

INTEGRATION OF ENVIRONMENT, COMMUNITY, AND THE CLASSROOM:
PLACE-BASED EDUCATION AND ITS EFFECT ON SECONDARY SCIENCE
STUDENT ACHIEVEMENT

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Eric N. Evans

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Eric N. Evans

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Terry Ford, Ph.D., Member of the Faculty

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ABSTRACT

This review of the literature examines the effects of place-based education on secondary science student achievement. The performance of secondary science students on standardized tests raised questions concerning curriculum in science classrooms. Place-based education, taking the classroom out into the environment, is proposed as a complement to current curriculum to enhance student success. Concerns about place-based education include incompatibility with standards-based curriculum and educator comfort with regard to the content. Analysis of the research on place-based education shows a positive effect on student achievement regarding standardized tests as well as improved concern and motivation regarding the environment. This review also shows that educator concerns about place-based education can be alleviated resulting in positive outcomes for teachers and students.

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CHAPTER ONE: INTRODUCTION

Introduction

Imagine revisiting one of your elementary school classrooms. Enthusiasm, excitement, anticipation-- all are emotions associated with these memories reflecting positive feelings when it comes to our educational experience. When looking back we generally think of learning as enjoyable. If asked, elementary students may also use positive descriptors to illustrate their feelings toward what they are learning. If one inquires what their favorite subject is, many will say science. When asked why they like science, children might say, "I like doing fun things." Now, take aside that same child as a secondary student and ask a different question, "What is your least favorite subject?" Chances are good that student will say "science." How does a subject that was once considered fun and engaging become so unpopular?

When in elementary school, learning is doing. In this setting children are not just told what will happen, they have results illustrated through their own experience. Our educational system now disregards this critical part of science education for secondary students. Indicative of this is the small number of public schools achieving yearly science education requirements (Office of Superintendent of Public Instruction, 2011). Many states have adopted test scores as an indicator of science learning. Why is hands-on experience considered important in the primary setting, but ignored in secondary school? A proposed solution is a curriculum that involves community and environment as

an integral part of the classroom-- a concept dubbed "place-based education." This paper investigates the literature, determining the effects of place-based education on the achievement and growth of secondary science students.

Rationale

Place-based education is an idea that incorporates hands-on science into the classroom. If a child is interested in science in elementary school, it is logical to infer the foundation exists for that child to remain engaged in science throughout his/her academic career as well as his/her life. Recently, the State of Washington designated environmental sustainability as a required subject to be integrated throughout the educational curriculum. If students can be encouraged to engage in their science education, this subject can be basis for understanding environmental sustainability. However, complex global problems and the complicated potential solutions to these problems can overwhelm students. To address this, new approaches to teaching or "mental models" are needed to instruct students in the skills necessary to support ecologically healthy, socially just, and economically sustainable communities (Eaton M., Davies K., Williams S., MacGregor J., 2011). The educational system can use place-based education as a tool to succeed where other science curriculum has failed. Over time, the community and the student within their school have become disconnected (Sobel, 2005). Place-based education brings the classroom into the community, and the community into the classroom. Students find relevance to what they use in the classroom and apply it to the real world. By using the community as a learning tool, students visualize problems and potential solutions to those

problems readily. Science becomes "actual" and personal instead of "virtual" or disconnected. If educators are to encourage the type of thinking that allows for sustainable thought for the future, they must develop the confidence within the student that sustainability is possible. A natural way to build this foundation is by reintroducing students to the small, most familiar aspects of their lives.

Place-based education gives relevance to student learning. It is a tool that engages the student in their science education by exploiting their prior knowledge and experience. "The core objectives of place-based education are to look at how landscape, community, infrastructure, watersheds, and cultural traditions all interact to shape each other" (Sobel, 2005). Introducing the student to relevant issues they may or may not have awareness of locally can engage them in science. This interest proliferates into their community and their future lives. This not only has the potential to increase state-required science scores, it does so with cultural and social relevance. In fact, this type of curriculum has had significant affects among aboriginal students where culturally the personal relevance toward their education is based upon the significance of their local environment (Wilson and Stemp, 2010).

The addition of place-based education into a school curriculum has relevance to teachers and how they teach as well. Collaboration among other teachers, enjoyment in their work and freedom of curriculum may decrease with the implementation of standardized testing and the subsequent decrease in place-based education (Thomas, 2005). Teachers as minor public figures are integral parts of the community. Place-based education may help alleviate the

divide between the community and teachers within the educational system created by the initiation of state standardized testing. This disconnect has the potential to effect the educational engagement with curriculum among students and teachers alike (Jennings, Swidler, and Koliba, 2005).

The use of place-based education and its potential effects on students and teachers creates some concerns, however. Some educators and politicians criticize place-based education as not fitting within the philosophy of state standardized testing (Jennings et al., 2005). They assert that without standardized testing, there is no way to measure the effectiveness and efficiency of public schools. The political community generally believes that without this measure, it would be difficult to determine what is broken within the educational system (Ravitch, 2010). The inability to measure the success of place-based education in a quantitative way underscores this argument (Sobel, 2005).

Other criticisms of place-based education include the dedication of time required by educators, and the financial cost implementing these programs. Often in the face of budget shortfalls the responsibility of finding the funds to support these programs falls upon the teachers. In a time when test scores are of utmost importance, teachers may not be able to find the time required. Attending to students' emotional needs creates another time constraint. As mentioned previously, the challenges facing local communities and the environment can be overwhelming for students to conceptualize without dedicated guidance from teachers. This direction takes time. This time may or may not be supported by a teacher's administration.

Historical Background

Place-based education is a relatively recent term but its roots run deep in the history of the public school system. Before a government educational system existed community, schools, and students were typically interconnected. Classes were suspended for harvest of crops, community meetings, and in response of regional threats. Before the 20th century, schools were a part of the community. The buildings themselves were community gathering places. In essence, the school was a community center. However, this relationship shifted in the wake of the industrial age.

As cities developed, the lure of funding not based upon environmental conditions was hard to resist. Individuals chose the consistency of an industrial paycheck over the uncertainty of a quality of life that depends on community support. People moved into cities at an ever-increasing rate. The infrastructure for this urban living came into place just as the country was thrust into a world war. This further drove the industrial machine, as more people moved into the urban setting to take advantage of the opportunities available. A recession and depression soon followed. With many in the country committed to the life they had made within the urban environment, community and environment became important once again as a support for survival. Education, for those children that had the opportunity to experience it, incorporated this influence of environment. The nation ended the depression with the beginning of a second world war and a government message that drove a new awareness of country, community and land. Conditions were set for a new paradigm among educators across the

country; one that moved from a manifest destiny of settlement to one that encouraged the conservation of that which has been settled. At this point in time, appreciation, ownership, and individual participation within the environment began to be encouraged.

Between the end of the Great Depression and the beginning of World War II, education that included the community and the environment developed its own identity. MacGregor (2011) outlined the evolution of education that once again began to include aspects of the environment outside of school. At the start of this transition between the depression and WWII outdoor education evolved. The works of John Dewey, and Harold Rugg, considered the influential progressive education philosophers of the time, influenced this movement. This idea was based upon bringing the environment into the classroom and using the environment as an educational resource. They believed that getting the students' hands "dirty" by actual experience would give relevance to the subject matter they learn within the walls of the school. This idea is still a foundation for many programs across the country promoting outdoor experiences for children. With its hard to define goals, this movement came under scrutiny. Regardless, outdoor education took root and evolved.

By the 1930's many of the wildlife resources in this country showed signs they were not sustainable under the existing pattern of exploitation. Market hunting created a decline in wildlife populations that was indisputable. Due to poor and unsustainable agricultural practices farmers had to choose between the degradation of intact habitat and ecosystems or certain bankruptcy. Unable to

ignore this, educators promoted a movement termed "conservation education." This movement brought many political changes. For example, the institution of the Duck Stamp Act, and the Pittman-Robertson Act, provided funds dedicated to the pursuit of wildlife management. The national refuge system was created in order to protect remaining critical habitat from future development, and the first Farm Act was introduced to encourage farmers to work with the government to develop agricultural practices that were sustainable. This encouraged development of conservation education within the school system. Champions of this movement such as Aldo Leopold created the idea of a land-use ethic, a sense of commitment and dependence on the environment that would set the stage for what would be called place-based education in the future (Knapp, 2005).

As a result of conservation education, many educators understood the importance of the environment as an educational opportunity. The result of this was "Experiential Education." This idea gave students the ability to learn personal and social skills with the environment as the curriculum, challenging students to discover their own strengths. This was an important step as it recognized the importance of the environment as a learning tool for students to develop physically, mentally, socially, as well as environmentally. This set the stage for an educational system that moved toward the community as an integral part of the learning environment. Environmental education began to form.

Within the movement of environmental education came an awareness of the importance of "place" within the individual. The educational system

understood that a students' attachment to their community affected their perception of relevance to their education and their motivation to pursue it. Sobel (2005) called this "place attachment." Place based education is the latest stage in the evolution of more than a century of gradual acceptance of the effect of the environment within the classroom, and the effect of the student upon the environment.

Definitions and Limitations

Place-based education has a broad scope that has been implemented in elementary, secondary, and post-secondary classrooms. Place-based education is defined as having these criteria: 1) learning that is rooted in the unique history, environment, economy, and culture of a particular place; 2) community and environment are the context of learning; 3) student work focuses on community or environmental issues; 4) community members are partners and resources in teaching and learning; 5) products of student learning address community needs (Rural Schools Partnership, 2011). As place-based education is investigated multi-nationally, studies that involve students from a variety of cultures and nationalities are reviewed. A large collection of research on the effects of place-based education uses post-secondary students as subjects. These studies may be included when relevance to secondary science education is deemed substantial. This may be particularly significant in studies that work to quantify the ideas behind place-based education.

