and groundbreaking paper by American scientist Warren Weaver published in 1948 ("Science and Complexity") categorizes complexity into disorganized and organized complexity, with organized complexity being a property exclusive to life and disorganized complexity referring to all other matter.

disproportionate human impact on those ecologies. While this is an effective (and important) manner in which to discuss and investigate human activities and their side effects, this kind of investigation will inevitably involve oversimplifications of those complex systems and the interactions between them. This is an ironic problem, because while striving to illustrate the interconnectedness of the biosphere Environmental Education minimizes complexity.

Environmental Education is too broad to focus on every complex interaction, but more of an effort should be made to typify select interactions. Students should not just be taught that global warming is the result of the activities of man, particularly the extraction and use of certain resources. Students should see the effect that global warming has upon the other life forms and environments, and have those profound effects explained in detail. Students shouldn't just be taught basic facts such as the effect that global warming has upon the air temperature; they should also be taught that forest fires will increase in severity because of the longer amount of time forests spend without water and higher temperatures that increase evaporation (Westerling et al. 2006, Dale et al. 2001, Sticks et al. 1998, National Wildlife Foundation Report 2008). Mountains are uplifting at a greater rate as the crushing weight of ice flows away (Barletta et al. 2006, Molnar & England 1990, Burbank 2009). Complex problems such as the many negative effects of climate change should not be oversimplified and disguised as they currently are in education; many of the environmental issues are also tied into social and political issues and are not discussed as fully as they should be.

Another problem within the field of Environmental Education is overemphasis on individual action. It focuses on the individual because it seems the best way to involve learners in the subject. Showing students the effects of climate change in person and visiting dumps and other polluted natural areas is good way to do so, but Environmental Education often focuses too

much on small scale actions such as individual resource consumption. While these kinds of individual actions do influence the environment in an almost imperceptible manner, they concentrate on local, individual actions instead of larger scale actions. Focusing on small-scale local actions limits students to those pathways of action that are little more than symbolic gestures with little impact on root causes. That is not good because the way students are taught about the world, especially when they are taught actions that influence the world, alters and in a way limits the way students will think in the future. Instead of opening up possibilities and assisting students with the development of logic and critical thinking skills, Environmental Education does the opposite by overemphasizing pro-environmental activities on the individual's part.

By immersing students in local issues to learn about the environment, too much attention and energy on the part of the teacher and learner is directed into those small-scale actions. In the words of sociologist and environmentalist Catriona Sandilands in a paper about personal environmental actions, "Environmentalism is not simply a question of personal change…at best such isolated actions forestall the inevitability of radical change to social/environmental relations; at worse, these actions however well-intentioned, are part of the problem". She goes on to state that:

> Privatization of environmental change shifts the burden of responsibility onto individuals and households, and away from states, corporations, and global political arrangements. The privatization of environmental change undermines both collective and individual resistance; it turns politics into actions such as squashing tin cans, morality into not buying over packaged muffins, and environmentalism into taking your own cloth bag to the grocery store…rather, the idea that these actions are part of "saving the earth" would seem to turn attention away from subversive collective, or public solutions"[30]
>
> - Sandilands 1993

[30] The full article can be found here: http://pi.library.yorku.ca/ojs/index.php/cws/article/viewFile/10409/9498

This quote is highly applicable to Environmental Education. It is not an indoctrinal form of education, but tries to give its learners the tools and concepts to understand the immediate world around them. In limiting the scope of an education the type of worldview it exposes its learners to is thus limited as well. Given the focus upon the environment that Environmental Education possesses, it should take care to introduce its learners to a wider perspective.

SEER Evaluation

In order to identify problems with Environmental Education and to suggest ways to improve it, I have explored the curriculum of many schools. The problems and suggestions are purposefully general in order to be broadly applicable. In this section a single educational model will be investigated and the strengths and weaknesses of the program will be evaluated in the context of the suggestions and problems in the previous sections. The model investigated in this section is named the "Environment as an Integrating Context" model (EIC), and was previously discussed in the Educational Benefits section. It consists of a series of combined instructional practices developed by the researchers and administrators that make up the State Education and Environmental Roundtable (SEER).

This model was numerous virtues. It is a widely utilized model for Environmental Education, implemented in over 200 American schools across sixteen states (and used by personnel in over 700) over a consistent period of eighteen years.[31] In addition to the prevalent use of the model to educate teachers and professionals, EIC is utilized in a diverse array of schools including traditional schools, green schools, and charter schools. The model was created by professionals in the field of education drawn from private and public schools, and most importantly, the efficacy and effects of utilizing the model in schools has been extensively investigated and tested using the scientific method.

The EIC model developed by SEER is the result of the efforts of Dr. Gerald Lieberman. Dr. Lieberman went to U.C.L.A for his undergraduate degree, and received his master's and Ph.D. from Princeton University. Lieberman is a respected scientist with a long history of trying to improve the field of education; he began designing curricular development programs in the 1980's in Argentina, Honduras, Columbia, and Costa Rica. In 1994 a variety of organizations

[31] Information about the project was taken from http://www.seer.org/

including schools and federal education agencies conducted a study to investigate the benefits of Environmental Education. Nine directors from previously successful Environmental Education programs from several states gathered as part of the 1994 study to identify areas of interest for the study. Dr. Lieberman, one of the nine directors, published a document after the 1994 study in 1995, which states that the collection and analysis of data concerning the implementation and success of Environmental Education should be of paramount concern by those attempting to improve it.

The Environment as an Integrating Context model has several basic principles. As it is essentially a series of ideal teaching practices amalgamated into a model meant to emulate what is best about Environmental Education, the best practices advocated by the EIC model have been broken down into six key instructional practices that are meant to epitomize the pedagogical benefits of an Environmental Education. These sections have been identified by SEER on their official website[32] as the component parts of their EIC model, and their concise summaries of the purpose of the practices are laid out near-verbatim below:

- Cooperative and Independent Learning
    - Combinations of these kinds of learning are intended to "promote collaboration among students while encouraging individual students to maximize their potential".
- Learner-centered, Constructivist Approaches
    - The approaches are "adapted to the needs and unique abilities of individual students".
- Collaborative Instruction
    - This kind of instruction is intended "so that teachers, parents, students and community members can connect together instruction and learning".
- Community-based Investigations with Opportunities for Environmental Service-Learning
    - The investigations are intended to "provide learning experiences that offer both minds-on and hands-on experiences through service-learning opportunities".

[32]At this link: http://www.seer.org/pages/practices.html

- Local Natural and Community Surroundings as Context
    - Surroundings should be "more than a venue for connecting together these proven pedagogies, to improve teaching and learning".
- Integrated, Interdisciplinary Instruction
    - This "breaks down traditional boundaries between disciplines".

The six key instructional practices are all intended to be enacted simultaneously and are meant to interact with one another. These instructional practices are also applicable to most if not all disciplines taught in pre-college educational institutes, and are intended to be implemented in this manner. It is important to keep in mind that these six principles are not rules for the classroom that are supposed to be followed as rigorously as possible by teachers and students, but rules of instruction intended for teachers directly interacting with students. In this respect the researchers who designed the model depart from what can be considered the traditional model of teaching, as modern curricula are typically detailed and provide highly structured activities.