Place-based education uses a large number of terms that need to be defined in regard to this paper. Place-based education is a synonym for community-based learning, service-learning, environment as an integrating concept (EIC), sustainability education, project-based learning and environmental education (Powers, 2004). Place-based learning encompasses these terms in this paper. The environment is a recurring theme within place-based education. Here, "environment" refers to the natural and man-made conditions to which an individual resides. Community refers to the environment including the atmosphere created by other individuals. Many studies on the effects of place-based education use indigenous cultures as the subjects. Within the definitions of this paper, "indigenous" cultures refer to all cultures existing prior to colonization. This may include "native" or "pre-westernization" as reference to these cultures.

Sobel (2005) defined "place-attachment" and "sense-of-place." With regard to this paper, place-attachment refers to a subjects' emotional connection to a particular artifact within their environment. This could be a specific location, group, or community. An individuals' "sense-of-place" will refer to the particular degree in which they feel comfortable, or belong, within the context of a particular artifact within their environment or community in general.

Statement of Purpose

Place-based education has had growing attention in recent years. Teachers from all content areas have experimented with implementing this curriculum style in order to positively impact students. In response, interest in research on the effects of place-based education has also increased. This paper reviews the literature regarding the effects of place-based education on secondary science student achievement.

Summary

Place-based education is a relatively recent term in the literature. However, this idea has a long history in the educational system. Using the surrounding natural and man-made environment as a learning tool may be a 20th century invention, but the interconnection of the school and community dates back to the beginning of formal education. War, economic strife, and cultural change reduced the perceived importance of the environment in education. A renewed attitude toward the importance of a "sense-of-place" and "place-attachment" with regard to student success evolved over the last few decades. Still, science has continued to be a subject of disinterest among secondary students. The place-based approach to education has many implications for the student. With this approach the student has the ability to become increasingly engaged in their education and find relevance to what they are learning. This has the potential to produce an individual that has both the community morality to promote sustainability but also the drive to promote positive change. Educators

using this approach have the potential to collaborate more with their peers and create more enjoyment and freedom with regard to their curriculum. This seems to contrast with current state systems of quantitative academic assessment and school accountability where immediate numbers matter and future success is not accounted for. This paper reviews the literature on place-based education to determine its effect on secondary science students. Chapter two is a critical review of the literature regarding place-based education. The literature reviewed is organized into four themes. "Student Perceptions" reviews the literature exploring student experiences and perceptions of place-based education. "Environmental Perception and Attachment" reviews literature regarding the effect of place-based education on students' attitudes regarding the environment. "Teacher Perception and Practice" reviews the literature regarding educators' perception of place-based education and their perceived limitations to implementing it. "Motivation Knowledge and Increase" reviews the literature regarding the effect of place-based education on motivation amongst students, increased knowledge, and personal environmental attachment. Chapter three provides a summary of these findings, as well as classroom implications, and suggests further research. Finally, this chapter concludes the paper and reviews the contents of all three chapters.

CHAPTER TWO: CRITICAL REVIEW OF THE LITERATURE

Introduction

Chapter one introduced the concept of place-based education as a means of continuing in the secondary setting the hands-on approach so often utilized in elementary classrooms, thereby increasing the enthusiasm for science and its relevance. This increase in interest and understanding of significance could improve achievement among secondary science students. This is an artifact of the definition of place-based education which is a hands-on curriculum that uses the environment as its base while working with local community members for support. Chapter one also documented several different names given to place-based education. Place-based education can also help alleviate the stress felt by students when confronting environmental issues by illustrating that sustainable solutions are possible. This type of curriculum also affects teachers as an influence encouraging collaboration and freedom of content. However, there are criticisms of place-based education as not conforming to the ideals of standardized state testing, its potential cost, and the large amount of time required. Finally, chapter one summarized the history of environmental education and its evolution toward the more recent concept of place-based education.

Chapter two now reviews the literature regarding place-based education. This chapter is organized into four sections: Increase in student environmental perceptions, teacher perception and practice, environmental perception increase and attachment development, and motivation and knowledge increase.

Increase in Student Environmental Perceptions

The six studies in this section reported a positive effect on the perceptions and experience of students after participating in a place-based education (PBE) program. In a qualitative study to determine the effect of environmental education (EE) on motivation and attitudes toward learning, Battersby (1999) surveyed 11th and 12th grade students and found an increase in enjoyment with regards to learning about the environment. In another qualitative study, Russel and Burton (2000) analyzed student experience in EE with a survey of 73 secondary students and discovered their learning enjoyment improved. In a qualitative case study Davison (2001) observed 10 high school students as they attended an outdoor education (OE) program to determine how students make meaning of their experience and found an increase in self efficacy among the subjects. In a qualitative case study to determine the effect of OE on the behavior of students with emotional and behavioral difficulties Fox and Avramidis (2003) perceived a positive effect on behavior among 11 high school boys in an OE program. In a mixed-method quantitative study Ernst and Monroe (2004) analyzed the effect of EE on disposition toward critical thinking by testing 404 high school students, determining the program had a positive effect. Finally, in a quantitative study to establish the effect of using a remotely operated underwater vehicle in an EE program, Harmon and Gleason (2009) surveyed 270 students and found an increase in student engagement.

In a qualitative study to determine the effect of environmental education (EE) on motivation and attitudes toward learning Battersby (1999) surveyed 11th

and 12th grade students in secondary schools in the United Kingdom. In question was whether or not an environmental education program should be an integral part of a curriculum to increase motivation, learning enjoyment, and awareness about the environment among students. Student perceptions of the potential for environmental education to reduce disaffection and underachievement were measured through a pilot questionnaire given to two groups of 11th and 12th grade students. The tool allowed each respondent to answer the questions as fully as they wanted to. The questionnaire was in two parts. The first part asked about their attitude, behavior, involvement and interest when learning about the environment. The second part asked students about their perceptions of whether or not learning about the environment changed their attitudes towards their community and environmental issues.

This open ended survey revealed the following themes. Battersby (1999) found students enjoyed learning about the environment and that it increased their awareness of the complexity of the world and systematic consequences of their actions. These results indicate that environmental education is a valuable and necessary part of curriculum as clear evidence is given that exposure to EE changes students' attitudes and values towards the environment. The majority of the students claimed that learning about the environment enhanced their involvement with local and global issues having a more empowered feeling about their learning. However, some students felt environmental education changed their attitude toward school in general and some did not.

The results represented in this study reflect those found in Russel and Burton (2000), Harmon and Gleason (2009), Bradley, Waliczek and Zajicek (1999), Ballentyne, Fien, and Packer (2001), and Bogner (2002). The theoretical basis and methods were also grounded in the research according the references given by the author in this study. However, the reliability of the survey instrument, triangulation of the data, and demographics concerning the subjects were not addressed. Furthermore, results were not given in tabulated form. Therefore, although the results tend to reflect prior and subsequent research, it is difficult to say this study is generalizable, reliable, or reproducible.

In their qualitative study, Russel and Burton (2000) analyzed the student experience in EE with a survey of 73 secondary students in a rural secondary school near Toronto, Canada. Most students in this school were lower to middle class and white. Subjects were voluntary.

Russel and Burton (2000) used a case study design with pre and post course questionnaires containing open ended questions. Before and after an environmental studies program students were given a questionnaire to measure their experience and perspectives regarding the program. Fourteen questions were in the pre course questionnaire and 16 were in the post course questionnaire. The researchers were also a part of the environmental education program. Responses to the questionnaires were coded.

Analysis of the questionnaires indicated three key themes regarding experiential learning, interpersonal skill development, and personal growth. First,

Russel and Burton (2000) found that students considered learning outdoors more effective than a traditional school setting. Some students considered learning outdoors more difficult. One student stated that the question was ridiculous because they're two different situations. The study did not further examine this attitude. Most students enjoyed the opportunity to develop interpersonal skills and friendships in the program. The majority of students acknowledged an increased awareness and knowledge of the environment and even recognized skills they would like to develop for future careers. Some students complained about the addition of homework.

Student responses to the questionnaires were candid and reflected the assurance of the researchers that they would be anonymous. This gives the responses credibility. The results of this study regarding an increase in environmental awareness and EE effectiveness reflects those found in Battersby (1999), Bradley, Waliczek, and Zajicek (1999), and Lisowski and Disinger (1991). However, the nature of the school in which the students were from might lend them to a greater innate awareness of the environment. Thus, transferability proves difficult. Furthermore, transferability may also be affected by the fact that the students paid to participate in the program. Therefore, their enthusiasm for the environment might already exist. This we do not know since results from the pre questionnaire were not given.

Davison (2001) observed 10 high school students from an all boy Catholic school in New Zealand as they attended an outdoor education program to

ascertain in what ways outdoor education students made meaning from their experiences.

Davison (2001) used a case study design consisting of observation and interviews during the six-week outdoor education course. First, through observing the course the investigator raised reflective questions that could be addressed in the in-depth interviews given toward the end of the study. Four students were given face to face interviews concerning the issues noted during the observation process. These four students were chosen based on consultation with the teacher and the observation process in order to incorporate a wide representation of backgrounds and attitudes. Observations and transcriptions were divided into themes that represented the data based upon the Constant Apparent method.

Davison (2001) found three major themes emerged from the data analysis process: enjoyment of overcoming challenges, building confidence and mental strength, and freedom of choice. The interviews revealed that students enjoyed recognizing a challenge, having the opportunity to face it, and overcoming it. The students recognized that this gave them self-confidence and less apprehension to face the next challenge. Confidence and mental strength seemed to be due to just the right amount of risk in outdoor education challenges to give optimal arousal creating increased self-efficacy. Students also felt a sense of freedom to choose and participate in activities in which they had interest. As efficacy improved, activities were chosen based on challenge. Self

confidence and mental strength in general though, were difficult to measure do to their abstract nature.

The methodology and data treatment are recognized in the literature according to the references given by the author and give this study some credibility. These findings are also consistent with those found in Harmon and Gleason (2009), Athman and Menree (2004), Way (2009) and Battersby (1999). However, the abstract nature of the data analysis as given in the study may limit confirmability by an outside party. Furthermore, transferability is in question due to this specific nature of the school in which these boys were enrolled.

Fox and Avramidis (2003) followed 11 high school boys through an outdoor education program. Subjects in this program represented a range of emotional and behavioral difficulties including Asperger syndrome, Tourette syndrome, ADHD, and OCD. The program was a six week outdoor school in Dartmoor, England. The students were divided into two groups. The first group comprised of five 10th grade boys. The second group comprised of six 9th grade boys. The researchers were interested in any positive effects an EE program might have on these students and the perceptions the students might have regarding the program.

The researcher was an instructor in the program. This study was a participatory, exploratory case study. Data collection was through systematic observations relating to the behavioral and academic performance of the group as well as semi structured interviews with all students. Students IEP records,

national curriculum achievement records, and case history notes were also consulted for this study. All systematic observations relating to the students' behavior were recorded by means of a system developed for use in the school setting. This involves the assigning of a score for every pupil under the subsections of; classroom rules, special area, and effort for each 45 minute teaching session. The maximum score for these sections are five, four, three points respectively with a maximum of 12 points for each session. All data were transcribed in imported into NUD.IST version 4 and coded. The following themes were revealed.

Fox and Avramidis (2003) found success in promoting positive behavior for a group of pupils with severe emotional and behavioral difficulties through an outdoor education program. With regard to academic gains the evidence is less clear-cut and considerable variation exists in the degree of academic success. Perceptions of the program amongst the students were positive.

The inclusion of prior history with regard to the students and having the researcher as a participant in the program gives this study credibility. The subjects of this study had a wide range of behavioral and emotional difficulties which gives potential transferability to the research. This author has not been able to find the current research using the subjects in order to compare if the findings are consistent with other studies although past research referenced in this study does seem to concur with their findings. However, positive perceptions amongst the students regarding the EE program is consistent with Russel and Burton (2000), Harmon and Gleason (2009), and Way (2009). The use of a

generic computer program in order to code the data allows for analysis from an outside party.

In a mixed method quantitative study Ernst and Monroe (2004) analyzed the effect of environmental education on disposition toward critical thinking by testing 404 high school students in 11 Florida high schools. One hundred and sixty five 9th grade students and 239 grade students participated. Forty two point nine percent were male, 57.1% were female, 56.5% were Caucasian, 33.2% were non-Caucasian, and 10.3% did not indicate ethnicity.

Researchers were interested if controlling for pre test scores, achievement level, gender, and ethnicity, do ninth and 12th grade students who participate in environmental education have higher critical thinking skills and a stronger disposition towards critical thinking than their peers?

This was a pretest post test non equivalent comparison study. This study was comprised of two groups, the ninth graders and the 12th graders. The study was non equivalent because the 12th graders had previously had environmental education. Therefore, the 12 grade group received a post test only. The study used the Cornell critical thinking test to measure student's critical thinking skills with a Cronbach's Alpha of 0.88. The California measure of mental motivation assessed disposition towards critical thinking. The Cronbach's Alpha was not given for this measure. Teachers administered the instruments as a pretest within the first month of the school year and as a post test in the last month to the school year for the ninth grade group. Students from these same schools in a

traditional program as opposed to those that were included in environmental education were used as a control group.

For the ninth grade study on critical thinking the treatment was statistically significant. There was a significant positive effect of the environmental-based program on students compared to the control group with the treatment group scoring 4.33 points higher on the instrument $b = 4.331$, $t(159) = 3.186$, $p = 0.002$. For the 12 grade study on critical thinking, the treatment was statistically significant $b = 5.544$, $t(221) = 3.657$, $p < 0.001$. Twelfth grade students in the environmental education programs scored 5.54 points higher on the post test than students in the control group with regard to critical thinking, $b = 5.544$, $t(221) = 3.657$, $p > .001$.

With regard to disposition for critical thinking, the ninth grade study was not significant $b = 0.640$, $t(147) = 0.916$, $p = 3.61$. For the 12th grade study the treatment was statistically significant with the EE students scoring 3.96 points higher on the instrument than the control group $b = 3.958$, $t(234) = 4.624$, $p < 0.001$. They showed that for the 12th grade students, environmental education increased the disposition toward critical thinking.

This test does raise a few questions regarding the data. The maturity level between the two groups can be directly involved in the disposition toward critical thinking. Significance values for all but the question of ninth grade disposition toward critical thinking were strong. However, internal validity is questionable with the same test used in the pretest-post test design for the ninth

grade study. Results of this study reflect those found in Davison (2001), Athman and Menree (2004), Harmon and Gleason (2009) and Way (2009) concerning enthusiasm toward learning after an EE program. Histories with regard to the study are not addressed in terms of testing time. Could disposition toward critical thinking be different in the fall as opposed to the spring? However, the large sample size and the Cronbach's Alpha rating for the instrument suggest this study may be repeatable.

In a quantitative study to determine the effect of using a remotely operated underwater vehicle in an environmental education program, Harmon and Gleason (2009) surveyed 270 students in three different groups, each group were involved in a separate environmental education program involving a remotely operated vehicle.

Subjects were 10 to 15 years of age. In groups one and two the majority are African American medium-sized-city residents. Group one was 69.1% female, group two was 9.7% female. Group three was 75% white, medium-sized-city residents, and 54.2% female. All subjects paid to be in the programs.

This was a one shot case study using an open ended, 3 point, Likert-scale survey. The group one program occurred in Chesapeake Bay, with 153 subjects, and a daily survey for a two week program. Group two was also in Chesapeake Bay with 31 subjects and a three day program with a five page survey at the end. Group three was in Florida and had 86 subjects, it was a one day program with a five page survey at the end. Questions on current residence and gender were

included in all surveys. Open ended responses were reviewed by three independent researchers with a 92% inter-rater reliability.

Chi square analysis showed that overall, the students thought the ROV was interesting, easy to use, and helped them understand the oceans better in all three programs. In the three programs 50.3%, 64.6%, and 83.7% agreed that the ROV was interesting, $X^2 = 31.23$, $p = .000$, and $df = 6$. In the three programs 72.2%, 93.1%, and 93.9% agreed that the ROV helped them interact with the environment, $X^2 = 27.45$, $p = 0.001$, and $df = 6$. These three programs also showed a 47.6%, 63.3% and 48.2% agreement that the ROV helped them understand natural resources better $X^2 = 17.94$, $p = 0.022$, and $df = 6$. Responses to the open ended questionnaire revealed an overall enthusiasm for operating the remotely operated vehicle, and an enthusiasm for new access to underwater habitats. Most students expressed that the remotely operated vehicle helped to facilitate their understanding of natural resources. However, response for enthusiasm decreased with an increase in group size over five regarding using a remotely operated vehicle. It may be that wait time between turns decreases enthusiasm.

Three different researchers independently reviewed the questionnaire results, giving the results validity. The results of this study concerning technology in EE and students performance reflects those found in Perkins, Hazelton, Erickson, and Allen (2010), and Bodzin (2001). Internal validity may be questioned by the lack of a control group or a pretest instrument. Furthermore,

the specific technology used might make it difficult to repeat the nature of this study by an outside study.

The analysis of the research in student perceptions suggests the place-based education styles contributed to an increase in positive attitudes and awareness toward the environment along with an increase in learning enjoyment. Place-based education has also demonstrated a positive effect on personal and emotional issues such as behavior and self efficacy. As Battersby (1999) found, students became more aware and empowered with regard to environmental issues. The Russel and Burton (2000) study also indicated greater environmental awareness among the subjects but also a greater appreciation among subjects to develop interpersonal skill and relationships as found by Fox and Avramidis (2003). Several studies revealed this potential for personal growth in a place-based program including those by Davison (2001) and Ernst and Monroe (2004). The latter showed a large increase in self efficacy among the subjects and a greater disposition toward critical thinking. Harmon and Gleason (2009) found an increase in student engagement in the learning process with regard to place-based education. More analysis of the literature is needed to determine if this increase in student motivation and awareness affects teacher practice and leads to an increase in student motivation, environmental attachment, and knowledge.

Teacher Perception and Practice

The six studies in this section analyzed the effects of PBE on teacher perceptions and practice as well as the effect of standardized testing on PBE and found a range of results from encouraging to challenging. In a qualitative study, Powers (2004) studied the effects of four PBE programs on teachers and schools and found challenges ranged from time constraints to collaboration. In a qualitative study to determine the effects of standardized testing on the implementation of PBE, Thomas (2005) case studied four secondary teachers in a small rural school and found the teachers believed that testing had little effect on their implementation of PBE. In a quantitative study, Scales, Roehlkepartain, Neal, Kielsmeiser and Benson (2006) studied the attitudes of school administrators with regard to service learning (SL) by surveying 1799 principals and found principals from low income schools consider SL to have a very positive effect on student achievement. In a qualitative study, England and Marcinkowski (2007) studied teacher growth and practice with regard to SL programs by surveying teachers from 25 secondary schools and found that teachers reported an increase in growth and a positive student outcome after implementing SL programs. In a quantitative study to determine the effect of EE on professional development, Meichtry and Smith (2007) surveyed 18 active secondary teachers and found an increase in confidence across multiple domains after participating in an EE training workshop. Finally, in another quantitative study, Ernst (2009) studied teacher's perceived barriers to using EE by surveying 1000 middle school

teachers and found barriers include: state testing, state standards, transportation, and lack of planning.