The principles and philosophy underlying the EIC model can be more broadly utilized outside of student-teacher interactions to develop Environmental Education curricula, but the primary usage of the EIC model as directed by the experts who created it is on the front lines of education. The instructional practices were intentionally created to be broad. These instructional practices are also applicable to most if not all disciplines taught in pre-college educational institutes, and are intended to be implemented in this manner. It is important to keep in mind that these six principles are not rules for the classroom that are supposed to be followed as rigorously as possible by teachers and students, but rules of instruction intended for teachers directly interacting with students. In this respect the researchers who designed the model depart from what can be considered the traditional model of teaching as modern curricula are typically detailed and provide highly structured activities. The principles and philosophy underlying the EIC model can be more broadly utilized outside of student-teacher interactions to develop

Environmental Education curricula, but the primary usage of the EIC model as directed by the experts who created the model is on the front lines of education. The instructional practices were intentionally created to be broad.

The efficacy of Environmental Education programs was investigated in a qualitative 1998 study of forty schools in thirteen different states. Funding for the endeavor was provided by The Council of Chief State School Officers, which "is a nonpartisan, nationwide, nonprofit, organization of public officials who head departments of elementary and secondary education in the states, the District of Columbia, the Department of Defense Education Activity, and five U.S. extra-state jurisdictions" according to their website.

The findings from this first study "Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning," informed the efforts of the SEER researchers, who spent the next two years using what they learned from the study (and an intensive literature review) to create the EIC model. Another study was conducted in 2000 in a continuation of the researchers' efforts to quantitatively gather more evidence of the effects of an Environmental Education. The study reported significant gains in student achievement for those that had been exposed to Environmental Education. In 2005, the same researchers published a follow-up quantitative and qualitative study titled "California Student Assessment project: Phase two: the Effects of Environment-Based Education on Student Achievement" which further validated their findings. Many Environmental Education curricula and models have been created and evaluated, while many more have but never evaluated. Hence, many programs do not have as diverse an array of literature supporting them as the SEER project does. Peer reviewed literature such as "The effects of environment-based education on students' achievement motivation" and reports

released by education departments in two states and a district[33] support the efficacy of the EIC model (Julie and Monroe 2004). There are numerous other white papers and masters theses' investigating the EIC model, as well as reports released by respected organizations such as the Chesapeake Bay Foundation and the American Institutes of Research further backing the SEER claims as to the success of their model. In addition to EIC's academic validation, the model has won multiple national awards.

SEER received California's Education and Environment Initiative award for recognition of the role that it played in the development of the state's environmental principles and development of the Education and the Environment Initiative curriculum that emerged as a result of its research. National Environmental Education Foundation (NEEF) also awarded SEER a Special Recognition Achievement Award because of its role in "bringing environmental learning into the mainstream of American K-12 education". Further recognition of the EIC model is found in the Education Commission of the States (ECS) extensive catalog of programs and practices, which lauded the EIC model in 1999 as a unique model. ECS went on to explain that the model was created by "a group made up of the top Environmental Education administrators". The Commission praised the EIC model, stating that it was being reviewed in their catalog "to show the diversity of approaches schools are using to accomplish comprehensive reform," and that the model is a "promising practice…that show[s] evidence of success in improving student achievement. ECS recognizes EIC as a promising practice for both comprehensive school reform and improving education for at-risk students" (SEER 2000, NEETF 2000).

[33] Washington, California, and Washington D.C.

Influence and Impact of SEER

The research, development, and ultimate emergence of the EIC model as a result of the efforts by SEER has influenced the field of education. In addition to the prevalent use of the EIC model to educate traditional teachers and professionals, is a diverse array of schools utilized it. As alluded to in earlier sections, there has not been an abundance of detailed, longitudinal research conducted upon the efficacy of Environmental Education. Since there have been even fewer substantial studies conducted *in situ*, the members of SEER wanted to remedy this deficiency. As bluntly stated in the executive summary of their first effort:

> In the face of limited research on the efficacy of environmental-based education programs, roundtable [SEER] members designed a study to identify the most innovative and successful programs, describe their effectiveness, and analyze their commonalities and differences. They also sought to identify the factors that contributed to the success of these programs and any challenges they encountered during implementation.
>
> - SEER Executive summary 1998.

The goal of the researchers at SEER was to do exactly that: conduct detailed research because there have been few prior concerted attempts to do so. Because of their multidisciplinary efforts, Environmental Education as a whole was greatly improved. They developed novel research metrics to quantitatively measure the success (or lack thereof) of multiple styles of education using not just test scores but the behavior of the students themselves and their interactions with others, creating a more accurate way to measure how students fare scholastically.

One of the reasons why the EIC model has had such an impact and influence upon education in the United States is that SEER researchers answered many questions about Environmental Education. Coupled with the demonstrated success of the EIC model, this

openness has had a profound impact upon the way that Environmental Education is studied and applied by researchers and educators in modern education. The manner in which the research was conducted from the very start can be showcased as a shining success. Years of research were conducted, concluding that there was merit to certain philosophies of education. Experts from many fields came together and formed various hypothesis' about the effects of one type of education versus another, and then used the best practices of science to lay a rigorous foundation of support to validate their hypothesis. Because of the efforts of SEER, a highly effective form of Environmental Education was developed and implemented, and is being improved over time through evaluation.

There are areas in which the EIC model and its implementation could be improved. One major issue with SEERs EIC model is that it veers dangerously close to becoming the type of indoctrinal education warned about in previous sections. On the front page of the official website of SEER, it is plainly stated that “All of SEER's work is focused on promoting and supporting EBE [Environmental Based Education]”. There are several implicit issues with this statement, and even more with the three major goals that the EIC model tries to accomplish. SEER is explicitly promoting and advocating for Environmental Education. For an organization to not just support but promote a type of education implies that the organization has a vested interest or ideological bias. Promotion also connotes competition, and the last thing an organization dedicated to improving education like SEER should do is pettily “compete” against what it perceives to be diminished types of education (whatever they may be), especially because competition between different educational philosophies will likely not end well for the students. The fact that SEER is entirely focused upon promoting environment based behavior through

their EIC model also intimates an underlying political motive, as environmentalism is a highly political movement.

The three goals SEER attempts to attain through the application of its EIC model are also poorly considered. The reader of previous sections about the deficits of Environmental Education should swiftly see issues. Only two of the three major goals are problematic, and the third ("developing their understanding of interactions between natural and human social systems") is benign.

There are several issues contained within SEERs first goal of "helping students achieve success with academic content standards". Standard measures of scholastic success (in essence, test scores and grades) are not a predictor or indicator of intelligence, achievement, future income, success, or student abilities.[34] The EIC model is lauded because its success can be measured through quantitative data in the form of higher grades and improved test scores, and receives additional praise because it improves those metrics while improving students' exposure to the environment and increasing their environmental awareness. If such qualitative measures are not indicative of any future attributes of an individual (which they are not), then why does SEER place such emphasis upon them? While using qualitative measures is the only way proper

[34] There have been many studies published confirming the tenuous, almost nonexistent connection between academic success and occupational success. The grades of standardized tests such as the SAT and ACT are likewise indicative of nothing, and have been implicated as significant barriers to entry for the majority of the American population, mainly those of Latino and African American descent. Despite significant evidence to the contrary, single numbers are still used to decide the abilities and future of individuals. Papers concerning the lack of or extremely weak correlation between academic success versus occupational success include Hoyt 1965, Samson 1984, Wingard and Williamson 1973, and Hiss 2014. Additionally, Google Inc., a company well known for its data mining and analysis, has stated that "One of the things we've seen from all our data crunching is that G.P.A.'s are worthless as a criteria for hiring, and test scores are worthless — no correlation at all except for brand-new college grads, where there's a slight correlation. Google famously used to ask everyone for a transcript and G.P.A.'s and test scores, but we don't anymore, unless you're just a few years out of school. We found that they don't predict anything". (New York Times 2013). Even this authors alma mater has implicitly and explicitly acknowledged that rote testing is useless and meaningless, stating in an announcement that the college would offer an alternative admissions process. College president Leon Botstein reiterated this position in the announcement, stating that "The tradition of high stakes examination, using multiple choice questions, has made the entire apparatus of high school and college entrance examinations bankrupt," with registrar Peter Gatsby going on to state that idea is that goal is to "move the college admission process away from the current standardized testing regime and toward a fairer process that is more predictive of college success". (http://www.bard.edu/news/releases/pr/fstory.php?id=2474)

science can be conducted, and perhaps the researchers of SEER were aware of this and had no other way to measure success, the EIC model is intended to increase awareness about the environment. It may be a political decision, and it may be because modern education demands testing as a verification of success, in which case the researchers include testing as a concession to win broader acclaim/acceptance from the educational community. Whatever the reason is, measuring and proving the existence of such awareness is difficult from a scientific perspective, and should perhaps not be a major component of measuring success. Additionally, the academic improvement of students who experience the EIC model could be a third variable problem; perhaps the multidisciplinary approach and increased exposure to the environment changes (whether the change is beneficial or not) how students view the world and make logical connections and leaps. This potential change in students' worldview could be incidentally measured as increased academic scores when said scores are not actual a causal factor.

The third goal of SEER, which is stated to be "preparing students to be active members of a civil society with the skills they need to identify and resolve environmental issues," is problematic. The political undertone and the vocational implications immediately provokes criticism. Dealing with environmental issues is always politically charged, as environmentalism is a political movement. It is not the goal of a good education to take a political stance, and SEER has clearly (and publicly) stated that a crucial aspect of their EIC model is to train environmentalists. It is true that the environment of planet Earth has been damaged by humanities presence, and it is also true that there need to be specially trained persons to remediate and prevent environmental damage. But it is not the goal of curricula, or general, pre-college education (especially when the curricula is widely used in *public schools)* to train all individuals from pre-K - 12 without their consent or knowledge so that they may work in the

future towards the goal of fixing environmental issues or the betterment of the environment. To fixate on such a defined goal raises serious questions about the benign intent of that education. Schools should not be foisting the EIC model upon unknowing students to train grade after grade of children who are only taught to fix and assess environmental issues. Even though SEER states that it supports using the environment as a setting in which issues can be explored and classes conducted, the creation of a certain mindset is an ultimate goal of this kind of Environmental Education. While the reality of the implementation of the EIC model is different, this goal comes uncomfortably close to establishing the EIC model as a form of vocational education.

There are also broader problems beyond the EIC model, particularly the many implications of curricula being designed by a private organization. It is problematic that the direction of the EIC model is also in the hands of an individual who is still closely involved with SEER. The main issue beyond the EIC model is that if SEER wants to make children into environmentally responsible citizens (which it does), who gets to decide what is and is not environmentally responsible, and how that is taught? By restricting what is taught to kids, whatever form that restriction takes and no matter how well intentioned it is, a serious problem emerges. When teaching about a politically infused topic, especially if children are being taught about environmental responsibility and what constitutes it, then the educators are severely limiting those children's potentialities. How can a group of children go on to have different, diverse futures if the potentiality of those futures is reduced to zero by steering all of the children towards the same outcome and exposing them to the same inputs? A counterargument can be that despite the uniformity of general education, exposed children go on to have diverse experiences. The difference between a general education and an education structured by the EIC model is that the EIC model, from the outset, is heavily biased towards environmentalism and related skills,

thus narrowing the possibilities for those exposed to the model from the very start. While Environmental Education still provides many more benefits (and in many cases is more effective) than a traditional education, these are still issues that should be considered.

The very local focus of the EIC model is not a major issue, but is a potential problem worth discussing. It restricts the way that students view their natural environment. While there are often budgetary constraints that schools have to operate under, using only the local environment could limit the way that children view other environments. Local environments are great for demonstrations and context, but the full diversity of the many different ecologies and conditions on earth are lost if students and their studies are confined to one environ.

Recommendations on how to improve Environmental Education programs

This section will suggest ways that Environmental Education programs within schools can be improved. There has been much research on this topic over the past several decades, and the sum of the available knowledge is considerable. Based upon what is known, there are several recommendations and "best practices" that administrators and teachers can implement to improve Environmental Education programs. However, a survey of literature that comprehensively evaluates programs over time exposes a troubling lack of papers relating to that topic. As an article published in 2007 in the journal *PLoS Biology* states, "such scientific approaches to evaluate the efficacy of Environmental Education are either not conducted or are conducted over such a short time period that we have absolutely no idea whether programs or lessons actually work". The authors go on to admit, "We are aware of no long-term follow up tests designed to quantify environmental literacy" (Blumstien & Saylan 2007).

However, several studies do appraise Environmental Education programs. They range in scope and size from focused, controlled case studies such as the California based SEER project to nation spanning reviews of the state of Environmental Education, as exemplified by England's "Review of Research on Outdoor Learning" (Rickinson et al. 2004). The diversity of the few scientifically rigorous, large case studies[35] and meta-analytical papers allows for a relatively

[35] There are many independent reports, articles, and letters that evaluate and critique Environmental Education and suggest courses of action. While the majority of the time such evaluations are not written by laymen but rather by scientists and educators, the evaluations and suggestions are often independent theoretical or moral critiques rather than scholarly or scientific critiques, limiting the objectivity of their usefulness. True scholarly discourse of Environmental Education is rare, and there are rarely objective papers upon the subject. Many independent commissions and even purportedly balanced scientists often have an agenda, and are not unbiased. Examples are the book "Facts, Not Fear: A Parent's Guide to Teaching Children About the Environment" (Sonera & Shaw 1996) and the Independent Commission on Environmental Education report "Are We Building Environmental Literacy?" Both works purport to present an impartial evaluation and review of Environmental Education, but are backed by the conservative organizations such as the Heritage foundation, George C. Marshall foundation, and The Claremont Institute. An example of theoretical apolitical criticism can be found a 2007 article, "The Failure of Environmental Education (and How We Can Fix It)" (Blumstien & Saylan 2007), and an example of the charged atmosphere surrounding critiques of

diverse assessment of what can be done to improve programs in a variety of ways, suggesting improvements via congruities in results that can be put into practice to increase the effectiveness of such programs. Information about how to improve schools in general will also be integrated, as there is a vast amount of information from the wealth of available government and civilian research.

There are also additional, deeper philosophic issues that must be thought through when thinking about improving education. Improving, modifying, or adding something new to the body of knowledge about how to educate invariably brings up questions about what an ideal education is, and what the goals of an education should be. While education is often intended to create better citizens, to indoctrinate, to instill specific values, or to keep children occupied, those kinds of education are not ideal and have substantial flaws. A better model is progressive in the Deweyite tradition.

Influential educational reformer John Dewey had much to say about the goals and aim of education. He argued that education has no aims; he thought that it is the people involved in the endeavor of teaching who do. Humanity has debated the matter for more than a millennia. Examples include the belief that knowledge and understanding are intrinsically good in and of themselves, that education should promote knowledge and understanding when they are seen as valuable, that it can enhance an individual's quality of life, and that it allows individuals to serve a purpose or achieve a goal.[36] A more utopian position promotes what is good about the self and others. Such quasi-civic education should serve a moral goal so that society and humanity can be ultimately bettered through learning. In order to educate individuals a type or style of education

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environmental education can be seen in an article in the New York Times, "Critics Rise Up Against Environmental Education" (Cushman 1997).