Powers (2004) studied four place-based education programs in a qualitative study by interviewing 85 public school students and 164 adults including teachers and administrators and community partners in order to identify the effects of these programs and how they influence teacher practice.

Powers (2004) and two graduate students developed a qualitative evaluation for each of the programs: Co-Seed project, Community Mapping Program, Sustainable Schools Project, and Forest in Every Classroom Project. These evaluation instruments were reviewed by outside sources and came to a consensus for the two cross-program research questions. Evaluators conducted interviews with the subjects within each program asking what they know and like about the program, how they have been affected by the program and what they would do differently. Internal staff regularly completed observation records and monthly reflection forms during and after their involvement with the programs. Upon completion of fieldwork, the transcribed interviews, reflection forms, and observation, all data from 41 field observations were coded to identify key emergent issues and then analyzed using induction methods. Researchers employed pattern matching to the open-ended responses and found the following themes.

All four programs investigated had numerous strengths and challenges but shared some attributes. Positive attributes across all four were; using community

partners gives students and teachers greater resources and diverse viewpoints, high quality program staff, and summer institutes in these programs help ensure that they will be sustained. Challenges across all four were time constraints and teachers need greater curriculum planning skills.

Impacts on teacher practice across all four programs were notable. Teachers augmented their use of local places, interdisciplinary teaching improved, and collaboration with other teachers enhanced. Furthermore, leadership, personal growth, planning skills, and use of service learning all increased.

The findings in this study are reflective of those of Ernst (2009) and Thomas (2005) which gives this study credibility. These four programs are used nationwide and provide transferability to the study. The evaluation of the instruments by an outside party gave confirmability to the data collection and analysis although no Cronbach's Alpha was given. An instrument that reflected preconceptions regarding these programs would give more credibility to the research. Furthermore, credibility is reduced by the lack of demographic data regarding the subjects.

In a qualitative study to determine the effect of standardized testing on the implementation of place-based-education, Thomas (2005) followed four secondary teachers in a small rural school at Mollusk Island to determine how mandated curricular standards affect teachers instructional planning and content selection with regard to place-based education.

Three ethnographic interviews were given to the faculty of a very small isolated school. Subjects of this study included four secondary teachers; two male and two female. One was a shop teacher, one taught social studies, one taught science, and one was an English teacher. All four taught place-based education before the implementation of standardized testing. This school serves 113 students on a small island off the Atlantic Coast.

The researcher became a participant in the daily life of the island in the school, attending school every day, and gaining full access to the community. Themes for the three interviews were dictated by interview guides with the purpose of drawing out the participants understanding of their practice in instructional planning after the implementation of standardized testing. After the interviews were transcribed the participants inspected the transcripts in each series and analyzed them using case-study-analysis. To check the validity of the analysis the researcher compared the patterns that emerged to four propositions based on the literature that were composed before data analysis addressing the following areas; effects of curricular mandates on teachers, teachers authority to make choices, place-based lessons vs. mandated content, and teachers reliance on conventional materials.

Participants displayed a mix of promising and unsatisfactory educational practices related to their instructional planning. Participants recognized the expectation to teach more rapidly and cover more content with more limited time, limited instructional resources, and limited types of assessments than before the implementation of standardized testing. Assessments began to mirror

standardized testing. Teachers collaborated less frequently after standardized testing. Teachers perceived a risk in using place-based curriculum and were likely to abandon it in light of student test scores. However, the science teacher noted the importance of place-based education and said she would continue this curriculum regardless.

The duration and inclusion of the researcher into the community over a long period of time gives credibility. Collaboration issues amongst teachers reflect the findings of Powers (2004) and Ernst (2009). However, the issues surrounding standard testing and EE contradict those of Ernst (2009). Having the subjects review the instruments gives this study a sense of verifiability. However, the culture and nature of the community and the school make it difficult to give this study transferability.

Scales, Roehlkepartain, Neal, Kielsmeiser and Benson (2006) surveyed 1799 principals in a qualitative survey to determine how those who work in urban, high-poverty, and majority non-white schools assess student achievement, engagement, and attendance with regards to service learning programs. Forty-seven percent were from elementary schools, 26% were from middle schools, and 28% were from high schools.

Two thousand and two schools were selected from the 2001 to 2002 common core of data public school universe file, stratified by instructional level, urbanicity, average class size, and minority status. Administrators of the schools received a survey which asked the impact of service learning on 10 different

academic measures; social development, school climate, thinking in relations outcomes, whether service learning very positive, somewhat positive, or had little or no impact. Survey responses were received from 1,799 schools (91%).

Results of this survey revealed the following themes.

Principals of urban, high poverty, or majority nonwhite schools were significantly more likely than other principals to regard service learning as having an impact on attendance, and school engagement. The same principals stated academic achievement with regard to service learning was very positive. Moreover, principals of schools that have all three characteristics: urban, high poverty, majority nonwhite population, also are more likely than other principals to consider service learning to have a positive impact on student achievement.

This was a qualitative study regarding educators in service learning. As a national survey that was voluntarily returned, the results cannot be given in context and gives question to credibility. Socio-demographic attributes of the schools and the administrators responded were not included. This was a national survey, therefore transferability is not an issue. The results of this study reflect those of England and Marcinkowski (2007). However, the study did not indicate how the data was treated. All references to the analysis of the data were directed to a previous study by the authors. This referenced study was found to be unavailable with current resources. Therefore these results cannot be confirmed.

In a qualitative study, England and Marcinkowski (2007) surveyed teachers in 25 secondary schools in Florida with service-learning programs in a

one shot case study to determine the effects on students of these service-learning programs that teachers report.

The survey was sent to schools identified as using environmental service-learning programs. Indicators on the instrument were: school participation and behavior, academic achievement and success, career development, social/interpersonal development, personal development, ethical and moral development, and civic responsibility development. Teachers involved in these programs were asked whether they assess these issues and the overall effect. The open-ended responses were content analyzed and the following themes emerged.

Teachers reported that they collected data through assessment on academic achievement and success more than any other indicator. In addition, teachers in this study also indicated an increase in growth and learning amongst students within all seven indicators of the survey.

Although this study might suggest behavior among teachers with regards to service learning, there are issues with this data. There were no data presented for teacher opinion on growth and learning which lends credibility issues for the question of the effects of these programs. There are no demographics listed for the subjects so transferability is impossible to determine. However, these findings are consistent with those found in Scales, Roehlkepartain, Neal, Kielsmeiser, and Benson (2006).

Meichtry and Smith (2007) surveyed 18 active secondary teachers to determine the impact on an environmental education professional development program on the confidence levels in classroom practices of the participants and their attitudes towards the environment.

This was a quantitative study which included a pretest, post test, and second post test nine months later. The second post test was identical to the first. The tests were a Likert-scale survey. Cronbach's alphas were between 0.79 and 0.85 for all parts of the survey.

The survey was given to 18 active teachers from the 19 counties that encompassed a watershed project and environmental education retreat. These teachers included two primary teachers, one school support staff member, seven middle school teachers, and 10 high school teachers.

The subjects were given a Likert-scale survey measuring the confidence level with regard to: technology, teaching strategies, community resources, conducting field investigations, and ability to teach watershed topics. The same survey was given before, after, and nine months after a six day summer workshop. MANOVA was used to analyze the groupings within each survey.

In the long term post assessment greater confidence in using technology was measured as opposed to the pretest in six of the seven parameters ($F = 7.3, 8.4, 9.4, 10, 12, 24$) ($p = 0.003$ to 0.0001) respectively. Greater confidence in the use of instructional strategies was found in the post test and long-term post tests as opposed to the pretest in two of the five parameters, addressing gender and

minority equity and subject integration ($F = 3.3$ and 7.6), ($p < 0.05$ and 0.002). Confidence and the ability to conduct field investigations were greater in the post and long-term post tests as opposed to the pretest in all four parameters ($F = 14, 14, 15, 22$) ($p = 0.001$). Confidence in the use of community resources improved in the two post tests in all three parameters ($F = 9.2, 10, 20$) ($p < 0.001$ and 0.0001). Confidence in the ability to teach watershed topics also increased in three of four parameters ($F = 5.6, 10, 14$) ($p = 0.007, 0.0001, 0.0001$).

Confidence intervals were good for all but a few of the parameters measured by the survey. The Cronbach's Alpha for the instrument was good at 0.79 and 0.85 . The second long-term (nine months later) post test gives validity to the instrument even though the tests are the same. This also gives validity to the results as that duration of time alleviates problems with instrumentation. The sample size was relatively small and subjects were voluntary, bringing the question of randomness into the selection of the subjects. Over the period of time this group was in the field historical situations or events may have influenced results. With such a long-term post test, regression toward the mean could also be a factor in the results. More research is needed in the confidence and growth of teachers with regard to implementation of environmental education, especially in the use of internet resources and inquiry-based teaching.