[36] This kind of 'intrinsic' property is debated heavily amongst philosophers, and was a topic at the forefront of the debates and discussions of ancient philosophers.

must be decided upon by experts, because in order to arbitrarily decide that one type of education is better than others, the goal of that particular type of education must be clarified and an ethical, not moral judgment must be made.[37,38]

Dewey argued that improving education must involve a better understanding of the human mind. He thought that mind was not purely the realm of the individual but a "function of social life" (Chambliss 1996). The actions and emotions of individuals play an important role in learning, and should be further explored and encouraged by educators. In his view, a human mind is not static and unchanging, but is an incredibly complex, constantly developing and changing process. Dewey also noted that pedagogy involving the nature and aim of education tends to be extremely polar. He thought that educators preoccupied with the pure subject matter of a given curriculum would direct focus to the rote memorization of facts and knowledge, which implicitly states that education at its heart is merely a form of vocational training. Dewey was opposed to this kind of education and the values supported by it, viewing it as flawed, but also noted that the other extreme was one in which "independent self-expression" (Chambliss 1996) of the learner and not the preeminence of a field was the goal of education, an extreme he also decried as often being too broad. His writings imply that his beliefs lay somewhere in the middle between these two extremes. Improving Environmental Education programs and their curriculums is a task that must acknowledge and learn from these extremes in order to achieve the goal of improving such programs: the creation of an ideal education.

One of the most crucial ways to improve existing Environmental Education programs involves carefully planning lessons. Short term and long term planning is important because the effectiveness appears to be directly related to the amount of lesson time. Planning additionally

[37] Dewey and Tufts stated in their 1908 work *Ethics* that "morality is custom observed, and ethics is conscience heard"
[38] How to tread the fine line between indoctrination versus education will be discussed at length in the next section.

ensures that the variety of beneficial effects for the learner does not dissipate over time (as has been seen in some studies). Utilizing Environmental Education consistently over time helps reinforce the duration of its beneficial effects; an example of this kind of ideal exposure would be greenery in areas used for recreation or daily reading done outdoors. Lessons or field trips that integrate Environmental Education need to be meticulously planned; placing a student outside is one of the first steps in the successful application of Environmental Education but the time spent outdoors should generally be structured. For example, a field trip to a local dairy should involve not only a walkthrough of its operations but observations of the pastures and animals, and a discussion of the various impacts the farm has on the surrounding environment. Such trips would ideally be synchronized with the students' curriculum. A difference should be seen between merely hosting a class outside, going on a field trip, and hosting a class outside with the goal of integrating the environment into the lesson.

For younger students (3-9), physically interacting with the environment will be more beneficial than a lecture discussing local water quality and climate change (which would be better suited for older students), as the way that children view the environment will be profoundly shaped by their earlier experiences (Matteo et al. 2014). While students of all ages would benefit from being in nature, the multifaceted nature of Environmental Education that combines information from discrete subjects and discusses complex ideas is ideal for older students. Lessons and activities, such as growing plants or exploring nearby nature, are suited for younger children because they are not as technically oriented as the material that older students would be subjected to, and encourages the social interactions and physiological benefits that are key components of Environmental Education. Field trips to parks, visits to nearby nature, and hands on activities such as gardening are ideal for younger children as they provide a host of

benefits for the student in the short term, including fine motor skills, social skills, as well as a familiarity and understanding of natural environments that many of their peers who will not experience Environmental Education will lack. Such outdoor exposure also lays a foundation for the more complex material they would encounter in the latter half of their formal education. The constructivist theory advanced by psychologist Jean Piaget, is highly applicable to this age group. It postulates that children construct their knowledge out of their exploratory actions in an environment, which is what Environmental Education attempts to do during a child's early years.

For older students (9-18) there is a much wider range of activities and lessons that Environmental Education offers. A sample will be discussed here. Students can handle complex information and theories, and their classes reflect this. Environmental Education tries to tie together classes such as Geology, Earth Science, AP (advanced placement) History classes, Biology, Chemistry, and Literature (or ideally integrates them from the start). In a Gödelian way this can be accomplished within the broad purview of Environmental Education. To take one example among many, in Earth Science, class readings and discussions can be coupled with assignments investigating local utilities and their impact on the environment. For older students, Philosophy and Economics classes could apply Environmental Education in order to analyze the epistemology of humanity's use of resources, such as the reasoning underlying economic growth and possible alternatives. Local internships or mentorships could be used to explore environmental issues that affect businesses or the way that businesses affect their environment while also giving students glimpses of the "real world" that they will someday engage in.

Understanding where resources come from and how humanities collective understanding of the environment has improved over time, and even self-guided, quasi-meta introspective investigations of how education impacts the way that people view and interact with the

environment are some of the ways that Environmental Education can be used in upper-level schools. Ideally, classes would be held outdoors, and there would still be field trips to age appropriate sites such as nearby conservation centers or state run agricultural co-ops. Speakers specializing in topics relating to the environment and curricula materials could visit and spark discussions and ideas, and there could even be school wide events such as Earth Day that are not merely observed as perfunctory events.

Table 1.

Pre-School/Kindergarten (ages 3-5)	"Sensory tables" filled with different mediums and accompanying items, such as sand, water, soil and shovels, fake bugs; draw/make an outdoor scene, raise butterflies, read stories about nature and animals, plant a seed, collecting outdoor items (pine cones, rocks…)
Elementary school (ages 6-10)	Have a class pet/make a small habitat in a terrarium, books specific to certain environmental issues, set up and maintain a class compost, visit and explore a garden, make a bird feeder, go on short walks outdoors to observe local wildlife, visit a farm.
Middle School (ages 10-15)	Visiting regional wildlife centers and looking for organisms in streams, identifying wildlife, build a pressure gauge or thermometer, work in a community/school garden over the course of a semester, visit animal sanctuaries, make a small windmill or a model solar powered car/USB charger, mapping or closely investigating a patch of wetland.
High School (ages 15-18)	Growing and planting trees around the school, sort through a day's trash at the school in an effort to identify wastefulness, discussion of climate change and human impact in classes, holding classes outdoors, water quality monitoring of a waterway, go fishing and then dissect fish, explore current sustainability issues (local and global).

This table shows a sampling of the Environmental Education activities that students can experience.

Environmental Education needs to be targeted to get maximal utility out of a lesson. Classes held outside should be focused on goals and activities that do just that.Extended discussions and homework pertaining to Environmental Education after the initial lesson are useful, and allow students to become more involved in the subject matter. Further emphasizing activities and behaviors that have low barriers to entry and have a high potential for improving understanding of issues should be encouraged by teachers, as this can foster lifelong awareness of environmental issues. Gardening, local hiking, and trips to zoos or conservation centers are examples of such activities. Carefully planning Environmental Education lessons goes hand in

hand with another way that lessons and curriculums involving Environmental Education can be improved and better utilized: integrating different disciplines.

Teachers should concentrate on using an integrated multifaceted paradigm, and should give equal focus to all facets in order to impress the interconnectedness of everything. Leave academic specialization for tertiary educational institutes. The goals of class curricula should primarily be to teach course material relevant to an understanding of that subject, but teachers should help students see the interconnectedness of artificial and natural systems even if the knowledge comes from seemingly opposite disciplines. The intent of teaching such interconnectedness is not to teach a form of environmentalism or political values but to encourage critical thinking à la the Socratic method. Most forms of education parcel knowledge into distinct, discrete disciplines such as geology and history and keep them separate. While Environmental Education is normally used in the context of that kind of environment, it tries to incorporate and use varied information by focusing on the interconnectedness of everything, and it is because of this realistic perspective that it is effective. A lesson about Earth Science can be taught in relation to the history of an area, and the concepts of geophysical cycles can be demonstrated on a patch of forest floor. As discussed earlier in this paper, the outdoors is not the ideal classroom for some disciplines but can be a very useful demonstrator and aid relevant to said disciplines. Active collaboration amongst teachers both before and during lessons is important because lessons can then be coordinated to be about certain themes, areas of interest, or specific topics relevant to the disciplines decided upon by the teachers. The multifaceted nature of Environmental Education is also well served by connecting students to their environment and lessons.

Much of the literature evaluating Environmental Education suggests that clarification of what exactly it is and how it works is needed for teachers. A report researching teacher perspectives on school improvement found that many have vague ideas of what Environmental Education is and how it works (Kearney 1999). While according to the report Environmental Education is effective and does address factors that teachers feel are important, not many are aware of this improvement. There is not much difference in teachers' understanding of Environmental Education, whether teachers use it or do not, and better training programs are suggested by the report (Kearney 1999). This indicates that better awareness and better training of educators could improve Environmental Education programs and make a larger difference, as most educators receive little to no information about it. As educators often possess a rudimentary knowledge at best, introducing basic concepts such as the benefits received when outdoors or in nature and many of the basic ecological underpinnings of Environmental Education is a good place to start. These basics provide a good foundation for other concepts, such as interconnectedness. Educators do not need substantial training in other disciplines (such as Biology, Climatology, or Natural History) to grasp that complex systems are a fact of life; a fact that educators should be readily able to pass on to their pupils. Discussing complex systems may seem daunting, but it is done every day in most classrooms around the world. A History class discussing the multiple causes of a famine is an example.

Educators can adopt many changes that would improve the efficacy and reach of Environmental Education. Integrating the communities that students live in into lessons is especially important to bettering existing Environmental Education programs. The immediate real world context links them to their environment and inspires interest. Using this approach ensures that the benefits of Environmental Education are reinforced over time.

The publication, "Review of Research on Outdoor Learning" states that "meta-analyses of research on outdoor adventure programmes [sic] provide strong evidence of short and long-term benefits, and several individual studies report positive impacts particularly in the affective and interpersonal/social domains" (Rickinson et al. 2004). Environmental Education techniques that further the advancement of student's interpersonal and social skills should be used because those skills have an influence on academic success. While this is one of the goals of most education in general, Environmental Education actively encourages peer discussion and interaction. There is a difference between schoolyard socialization, groups of students communicating in the classroom, and talking through problems and examining them from many different perspectives outdoors. Perhaps schools should attempt to have longer field trips or more over night field trips to allow students to develop the kind of positive impacts observed by studies by having more opportunities to interact with their peers, but this may bring about cost and supervision issues.

Finally, there must channels through which Environmental Education can improve. As already discussed in this section, many teachers require clarification of what Environmental Education is and how it works. This is a common issue and is absolutely essential. If teachers do not fully understand the goals of Environmental Education and how to use it, then they cannot fully utilize it. In order to remedy this issue and discover other issues within Environmental Education, it must be studied and critiqued empirically. It is through keen study of the flaws of Environmental Education that this issue was discovered; further improvement of and better explanations of Environmental Education can be accomplished through further meta-studies.

Many large studies that monitor curriculums all suggest that future utilizations of Environmental Education should be monitored in a manner that will allow for correction and study. Rigorous investigation that methodically scrutinizes Environmental Education over time is

the only way to find out how well it works when applied. However, it is difficult to conduct a proper investigation using the scientific method and even more difficult to draw meaningful conclusions given the widely varying environments and philosophies that use Environmental Education. This is an issue discussed by Environmental Educators (and scientists) Blumstien and Saylan, who address this issue in their critique "The Failure of Environmental Education (and how to fix it)".[39]

Often, Environmental Education is used in a curriculum without any steps taken to evaluate its efficacy in any rigorous manner over time. Many critiques of Environmental Education are often not based on empirical evidence, and balanced critiques are rare (see footnote 27). An example of a good critique is an article published in the journal *Bioscience*, which found that Environmental Education should better respond to changing demographics and integration of new information into curricula, and should more effectively communicate environmental issues (Hudson 2001). This is likely linked to the aforementioned uncertainty among teachers and administrations as to what exactly constitutes Environmental Education, and is why empirical critiques are one of the most effective to use. There have been many studies investigating the many disparate effects of Environmental Education, but there have been very few large scale studies investigating using many measures. Proper study of Environmental Education will also reveal flaws (such as the uncertainty about what it exactly is seen in teachers, and is an essential part of improving it.

[39] They state in the article that "...testing procedures, as currently implemented, are likely to be designed to provide an inventory of assimilated information with no metrics to gauge changes in lifestyle or behavior. Comprehension of a subject may be measured by a student's ability to memorize key bits of information, rather than the ability to grasp the concepts from which the bits of information measured are derived. This approach has led to a superficially informed society that is unable to act—and it illustrates the failure of environmental education. Given the importance of proper study design and the successes of evidence-based approaches in other fields, we believe that an evidence-based approach to environmental education will help improve the quality of environmental education" (Blumstien & Saylan 2007).

Sample Curriculum

An example of a curriculum that utilizes SEERs EIC model can be found in one of the schools that adopted SEERs environment based educational theory. The school, Greenwoods

Charter School, is located in Philadelphia, Pennsylvania. According to the school's distributed literature, educators at the school began to incorporate the EIC model and its six instructional practices in 2004, when they hired a new coordinator for curriculum and teaching.[40] Notably, the new coordinator enlisted the help of a founding member of SEER (Dr. Patricia Vathis[41]) whom had helped research and publish findings about Environmental Education in the initial 1998 publication that led to SEERs later proposal of their EIC model.

Dr. Vathis and the coordinator developed Greenwoods Charter School's strategy for utilizing Environmental Education. The school is now nationally recognized for being an EIC demonstrator. According to the school, the EIC model is used to allow students to achieve academic excellence while sculpting them into "environmental stewards". The way in which the EIC model is applied at Greenwoods Charter is precisely how SEER publications advise it be used. The school states, "The EIC Model is used as the overarching instructional model" and indicates that the teachers at the school have taken the advice of SEER, as they are "continually revising the school curriculum, which they themselves developed". It is noteworthy that this is explicitly how the EIC model is intended for schools, especially for curricula development. Its end users are intended to modify the model to support and amalgamate the knowledge that teachers distribute throughout a semester in an environmental context.

While Greenwoods Charter uses traditional academic tools such as tests and quizzes throughout a semester, the educators also use the environment as an integrating context by bringing "specific environmental content, technology skills, and the experiences students need to become active participants in their communities". The educators combine lessons and their

[40] Information found at this link: http://www.greenwoodscharter.org/eic-model.asp
[41] Dr. Vathis was also the Environment and Ecology Curriculum Advisor in Pennsylvania's Department of Education's Division of Standards and Curriculum until her retirement, and has assisted Environmental Education programs throughout the state.

content with indoor and outdoor experiences, effectively taking advantage of the opportunities that Environmental Education has to offer. Nearby nature around the school, and environments located further afield are used in lessons and are often the sole focus of field trips, as evidenced by past trips to the Delaware Bay and Cape May. The school has also had themed years of learning about ecological topics; in 2014 the fourth grade of the school participated in a year of learning about watersheds. The students raised trout from eggs, learned about local mills and dams, and went on a field trip to observe horseshoe crabs in their natural environment. The school believes that the approach it has adopted in its curricula design "gives students a solid foundation, constructed from integrated, inquiry-based learning experiences and ultimately guides their future development and success".