Ernst (2009) surveyed 1000 middle school teachers in a quantitative study in order to find perceived barriers teachers have in using environmental-based education and the influences that encourage them to use it. A survey was sent to 1000 middle school teachers. This survey was in two sections, pilot tested, in an

eight Cronbach's Alpha of 0.97 for section one, and 0.72 for section two. Response rate was approximately 20%. Teachers either used environmental education, environmental-based education, or neither. A total of 190 middle school teachers responded. Fifty-three used environmental-based education, 58 used other environmental education, and 79 used neither. All teachers were contacted through a national database. This survey had Likert-scale responses and was tested for significance using T-tests for influences and ANOVA for barriers to EE.

The author considers the following strong or very strong influences on teachers when it came to their decisions to use environmental-based education compared to the teachers that do not; environmental sensitivity $t(100) = 3.06$, $p = .02$, receptiveness to environmental-based education $t(92) = 3.89$, $p < 0.01$, teaching context $t(98) = 2.92$, $p < 0.01$, awareness of evidence of positive outcomes $t(100) = 5.32$, $p < 0.01$, and environmental literacy $t(102) = 3.06$, $p < 0.01$. The following five barriers were perceived as strongest in using environmental-based education; lack of administrative support $F(2,181) = 9.74$, $p < 0.01$, state standards $F(2,182) = 9.90$, $p < 0.01$, standardized testing $F(2,181) = 5.47$, $p < 0.01$, comfort level with teaching approach $F(2,183) = 14.56$, $p < 0.01$, and lack of planning time $F(2,180) = 5.12$, $p < 0.01$. However, environmental-based education respondents did not personally perceive any of these barriers as a strong or very strong barrier to the implementation of environmental-based education. Sixty-four percent of those teachers who use neither were unaware of environmental-based education.

The statistics in this study were complicated and difficult to understand. The instruments had an adequate Cronbach's Alpha and the subjects were drawn from a national pool allowing for a degree of randomness of the sample. However, internal validity of this study is weakened by not addressing history and or maturation during the study. The results of this study are similar to those found in Powers (2004), Thomas (2005), and Meichtry and Smith (2007).

An analysis of teacher perception and practice with regard to place-based education found a common theme of issues that affect whether or not educators participate in place based education. As Powers (2004), and Ernst (2009) studies suggested, barriers included: standardized testing, content knowledge, time constraints, collaboration, planning, and transportation. However, Thomas (2005) found that teachers could find a way to implement place-based education in spite of standardized testing even though PBE may be sacrificed in response to test scores. Furthermore, Meichtry and Smith (2007) found in their study that training and workshops can greatly increase teacher confidence with regard to place-based education. In the analysis of teacher perception it was also found that educators noticed an increase in awareness of the environment, growth, and knowledge among students as found by Scales, Roehlkepartain, Neal, Kielsmeiser, and Benson (2006) and England and Marcinkowsky (2007). More analysis is necessary to determine if teacher practice and the affects noticed by teachers has an effect on student environmental attachment, knowledge and motivation. Furthermore, as shown in Ernst (2009) teachers feel a lack of administrative support is a significant barrier to the implementation of

environmental education yet Scales, Roehlkepartain, Neal, Kielsmeiser, and Benson (2006) found administrators recognize the value of EE. More research is needed in regard to this contradiction.

Environmental Perception Increase and Place Attachment Development

The six studies in this section analyzed the effect of PBE on environmental attitudes and place attachment to the environment and includes findings that range from no effect to a very large effect on attitudes and attachment. In a quantitative study, Bradley, Waliczek, and Zajicek (1999) surveyed 475 students who participated in a 10 day EE course and found that students had more positive environmental attitudes and an increase in knowledge base after participating in the course. In a quantitative study to determine if access to the environment increased students' interest in working with environmental issues, Ruiz-Mallen, Barraza, Bodenhorn, and Reyes-Garcia (2009) and 95 students were tested, at preparatory school in Mexico found no association. In a qualitative case study, Ballantyne, Fien, and Packer (2001) surveyed 73 secondary students in Brisbane to determine the effect of EE on environmental attitude and behavior and found the program had made the majority of them want to change their actions with regard to the environment. In a quantitative study, Bogner (2002) studied whether an outdoor education program will increase students environmental perception by surveying 151 secondary students enrolled in a French OE program and found a significant increase in positive environmental perception. In a quantitative study to determine if PBE can enhance students' attachment to place, Semkin and

Freeman (2007) surveyed 30 undergraduate students in a local-based geology course and found the students significantly gained local place attachment. In another quantitative article, Semken, Freeman, Watts, Neakrase, Dial, and Baker (2009) studied whether or not a student's prior experience in a specific place correlated with the student's sense of place by testing 400 undergraduate students and found that teachers need not be concerned that PBE only works with resident students.

Bradley, Waliczek, and Zajicek (1999) surveyed 475 students in a quantitative study who participated in a 10 day environmental education course in Texas. All students were in grades nine through 12 from 18 schools and all were enrolled in Agriscience 384. This study was a pretest post test design to answer the research question of whether increased knowledge improves environmental attitudes after a 10 day environmental education course.

One hundred fifty schools in Texas were contacted from a list provided by the Texas Education Agency. 18 of these schools agreed to participate in this study. The study consisted of two surveys, one measured knowledge, and one measured attitude regarding the environment. The knowledge survey consisted of 18 multiple choice questions based on the curriculum but the Cronbach's alpha of 0.64. The attitude inventory consisted of 15 Likert type scale questions with a Cronbach's alpha of 0.72.

The knowledge and attitude survey were given before and after the environmental education course. This same test was given both times. Paired

sample T-tests were used to determine significance between the pre test and post test. To test the relationship between attitude and knowledge Pearson's product moment correlation was used.

Knowledge scores across the groups increased by 22% after the course with an increase in mean score of 1.78 ($r = .29$, $t = 7.77$, $p = 0.01$). Students who had less favorable environmental attitudes before the course tended to have more negative attitudes after the course. Students having more knowledge before the course had more favorable attitudes before the course. Overall students' environmental attitudes were more positive after the course with an increase in mean of .81 points ($r = .67$, $t = -2.44$, $p = 0.02$). Knowledge and attitudes were significantly correlated for pretest with $r = .29$ for knowledge and $r = -.19$ for attitude, ($p < 0.05$). They were also significantly correlated for the post-test as well, $r = -.27$, ($p < 0.05$).

Results of this study are congruent with those of Ballantyne, Fien, and Packer (2001), and Bogner (2002) yet disagree with Ruiz-Mallen, Barraza, Bodenhorn, and Reyes-Garcia (2009). Internal validity is questionable as the correlation r values of .29 and .67 are negligible. Testing may be an issue as the same instrument was used for the pretest and post test. Furthermore, history was not documented in the study as was maturation. In addition, the Cronbach's alpha scores for the instruments were negligible.

In a quantitative study to determine if access to the environment increased students' interest in working with environmental issues, Ruiz-Mallen, Barraza,

Bodenhorn, and Reyes-Garcia (2009) tested 95 students at preparatory school in Ixtlan, Mexico with a open ended, multiple choice, pilot tested questionnaire.

The researchers were interested knowing if students who have parents involved in forestry have a greater local environmental knowledge and are more receptive to school environmental knowledge and if the students' interest in working with environmental issues has a positive association to school and local environmental knowledge acquisition.

95 random students were selected from three academic years in a state science and technology preparatory school in Ixtlan, Mexico. Thirty three point six percent were enrolled in the first year, 26.17% in the second year, 40.19% in the third year. Average age was 16 to 17 with 46% male and 100% Hispanic.

The questionnaire included seven multiple choice questions to assess environmental knowledge which consisted of free listing of all local plant species known. Students were asked if their parents work in forestry. Points were awarded to answers. Standard deviation and significance with multivariate regression analysis was performed on the data. Data was clustered by school year.

No significant association existed between students who had parents in the forestry industry and school environmental knowledge ($r = 7.27$, $p = 0.06$). However, the authors' state students with a parent in forestry had a 13.76% higher school environmental knowledge score after ignoring the school year variable. School environmental knowledge score was not significantly correlated

with local environmental knowledge ($p = 0.38$), $r = 0.09$). In fact, students can name only 2.5 local native plant species ($SD = 1.61$). Students interested in working on environmental jobs had a 11.84% lower school environmental knowledge score ($r = 6.89$, $p = 0.09$). The authors suggest this may be an artifact that the local belief is that environmental jobs, including forestry, are low status and higher qualified students are choosing other occupations.

Although the sample was from the same school it consisted of random students giving the sample reliability. The one time nature of the study eliminates problems with history, maturation, or mortality as all students in the subject group were treated the same in the same school at the same time. The instrument was pilot tested which gives it validity. However, p values for this study are very weak and do not indicate significance. The authors state that they were concerned with sample size. Furthermore, this study might not be indicative of results of similar studies elsewhere given the large cultural influence on the attitude concerning environmental education.

In a qualitative case study, Ballantyne, Fien, and Packer (2001) surveyed 73 secondary students, ages 13 to 14 from a private girls' school, in Brisbane, Australia to determine the effect of environmental education on environmental attitude and behavior. This study addressed the research question: What are some of the learning outcomes, attitudinal, and behavioral changes resulting from students' participation in school environmental education programs?

After the completion of environmental education program called Six Thinking Hats, students in three different classes were asked to complete an open-ended questionnaire regarding what they liked about it, what they've learned, and whether the program had made them want to change behavior with regard to the environment. The program was incorporated into three year nine studies of Society and Environment Classes. One class was taught by the teacher who had developed the program and the other two classes were taught by a different teacher. The program aimed to raise students' awareness of local environmental problems, develop student understanding of the research process, and encourage students to think critically about the environment.

After completion of the program and the open-ended questionnaire, the researchers found the following themes in the data. Eighty four percent of the students indicated the program had made them want to change. Thirty-seven percent said presenting their work to the class was an aspect they liked. Twenty-one percent said they liked learning about the environment. Twenty-five percent enjoyed the research aspect of the program. Twenty-two percent reported positive changes in their environmental knowledge. Seventeen percent reported a change in their attitudes. Forty-five percent reported a change in their actions regarding the environment. These numbers are overall; the percentages for each individual class varied. Since the students in different classes worked on different topics, responses to the question regarding what they learned were not consistent.

This study has certain weaknesses. The almost certain variability in teaching styles, demographics, and topics among the three classes is not addressed even though it is stated the percentages in each class varied. Data was not triangulated. Transferability was questionable as this study was conducted in an all girls private school. However, the results of this study were concurrent with those found in Bradley, Waliczek, and Zajicek ,(1999), Bogner, (2002), Lisowski and Disinger (1991), and Ballantyne, Fein, and Packer (2000).

In a quantitative study, Bogner (2002) studied whether or not an outdoor education program was capable of increasing some facets of young peoples' initial environmental perception in a pretest post test design. The subjects of this study were 151 secondary students between 11 and 16 years of age that enrolled in a French outdoor education program. Fifty-four percent were male. All subjects were voluntary.

The instrument composed of 20 multiple choice questions designed with a 5 point response Likert-scale with options ranging from "strongly agree" to "strongly disagree" and an undecided category was given to students prior to and four weeks after a one week outdoor education program. Seventy-eight subjects were treated as a control group. The instrument had five parameters: care with resources, intent of support of resources, enjoyment of nature, human dominance, and human effects of altering nature. The instrument was tested previously with 900 French students to ensure its relevance to French culture. Results of the instrument were treated with a 2-tailed Z test and computation used the statistical package SPSS for Windows. Significance was set at $p < 0.05$.

Three of the five parameters: care with resources, intent of support, and enjoyment of nature showed no significant difference between the pre test and post test ($z = 0.97, 1.05, 0.68$, respectively), ($p = 0.33, 0.29, 0.50$, respectively). For the experimental group two of the parameters: human dominance and humans altering nature showed a significant difference between the pre test and post test ($z = 3.41, 4.02$), ($p = 0.001, 0.0001$). The control group did not show a significant difference in any of the five parameters ($z = 0.38$ to 1.94), ($p = 0.05$ to 0.707).

The use of a control group brought validity to the study. As sample groups were greater than 30 the choice of statistics was applicable. Personal responses to a Likert scale survey brings question to the validity of the results. Although no Cronbach's Alpha was referenced for the instrument, the instrument was pre tested to measure cultural validity. However, no mention was made of history between the pre test and the post test and the author repeatedly referred to his own research for validation and clarification of this study. With regard to enjoyment of nature, this study conflicted with the results of Battersby (1999), and Way (2009). With regards to awareness of humans influencing nature this study agrees with the results of Fox and Avramidis (2003), and Ballantyne, Fein, and Packer (2001).

In a quantitative study to determine if place-based education can enhance a student's attachment to place Semkin and Freeman (2007) surveyed students in a local-based geology course at Arizona State University. The subjects were 31 undergraduate college students enrolled in a geology course. The students

had no idea of the inclusion of the course in this study and did not have a major in geology or had taken a geology course in the past. Thirteen were female, and 18 were male. Of the subjects, 26 identified themselves as white, two as American Indian, 1 as Pacific Islander, and 3 as Hispanic. Nine of the students were from out of state.

The pretest instrument (place-attachment inventory) consisted of 12 questions on a 5 point Likert-scale from "strongly disagree" to "strongly agree". Questions ranged from "I feel this place is a part of me," to "the things I do at this place I would enjoy doing as much at a similar site". Cronbach's alphas for the instrument ranged from 0.81 to 0.94. A pretest score of 36 to 60 indicated some degree of place attachment. The post test instrument consisted of 12 items in the same format. A score of 36 indicated some meaning to the student, whereas a score approaching 60 indicated that the area was very meaningful to student. This course was based on local Arizona geology and had duration of one standard quarter.

Four students dropped out of the course, and so 26 students took the pretest and post test both. No control group took a similar course for comparison. However, the researchers had access to traditional geology course students as a reference who had taken the same instrument as a post test only (n = 753). The results were subjected to a directional dependent samples t-test using the SPSS software package.

Results showed a gain in place attachment after completion of the locally based geology course from the pretest post test comparison compared to the non place-based comparison group $t(27) = 2.94$, ($p < .01$). Pre test score for the Arizona base course had a mean of 37.93, standard deviation of 8.735, compared to a post test mean score of 41.44, standard deviation of 9.014. In contrast the post test score for students in the conventional course had a mean of 35.27, and a standard deviation of 8.82.

The statistics in this study were very transparent and showed significance of the results. The Cronbach's Alpha for the instrument was acceptable. Mortality for the study was noted. The fact the authors used one-time personal responses to a Likert scale instrument gives question to the validity of the data. Although a directly comparable control group was not available the authors did make a comparison with a traditional geology course group. This gives some validity to the study. The instrument derived for this study demonstrated effectiveness in previous literature. However, the same test was given pre and post which allows questions on the effect of the testing and regression toward the mean. Furthermore, selection was not random as the course was voluntary. The results of this study were not found to be confirmed in the literature. Although this study included undergraduate students as the subjects it gives evidence that place attachment can be measured and influenced by a particular course of study.

In a quantitative, one-shot case study, Semken, Watts, Neakrase, Dial, and Baker (2009) researched whether or not the student's prior experience in a

specific place correlated with the student's sense of place. The study population was 400 undergraduate students during the spring of 2005 at Arizona State University enrolled in an introductory geology course. The students were mostly non-science majors. Fifty three percent were female, 47% male, 69.2% white, 5.1% Asian-American, 3.7% African-American, 2.2% Native-American, 12.9% Hispanic, 2.7% international, and 4.2% undeclared. Participation was voluntary and anonymous.

The course involved in this study was a nine week introductory geology course based on the physical landscapes of Arizona. The study centered on the ninth week of the course which was focused on the geology of the Grand Canyon. In the ninth week students were given a Likert-style survey consisting of two parts. The first part consisted of four multiple choice questions concerning their individual history regarding the Grand Canyon. The second part of the survey consisted of 12 multiple choice items concerning their place attachment to the Grand Canyon. Students would use a number system of 1 through 5 relating to "strongly agree" to "strongly disagree". Selecting 3 indicated neutral. The lowest score of 12 showed strong place attachment, neutral was 36, and 60 showed place aversion. Cronbach's Alpha for this instrument ranged from 0.81 to 0.94. Results were added numerically and treated with an ANOVA.

For research question one the result was non-significant $F(2,362) = 0.10$, $p = 0.90$. For research question two the result was significant $F(2, 370) = 7.08$, $p = 0.001$. For research question three the result was significant $F(2,365) = 6.02$, $p < 0.01$. For question four the result was significant $F(2, 3.66) =$

6.52, $p < 0.01$. This indicated that proximity of the student to the place does not seem to influence the student's place-attachment. However, frequency and recentness of visits was an influence to place-attachment.

The F values in this study are acceptable. The Cronbach's Alpha for this instrument was also acceptable and its effectiveness was confirmed in the literature. The large sample size gives credibility to the selection of the subjects although the uses of personal responses to a Likert scale survey give question to the validity of the data. History, maturation, and mortality were not addressed in this study which further gives question to the influence of these factors in a personal response survey.

The analysis of student environmental perception and attachment suggests that involvement in a place-based curriculum can increase students' environmental perception and place-attachment. This analysis also suggests that place attachment and environmental perception may not be affected by the geographic history of the student but may be influenced by the native culture of the student as shown by Ruiz-Mallen, Barraza, Bodenhorn, and Reyes-Garcia (2009). As Bradley, Walicek, and Zajicek (1999) and Bogner (2002) illustrated in their studies the participation in a place-based education program could result in more positive attitudes toward the environment amongst students. This positive attitude towards the environment may result in a students' desire to change their behavior and advocate for action with regard to the environment as illustrated in the Ballantyne, Fien, and Packer (2001) study. As shown by Semken and Freeman (2007) and Semken, Freeman, Watts, Neakrase, Dial and Baker (2009)

the resulting place attachment among students after a place-based curriculum can be quantified and measured, and place-attachment in and of itself is independent of the geographic history of any individual student. However, as illustrated in the study by Ruiz-Mallen, Barraza, Bodenhorn, and Reyes-Garcia (2009) this place attachment and resulting environmental perception may be influenced by a student's native and local culture. More studies need to be performed that do not rely specifically on personal responses to Likert-style questionnaires. Further studies involving place attachment in K-12 students are needed to determine if the results of Semken et al. are not an artifact of age demographic. In addition, more research is needed to determine if this increase in environmental perception and attachment in turn results in an increase in student motivation and knowledge.