In this example EIC curriculum provided by Greenwoods Charter (see appendix 3), a robust array of scholastic assignments and natural settings are applied to the unit at hand. This curriculum is intended for children in second grade, and is meant to guide a three to four week unit of study about animal classification and bats, which are a local species. Included with the curriculum is a reading list, a list of relevant websites and online videos, what the goals and objectives of the curriculum are, and activities that have been integrated as a result of the use of the EIC model.

This curriculum has many positive aspects. Among established topics such as reading, writing, math, and science, there is also a dedicated "Environment & Ecology" section. Goals of the curriculum include learning about diversity among species, identifying how and why species such as bats have a specific ecological niche, and why it is important to protect bats. These goals are accomplished through traditional classroom discourse ("contributing to discussions," "understand the meaning of and use correctly new vocabulary learned in various subject areas")

and are supported via the EIC model through Environmental Education and activities. In the classroom, the curriculum outlines ways in which children can be introduced to the idea of ecology, and specifically outlines how the students can be taught to understand that the biotic and abiotic elements of ecology are interdependent. Human impact upon the environment is also included for discussion. Activities and trips outside of the classroom include visits to local caves such as Crystal Cave Park (a bat haven), taking nighttime walks to look for bats, and building and installing bat houses around the school. These activities are also supplemented via lessons specifically about bats, including classes dedicated to exploring echolocation and sound waves and discussions about what happens to bat populations when mines close.

While bats are the principle focus of this short unit outlined in the curriculum, a wealth of environmental and practical knowledge is taught to the children. Interdependency of systems on Earth, humanities effect on the environment, and necessity for society to actively seek the suppression/extinction of certain noxious pest species are topics on the curriculum. The adaptability of living things is also a topic. Pupils were also taught a variety of practical skills, with bats being the thematic center of activities such as how to draw a bat, how to make a flow chart, and how to participate in large and small group discussions. Identifying how best to approach problems, how to identify compound words, and how to distinguish between fiction and non-fiction are also taught within this unit of study. Combined with the subject matter of other units on the curriculum, such as "Science & Technology" and "Reading, Writing, Speaking, Listening," the children on the receiving end of the curriculum are experiencing an Environmental Education that has many opportunities to impart its benefits. The curriculum includes multiple field trips and outdoor activities in a variety of different locales, as well as discussion of human impact upon the planet and an introduction to ecology. Relevant activities

undertaken inside and outside supplement what students learn in the classroom. There is also communal environmental action undertaken by members of the class.

The curriculum could be improved by the addition of more bat related components of the "Arts & Humanities" section. Teaching "principles of arts" to second graders is probably futile given their age and maturity; using the arts classes to illustrate and explore the units focus on bats is a more productive use of time. Explaining what different kinds of pest control are, and what the pros and cons are of using natural versus artificial pest control should be a focus of this unit, given the focus of the "Environment & Ecology" section. This also segues into the "Science & Technology" and "Civics & Government" sections. The "Civics & Government" section should be replaced with a more relevant and meaningful goal, as the way of thinking that section tries to inspire in its students is antithetical to the mindset that Environmental Education tries to foster. Replacing it with a lesson and discussion about how organizations such as the government choose whether to artificially control pests (such as spraying pesticides to kill malaria carrying mosquitos), or a lesson of a similar content would be a more relevant goal within that section.

The listening component of the Reading & Writing section would be enriched by a speaker, ideally from an environmental agency, as they are trained educators and environmental experts. Their jobs exist expressly for public outreach, and the school should take advantage of them because the earlier children are exposed to attitudes advocating responsible use of the environment, the more likely and longer it is that they are going to possess those attitudes later in life. Although this sample curriculum has some supplementary activities and goals that involve physical activity, the health, safety, and physical education section of it only have a single goal. This goal ("recognize positive and negative interactions of small group activities") is opaque. Perhaps educating students about the symptoms of rabid bats and how to treat them, or a hike in

nearby woods to install bat houses would be good additions to this section. Understanding the negative economic impact of the loss of bat populations, whether the cause be habitat loss or white nose syndrome, is a simple goal that is easily accomplished, and meshes well with the subject matter in other sections.

This sample curriculum is well rounded for its subject matter, but some areas are puzzlingly blank. While students learn about the importance of pest control, and visit mines and caves to observe them, the "History", "Geography", and "Economics" sections are blank. While these sections do not need to be crammed full of goals and objectives like the other grid sections are, they should not be blank. Visiting specific habitats of bats around the state should certainly involve a short discussion lead by a teacher explaining that bats need specific, geographic places to live. This also ties in to the concept of interdependence between living and nonliving things brought up in a different section. The caves and mines visited by students have a long history of human activity, and visiting the mine in particular is a great way to discuss the pros and cons of human activities. Because the study of bats (especially in this area of the country) will involve a discussion of where they live (often caves) and why man made caves such as the caverns in the region around the school are of importance to preserving local bat populations, these sections can easily have goals relating to the subject matter of the unit. This curriculum was created with the support of state officials in the field of education, and many states including Pennsylvania have outreach officers for the environmental agencies within them.

Because the unit is centered around bats and why they are valuable and should be protected, a discussion of their value would include a mention of the many economic benefits of bats. It is also farfetched to think that second graders could "Identify how to resolve conflicts using interpersonal communications skills" in the Family & Consumer Science" section. The

"Career Education & Work" section of the unit is left blank as it should; the unit is intended for second graders. A better choice for this section may be why bats have the reputation they do, why people fear them, and why bats should not be feared but seen as an animal that helps humans with pest control, the very topic discussed in the first "Environment and Ecology" section.

While the information taught to students appears innocuous on the curriculum, it is the overall goal of Greenwoods Charter that is questionable. As mentioned earlier in this section, one of the two goals of the school is to sculpt students into environmental stewards, "steward" meaning "one who actively directs affairs".[42] The risks of an indoctrinal education are clear. It is difficult to tell without direct observation of the school environment if educators are trying to turn the students into environmentalists, or if they hope to educate the students in order to let them make their own choices. However, as most of the world is indifferent concerning climate change and its pervasive effects upon human society, perhaps the only way to make people care is to teach them such behavior. The goals of some sections of the curriculum may be too complex for the age group that they are intended for; similarly, some expectations for the students may be too high. The second graders at Greenwoods Charter are expected to learn some heady ideas at a young age, ideas that are normally taught later in their education - in high school. While the students can be taught some of the ideas on the curriculum, the majority of the students are not likely to intellectually grasp or understand the implications of what they are being taught. A teacher can certainly explain how human activities change the environment (as per the curriculum) but whether the students fully grasp the magnitude of influence that those activities have is doubtful. Finally, Greenwoods Charter still uses tests to find out how much

[42] Definition from the Merriam-Webster dictionary, eleventh edition.

children know - implicitly ignoring evidence to the contrary. Perhaps the political/ideological reality of curriculum design at a school such as Greenwood Charter necessitates the inclusion of tests, but for a school to use a model that steers clear of rote testing and its associated philosophies and then to implement testing within that model is odd and, and as a result the scores will probably never be good indicators of student knowledge or progress at Greenwoods Charter.

Conclusion

Environmental Education is a type of education that clearly possesses many benefits for the learner, often offering more than current educational methods alone. Improvement in the field of Environmental Education can be easily attained, and current programs and curricula clearly show the benefits of implementing such programs. An extensive literature review

confirms the beneficial psychological and social effects of being outside and in nature, many of which extend beyond a school and its grounds, a fact that Environmental Education has incorporated into its teaching style. However, there must be further research into the many effects of the outdoors on humans as the effects have not been exhaustively studied and further benefits and detriments may have yet to be discovered, which can be used to improve Environmental Education as a whole. While Environmental Education is occasionally utilized in education in America (for example, field trips), there are not many dedicated extant Environmental Education programs (such as the EIC model) utilized in schools outside of isolated test-bed schools or minimal offerings in traditional curriculums.

The balance struck by the popular EIC model used by SEER is a good one, and it is an example of one of the ways that Environmental Education can be better than a traditional education. The use of its principles to create a broad model focused upon best teaching practices is effective and allows for a wide array of proven educational techniques within certain constraints. The EIC model and Environmental Education in general are applicable outside of the scholastic realm, as evidenced by the beneficial application of nature in hospitals and workplaces researched for this papers literature review. Not only can students carry the independent and critical thinking skills that it deems so important for the rest of their lives, but they also end up possessing a broader knowledge of the role humans play in the natural world via Environmental Education. There are issues with it, but this is to be expected in a type of education that is relatively new and has not been stringently researched and critiqued. The same sentiment can be extended to the EIC model. Issues such as the vaguely political goal, vocational aspects, and overly local focus of Environmental Education are problems that should (and can easily) be further investigated and discussed by educators and scholars. Improving it and making it more

widely applicable and palatable as a form of public education can have many benefits, and delivers a superior education and educational experience than the standardized rote education found in many modern schools.

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Appendix 1

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Appendix 2

"Stress Recovery during Exposure to Natural and Urban Environments" (Ulrich & Simons et. Al 1991)

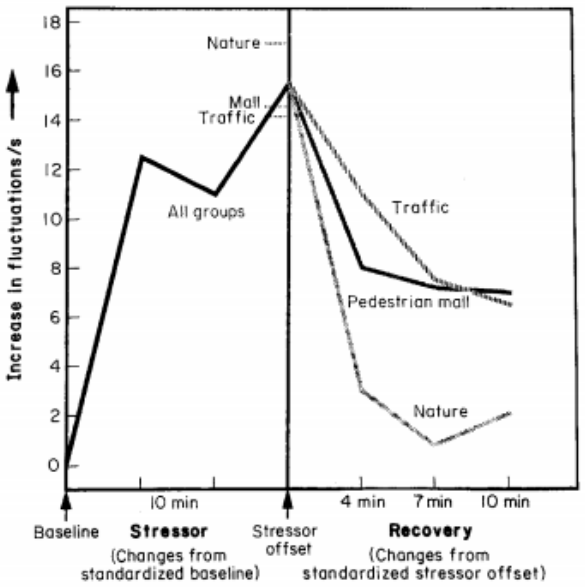

FIGURE 1. Changes in skin conductance (SCR) during stress and recovery.

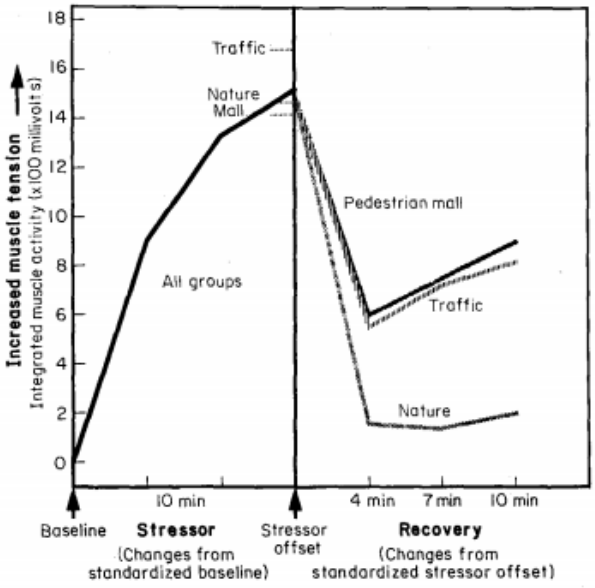

FIGURE 3. Changes in muscle tension (EMG) during stress and recovery.

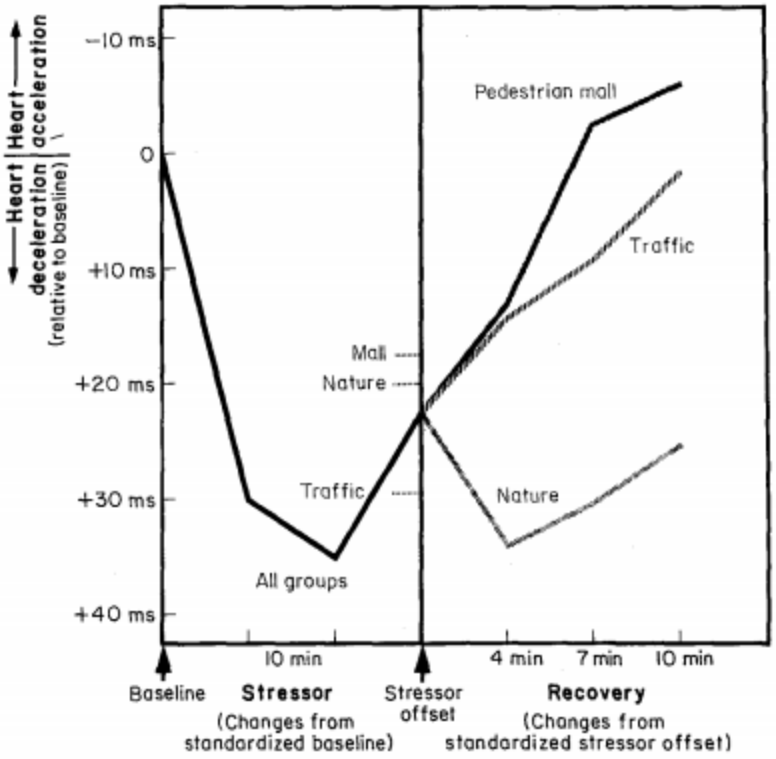

FIGURE 4. Changes in heart period (HP) during stress and recovery.

Appendix 3

This is the full Greenwoods Charter sample EIC curriculum, taken from: www.greenwoodscharter.org/pdf/BatsEICgrid.pdf

Grade: 2nd grade	Topic/Time Span: Animal Classifications and Bats (3-4 weeks - October)