Motivation and Knowledge Increase

The 12 studies in this section analyze the effects of PBE on student motivation and environmental knowledge and found an increase in both of these variables after participation in a PBE program. In a quantitative study, Lisowski and Disinger (1991) studied the effects of participating in field based instruction on student understandings of ecological concepts by testing 79 secondary students and found significant gains in knowledge. In a qualitative study, Ballantyne, Fein, and Packer (2000) analyzed the effect of an EE program on the motivation of students to share their knowledge by surveying 284 students and found the majority had improved knowledge and were more likely to discuss this new knowledge to others. In a quantitative study to determine the effect of PBE

on student achievement motivation, Athman and Menree (2004) tested 215 secondary students and found enhanced achievement motivation after participation in a PBE program. In a quantitative study, Bartosh, Tudor, and Ferguson (2006) analyzed if EE programs impact achievement in math, writing, reading, and listening by comparing state test scores from 77 schools in Washington. They found schools that participated in EE programs outperformed schools that do not in these subject areas. In a quantitative study, Ives and Obenchain (2006) analyzed the effect of EE programs on higher order thinking skills by testing 36 twelve grade students in Nevada and found that EE programs enhance higher order thinking skills. In a quantitative study, Bartosh, Ferguson, Tudor, and Taylor (2009) analyzed if students who participate in EE programs achieve at higher levels on standardized tests by sampling state tests from students in ten Washington schools and found that students that participate in EE programs achieve at higher levels on standardized tests. In a quantitative study, Way (2009) analyzed if a locally relevant EE topic had an effect on student learning by surveying 40 secondary students in Boston and found an increase in environmental knowledge and enthusiasm. In a quantitative study, Yager, Choi, Yager, and Akcay, (2009) analyzed the difference in student science knowledge attainment between 15 middle school place-based curriculum classes and 15 traditional classes and found a significant increase in knowledge in the place-based over the traditional classes. In a quantitative study to determine if a PBE program improves students' science content knowledge, Buxton (2010) interviewed 23 middle school students and found that students obtained an

increase in science content knowledge after participating in the PBE program. In a quantitative study, Larson, Castlberry and Green (2010) examined the effects of an EE program on environmental knowledge in relation to gender and ethnicity by surveying 133 students in Georgia and found that EE benefits all demographic groups equally. In a quantitative study, Perkins, Hazelton, Erickson, and Allen (2010) analyzed the effects of using GIS environmental technology as a part of a PBE exercise by testing 156 middle school students in Maine and found a significant increase in spatial literacy skills. In a quantitative study, Bodzin, (2011) analyzed to what extent a geospatial informational technology (GIT) curriculum effects student spacial skills by surveying 110 low-income middle school students and found a significant increase in spatial skills after the program.

In a quantitative study to determine the effects of an EE program on student understanding and retention of ecological concepts, Lisowski and Disinger (1991) tested 79 secondary school students enrolled in an EE program with a pretest/post-test design. The subjects attended EE programs in three different locations. Two of the excursions were at different locations in the Bahamas (n=29) and (n=21). The other location was in the Cayman Islands (n=29). The assessment instrument was pre-tested and reviewed by various ecological agencies. The instrument consisted of multiple-choice questions dealing with ecological concepts and was given to the subjects before the program, immediately after the program, and four weeks after the program. Predictor variables were analyzed with regression analyses to determine their effect on test scores. These variables were: gender, grade level, academic

standing, background in science, extracurricular involvement in science, travel, outdoor experience, and prior knowledge. Test scores were analyzed for significant difference using t statistics.

Students in the three groups showed significant gains in post test scores for all three groups. Group one (n = 29) had a mean increase of 6.59, $t = 5.99$, $p < .001$. Group two (n = 21) had a mean increase of 6.48, $t = 5.35$, $p < .001$. Group three (n = 29) had a mean increase of 9.15, $t = 6.72$, $p < .001$. This indicated an increase in environmental knowledge across all groups. Scores from the tests given four weeks after the program indicated knowledge retention among all three groups with the mean scores of the retention tests being greater than the pre-test. The regressions determine that only prior knowledge ($p < .001$) was a predictor variable. No regression values were given. This showed prior knowledge can be used as a predictor of post test scores.

Although no Cronbach's Alpha was given for the instrument, the pretest protocol with environmental experts gives validation to the instrument. The consideration of potential predictor variables gives further validity to the study. No regression values for these variables were included in the results. However, the results of the regression analysis as stated by the authors agree with Larson, Castleberry, and Green (2010). Use of the t test was applicable as each of the three groups had an n less than 30. Another strength of this study was the extreme significance of the results ($p < .001$). The findings of this study coincide with those of Ballantyne, Fein, and Packer (2000), Way (2009), Yager, Choi, Yager, and Akcay (2009), and Buxton (2010).

This study did show certain weaknesses. Although the instrument was scrutinized thoroughly a Cronbach's Alpha would have given even more strength and transparency to the study. No statistics are given to validate the significance of the retention, four week, post-test. This puts these data in question. The EE programs involved in this study are exclusive. Since no socio-demographic data is given, it can only be assumed that the subjects are economically privileged yet this variable was not considered. Furthermore, the fact that these programs occurred in exciting and exotic places may have had a significant effect on retention. Again, this variable was not taken into consideration.

In a qualitative study, Ballantyne, Fein, and Packer (2000) analyzed the effect of an EE program on the motivation of students to share their knowledge through a survey of 284 students and 117 parents. These students were from nine schools in Queensland, grades 5 through 12. One hundred and ninety two were girls and 92 were boys. Four of the schools were private. Ballantyne et. al. undertook one-shot case studies of six environmental education programs: Air Watch (n=48 students), Six Thinking Hats (n=73 students, 62 parents), Kids, Companies and Creeks (n= 35 students, 19 parents), Issue Investigation (n= 26 students, 20 parents), Story Walk (n= 79 students, 45 parents), and Powerwise (n= 23 students). Two research questions were addressed in this study: How effective are environmental programs in promoting inner generational communication about the environment, and what kinds of environmental education experiences tend to motivate students to share their school knowledge?

Parents and students were given written questionnaires to complete within 2 to 4 weeks of the end of the program. Parents were also contacted for a 15 minute telephone interview. Analysis of the data occurred in three stages: grouping similar responses together into categories, defining the membership of and distinctions between categories, and reclassifying responses according to the categories as defined.

Ballantyne, Fein, and Packer (2000) found that 95% of the students reported having learned something from the program in which they participated. 18% reported learning skills in monitoring environmental problems. Twenty eight percent reported learning approaches to solving environmental problems. Thirty five percent reported new attitudes about environmental issues. Thirty two percent reported they had changed their behavior. Eighty two percent of parents reported a change in their children. Sixty one percent reported their children were more aware of environmental issues. Nineteen percent reported their children have changed their attitude toward environmental issues. Seventy three percent of students reported discussing the program with their parents. Parents reported that most discussion was initiated regarding projects assigned as homework.

This study has many weaknesses. The general areas of concern regarding a one shot case study were not addressed. Many of these programs involved in the study occurred throughout the course of the school year. As a result, history, maturation, selection, and mortality are areas of concern yet these were not addressed. The results are not broken down by age, geographic

location, or socio-demographics. Furthermore, four of the schools were private. These issues bring into question whether this study is generalizable. Although these findings do align with other studies the absence of a pretest for comparison brings the results into question. The results of this study reflect those of Ballantyne, Fein and Packer (2001), Bogner (2002), and Lisowski and Disinger (1991).

Athman, and Menree (2004) conducted a quantitative study on the relationship between environment-based education and high school students achievement motivation. In particular, when controlling for pre test scores, achievement level, gender, and ethnicity, do ninth grade students who participated in environment-based education programs have higher levels of achievement motivation than their peers in traditional instructional programs?

Subjects in this study were 400 ninth grade and 12 grade students involved in environment-based programs from 12 Florida high schools. Participants were 42.9% male, 57.1% female, 56.5% white, 33.2% nonwhite, and 10.3% did not identify.

To control for differences due to grade level the 9 and 12 grade students were studied separately. Variables including pretest score, GPA, gender, and ethnicity were controlled and correlation calculated using regression analysis. The study used a pretest post test non equivalent comparison group design for the ninth grade study. This involved a pretest and post test for students in the treatment group (n = 89) who participated in environmental education and

students in a non randomized control group ($n = 83$) who did not. Students in the control group received traditional instruction at the same school. Many of the 12 grade students participated in environment-based programs in previous years so pretest was impossible. Researchers employed a post test only design in the treatment group ($n = 126$) and in the non randomized control group ($n = 102$). The control group again received traditional instruction. An instrument measured achievement motivation that included a 20 item, multiple-choice, Likert-style, inventory with five response categories that ranged from "strongly agree", to "strongly disagree". An outside motivation researcher validated this instrument. Piloted in a Florida school prior to the study, the reliability coefficient was 0.79 for the 9 grade students and 0.76 for the 12 grade students as measured by a Cronbach's Alpha.

When controlling for pre test score, GPA, gender, and ethnicity a significant positive effect of environment-based programs on students' achievement motivation resulted in the ninth grade study group $t(166) = 2.259$, $p = .025$. Ninth grade students in the environment-based program scored 2.75 points higher on the inventory than the control group. For the 12th grade study the treatment was statistically significant, $t(222) = 2.785$, $p = .006$. These results suggest that environmental-based education programs for 12 grade students increase achievement motivation as the study group scored 8.56 points higher on the instrument than the control group.

The ninth grade study gives no mention to issues regarding history, maturation, or testing. With the same instrument used both pre and post

treatment these issues come into question. The reliability coefficient for the instrument used in the 9 grade study was questionable in terms of reliability. However, the use of a control group gives selection in the study validity. In the 12th grade study the one shot case study design did not take into account history, maturation or mortality. The inclusion of a control group gave validity to the selection. The reliability coefficient for this instrument was also borderline in terms of reliability as well as the fact it was a Likert-style format not completed by an outside party. No other studies directly measuring achievement motivation are included in this analysis of the literature.

In a quantitative study, Bartosh, Tudor, and Ferguson (2006) analyzed if environmental education programs impact achievement in math, writing, reading, and listening. Seventy seven pairs of schools were selected in the study in Washington State. Sixty six pairs of schools were located in Western Washington, six in Eastern Washington, and five in Central Washington. Students in the schools that exceeded in the Washington assessment of student learning test (WASL) standard were chosen for the study.