Green Woods Charter School - EIC Curriculum Grid

Environment & Ecology: ● 4.3.4.A - Know that plants, animals and humans depend on air and water ● 4.3.4.C - Understand that the elements of natural systems are interdependent ● 4.5.4 A – Know types of pests ● 4.5.4. B – Explain pest control ● 4.5.4.C - Understand society's need for integrated pest management ● 4.6.4. A – Understand that living things are dependent on nonliving things in the environment for survival ● 4.7.4 A – Identify differences in living things ● 4.7.4 B – Know that adaptations are important for survival ● 4.7.4 C – Define and understand extinction ● 4.8.4.C - Explain how human activities may change the environment	Reading, Writing, Speaking, Listening: ● 1.1.3 F – Understand the meaning of and use correctly new vocabulary learned in various subject areas. ● 1.1.3 G – Demonstrate after reading understanding and interpretation of both fiction and nonfiction text. ● 1.3.3 F – Respond to nonfiction and fiction works of literature ● 1.4.3 B – Write informational pieces ● 1.4.3 C – Write an opinion and support it with facts. ● 1.6.3 A – Listen to others ● 1.6.3 B – Listen to a selection of literature and relate it to similar experiences ● 1.6.3 D – Contribute to discussions ● 1.6.3. E – Participation in small and large group discussions and presentations.
Science & Technology: ● 3.1.4.A - Know that natural and human-made objects are made up of parts. ● 3.1.4.C - Illustrate patterns that regularly occur and reoccur in nature. ● 3.1.4.E - Recognize change in natural and physical systems. ● 3.3.4 A – Know the similarities and differences of living things ● 3.3.4.B - Know that living things are made up of parts that have specific functions. ● 3.7.4 C – Identify basic computer operations and concepts ● 3.7.4 D – Use basic computer software	Math: ● 2.1.3.A - Count using whole numbers (to 10,000) and by 2's, 3's, 5's, 10's, 25's and 100's. ● 2.1.3.G - Use concrete objects to count, order and group. ● 2.5.3.A - Use appropriate problem-solving strategies
Civics & Government: ● 5.1.3 B – Explain the purposes of rules and laws and why they are important in the classroom, school, community, state and nation.	Geography: ● N/A
History: ● N/A	Economics: ● N/A
Health, Safety, & Physical Ed: ● 10.4.3.F - Recognize positive and negative interactions of small group activities.	Arts & Humanities: ● 9.1.3 A – Know and use the elements and principles of each art form to create works in the arts and humanities ● 9.1.3 B – Recognize, know, use and demonstrate a variety of appropriate arts elements and principles to produce, review and revise original works in the arts ● 9.1.3 C – Recognize and use fundamental vocabulary within each of the arts forms ● 9.1.3 H – Handle materials, equipment and tools safely

	at work and performance spaces.
Career Education & Work: ● N/A	Family & Consumer Science: ● 11.2.3.H - Identify how to resolve conflict using interpersonal communications skills.

Goals and Objectives:

- Students will learn the different classifications of animals.
- Students will learn how to identify animals based on their tracks.
- Students will learn why a bat is a special mammal.
- Students will learn to identify specific bats.
- Students will be able to locate the parts of a bat.
- Students will be able to explain why bats are natural pest management systems.
- Students will be able to describe the bat's role in the food chain.
- Students will begin to learn about echolocation.
- Students will write short informational paragraphs about bats.
- Students will be able to differentiate between bat facts and opinions.
- Students will identify what we can do in order to help protect a bat's habitat.
- Students will go on a field trip to Crystal Cave Park in Kutztown, Pennsylvania

Overview of Integrated Activities:

Science (possible lessons to use):

- Animal classifications lesson (2 classes)
  - mammals, birds, fish, amphibians, reptiles,
- Project Wild - First Impressions (to introduce the bat unit)
- Bat lesson - books and facts
- Bat videos online
- Little Brown Bat and Vampire Bat Lesson
- Bat Box Hike
- Build a bat box (if able)
- Incredible Bat Worksheet - bat ears (Science Made Simple)
- Vibrations Activity (Science Made Simple)
- Echolocation lesson and games (2 classes)
- Sound Waves Activity (Science Made Simple)
- Types bats lesson - microbats and megabats

Regular Classroom (possible integration lessons):

- Read the Great Ball Game and practiced using Venn Diagrams by comparing bats to birds
- Watched Magic School Bus Goes Batty and completed fact sheets about bats
- Used the How-To writing model to write a How-To Draw a Bat and students followed the model to draw a bat
- Used the How-To writing model to write a How-To Make a Bat paragraph from a sequence flow chart
- Created bat number stories using science vocabulary words
- Compound word bats
- Illustrated Bat Poems
- Looked at a variety of bat books to distinguish the difference between fiction and nonfiction. Then used a Venn diagram to compare fiction and nonfiction.

• Fact & Opinion (Science Made Simple) • Bat quiz	

Assessment:

- Students will complete a Venn diagram comparing two types of bats (including what they eat and their habitat).
- Students will write bat fact and opinion sentences.
- In their journals, students will describe the basic needs of animals and list animals that can be classified as mammals.
- Students will explain, in their journals, how bats are natural IPM systems.
- Students will use the information that they have learned about bats to write a short paragraph.
- Students will complete a quiz on bats detailing types of bats, bat homes, echolocation, and what bats eat.
- Students will explain what happens to bats when mines are closed and what we can do to help them survive.
- Students will explain what white nose syndrome is.
- Students will be able to detail where bats fit into the food chain.
- Students will be able to describe why bats facial features (ears and nose) are important to their survival.
- Students will be able to explain what echolocation is.
- Students will be able to complete an end of the unit bat test with at least 75% accuracy.

Science Resources:

- Amazing Mammals Part II by, National Wildlife Federation
- A Homeowner's Guide to Northeastern Bats and Bat Problems by, PennState College of Ag.
- Project Wild: K-12 Curriculum & Activity Guide
- Bats Incredible! – AIMS Activities Grades 2 – 4
- Shadows of Night: The Hidden World of the Little Brown Bat by, Barbara Bash
- Bat Kit – PA Fish and Game Commission
- Science Made Simple – (Grades 1-3) Best of Mailbox Magazine

Video/DVD:

- Season of the Bat – Pennsylvania's Wild Resource Conservation Fun (1993)
- Amazing Animals, Nighttime Animals – Partridge Films (1996)

Other:

- Bat Box Kit – Pennsylvania Fish and Game Commission
- Brenda Malinics – bat expert – Brenda.malinics@temple.edu

- http://members.aol.com/bats4kids
- Pennsylvania Bats - http://sites.state.pa.us/PA_Exec/PGC/w_notes/bats.htm
- Bat Thematic Unit Resources – http://www.cccoe.k12.ca.us/bats/welcome.html
- The Teacher's Guide: Bats – http://www.theteacherguide.com/batslessonplans.htm

Websites and Online Videos:

- http://www.incrediblebats.com/interactive.html
- http://kids.nationalgeographic.com/kids/animals/creaturefeature/vampire-bat/
- http://www.kidzone.ws/animals/bats/index.htm
- http://bats4kids.org/
- http://www.batrescue.org/batfacts/batfacts.html
- http://www.youtube.com/watch?v=vpxEmD0gu0Q
- http://video.nationalgeographic.com/video/kids/animals-pets-kids/mammals-kids/bat-flying-fox-kids/
- http://video.nationalgeographic.com/video/animals/mammals-animals/bats/weirdest-long-eared-bat/
- http://video.nationalgeographic.com/video/news/animals-news/bat-hospital-wcvin/
- http://video.nationalgeographic.com/video/animals/mammals-animals/bats/weirdest-flying-fox/

Literature:

- Stellaluna by Janell Cannon
- Bats by, Lily Wood
- The Bat Book by, Luann Columbo
- Squeaking Bats by, Ruth Berman
- Bats by, Anne Gordon
- Eyes on Nature: Bats
- Bats in the Dark by, John Kaufmann
- Bats – Creaturs of the Night by, Joyce Milton
- Bats and Other Animals of the Night by, Joyce Milton
- Bat Loves the Night by, Nicola Davies
- Bats by, Gail Gibbons
- Amazing Bats by, Seymour Simon
- I Can Read About Bats by, Elizabeth Warren
- Caves by, Veda Boyd Jones
- Shadows of the Night: The Hidden World of the Little
- Brown Bat by, Barbara Bash
- Eyes on Nature: Bats by, Celia Bland
- The Magic School Bus: The Truth About Bats by, Eva Moore
- Five Little Bats Flying in the Night by, Steve Metzger

Classroom Resources:

-

Extension Activities:

- Students can research one type of bat.
- Students can take a nighttime walk to look for bats.
- Students can build a bat box and put it up.
- Students can create posters for each type of animal classification.
- Students can visit a local cave.
- Students can research other types of bat homes.
- Students can read bat books.
- Students can watch bat movies.
- Students can complete bat crafts.