Using a set of environmental education rubrics developed by various state agencies the level of implementation of environmental education by schools was measured. Two groups of schools were determined for this study; schools that had well developed environmental education programs and schools that implemented a traditional curriculum as a comparison. Demographic data for the two sets of schools along with the state average scores of standardized tests were compared and calculated using the Washington Office of Superintendent of

Public Instruction website to determine if comparison schools had similar parameters. Scores from the WASL from 1996 to 2002 were taken from the state database and used to compare achievement in the two groups of schools. The combined percentages of students who met or were above standard were chosen for comparison. T-tests were used to determine any significant difference between the two groups.

Schools that undertake systematic environmental education programs consistently outperformed traditional schools on the state standardized tests for math $t = 5.379$, reading $t = 4.191$, writing $t = 5.470$, and listening $t = 3.016$ ($p = 0.000, 0.000, 0.000, 0.003$ respectively) according to the WASL scores from 1996 to 2002.

This study directly compared two educational programs. Demographics and the implementation of environmental education programs were taken into consideration and only those schools that were comparative as study and control groups were used in the study. This gives selection of the study group validity. Results of this study reflect those of Bartosh, Ferguson, Tudor (2009) and Taylor (2009), and Ives and Obenchain (2006).

In a quantitative study, Ives and Obenchain (2006) analyzed the effect of experiential education programs on higher order thinking skills. The subjects of this study were 12 grade students in a Nevada high school in three different, one semester, American Government classes. The experimental class had 34 students; 18% male, 82% female, 91% white, 6% Hispanic, 3% Native-

American, 3% special education, and 3% ELL. The first control class had 26 students; 38% male, 62% female, 85% white, 8% Hispanic, and 8% Asian. The second control class had 42 students; 55% male, 45% female, 60% white, 36% Hispanic, 2% Asian, 2% African-American, 4% special education, and 12% ELL.

For each class the students completed an instrument that measured higher order thinking skills during the second week of the semester. Two weeks before the end of the semester the subjects took a post test. This test incorporated Nevada State 12 grade civics standards and questions in higher order thinking according to Bloom's taxonomy. Questions were open-ended and required a written response. The pretest assessed standards that were covered in the previous semester. The post test evaluated standards that were covered during the semester of the study. Each written response scored as a 0, 1, or 2. Two rounds of inter-rater reliability checks and follow-up discussions were performed during data analysis. This resulted in inter-rater reliability ($r > 0.90$) in both rounds. A one tailed t-test analyzed the data.

Higher order thinking skills were shown to be significantly higher in the classroom that used experiential education as compared to the control classrooms $F = 3.276$, $p = .04$, $m^2 = .088$.

The results of this study are comparable to those found in Bartosh, Tudor, and Taylor (2006), Bartosh, Tudor, and Taylor (2009), and Way (2009). Although the series of questions in the instrument were different in the pretest and post test, the questions in the post test were on material recently covered in class.

This may have affected the reliability of the results of the instrument. The demographics comprising the three study groups bring the selection of the subjects into question as far as validity of comparison since the control groups had considerably more ELL and minority students. History and maturation were not addressed. However, the inter-rater reliability gave validity to the analysis of the data.

In a quantitative study, Bartosh, Ferguson, Tudor, and Taylor (2009) analyzed if students who participate in environmental education programs achieve at higher levels on standardized tests. This was a static group comparison study. All participants in the study were students in the K through 12 public school system in Washington during the 2002-2003 school years. Between 30 and 50 students from each school participated. The schools represented rural, suburban, and urban populations as well as geographically diverse regions in Washington State. Comparison and environmental education schools were similar in size, free and reduced lunch percentage (25%), and ethnicity. Subjects were about 80% white, 6% black, 3% Native-American, 7% Asian American, and 5% Hispanic.

Schools were ranked on environmental education rubrics developed by the Pacific Education Institute (PEI). For each school found using adequate environmental education, a comparison school was identified using the U.S. census and other economic, demographic, and geographic data.

To assess environmental literacy knowledge and skills, students from environmental education schools were given three integrated environmental education based tasks. These tasks regarded three areas: inquiry, systems, and civic participation. These criteria and assessment instruments were modeled after the Washington Assessment of Student Learning Test. Short answer response items were scored using rubrics similar to those for the standardized state test. Three trained teachers scored each student's work and the final student score was the average of the three. The Washington Office of Superintendent of Public Instruction website provided comparative data from the schools that did not use environmental education, and these data were compared using individual sample T-tests.

Inter-judge agreement data and internal consistency data for the assessments were high (70% and 90% respectively). Students in the environmental education schools had higher scores on the inquiry ($T = 54.8$, $p = 0.036$) system ($T = 47.0$, $p = 0.001$), and civics ($T = 44.8$, $p = 0.000$) tests.

History in this type of study is a point of question and was not addressed. Furthermore, regression was not mentioned as having influence on the results. The authors mentioned their knowledge of schools and teachers as partial validation for the study. This places the results into question. However, care was taken to account for extraneous variables between the environmental education and comparison schools. Furthermore, inter-judge agreement of the data analysis was high. This gives strength to the study design. Results of this

study are consistent with Bartosh, Ferguson, Tudor, and Taylor (2009), Way (2009), Ives and Obenchain (2006), and Yager, Choi, Yager and Akcay (2009).

In a quantitative study, Way (2009) analyzed if a locally relevant environmental education topic had an effect on student learning. Students from two teachers' classrooms from two different schools in the Boston area, one suburban the other inner city, were selected for this study. One classroom from one school had 14 students; two classes from the other school had 40 students combined. Students from the suburban school were 91% Caucasian, 3.8% Hispanic, 3.5% Asian-American, 1.3% black, 0.2% Native-American, and 0.2% were listed as other races. In the urban school 50% were black, 30% Latino, 10% white, and 10% listed as other.

This was an active research study of pre and post test interview data along with delayed survey data. The study assessed science knowledge before and after a class taught by the researcher for two weeks in two different secondary schools in science classes regarding the local species coyote. The class was a two to three week curriculum about coyote behavior. This curriculum was pilot tested at a suburban high school during a three week period. Pre and post assessments along with an assessment 10 weeks after the curriculum were given. Assessments were a 5 point Likert-scale of five possible multiple choice answers with 35 questions total. Only the knowledge related questions (n = 9) were discussed in this study. The five possible answers were quantified and treated to ANOVA analysis with SPSS software.

Scores at both high schools showed a significant increase in three of the nine questions between the pre test and post test and pre and post delayed tests ($F = 13.24, 3.60, \text{and } 11.48, p = 0.000, 0.037, 0.000$ respectively). This illustrates an increase in environmental knowledge and effect on student learning.

The curriculum in this study was pilot tested giving reliability to the study. The assessment tools were also developed and pilot tested although no Cronbach's Alpha was given. However, history, maturation, and regression were not addressed in this study. Using the same instrument for each of the three assessments calls the testing protocol into question. Although the author states an increase in knowledge base in the post test the increase was in only three of the nine questions. This brings validity of this statement into question. Furthermore, given the small sample size the statistics in this study and the results stated by the author have questionable reliability. However, the results stated by the author are in line with those found in Bartosh, Ferguson, Tudor, and Taylor (2009), Ives and Obenchain (2006), and Yager, Choi, Yager and Akcay (2009).

In a quantitative study, Yager, Choi, Yager, and Akay (2009) analyzed the difference in student science knowledge attainment between traditional and place-based curriculum classes. Thirty classes from fifth to ninth grade in schools throughout Iowa participated in the study. Fifteen classes with 310 students total participated in place-based education. Fifteen classes consisting of 302 students were the control group.

This study was a pretest-post test design. Both treatment and control groups were taught the same subject. Pretests were given at the beginning of the curriculum and assessments were given in two 9 week intervals. Reliability regarding these instruments was 0.76 and 0.96 (test-retest). Questions on these assessments measured five domains: concepts, process, creativity, attitudes, and applications. These questions were in a multiple choice format. Results were calculated with ANCOVA.

Post test scores demonstrated a greater significant increase as opposed to pre test scores for all five domains in the instruments in all 15 place-based curriculum classes as opposed to the 15 non place-based education classes ($T = 11.07-31.98$), ($p = 0.000$). This indicated a greater increase in curriculum knowledge amongst the students that participated in place-based education.

Cronbach's Alpha for the instrument was modest to good for the pretest and posttest at 0.76 to 0.96. However, the study did not provide an example of the instrument. The sample size was large giving greater validation to the results and chosen statistical method. However, there was no indication of intent for a random sample as demographics concerning the school and the subjects were not given. This also allows questions of comparability between the control and treatment group. Though it was of a significant duration, the study did not address history, maturation, and regression. However, results of the study reflect those found in Bartosh, Ferguson, Tudor, and Taylor (2009), Bartosh, Ferguson,

Tudor, and Taylor (2006), Way (2009), Buxton (2010), and Ives and Obenchain (2006).

In a quantitative study, Buxton (2010) sought to determine if a place-based education program improves students' science content knowledge. The subjects of the study were 23 students that were rising fifth through seventh graders. In other words, they were all going to be in middle school the following year. Fourteen of the participants were female and nine were male. One participant had moderate disabilities and five participants qualified for financial support for the program. Although the city itself is not mentioned, the authors state that the sample is representative of a wide variety of ethnic, linguistic, and socioeconomic backgrounds representing all geographic locations within the city.

This was a quasi experimental, pretest-post test study based on pre and post interviews of the subjects. This place based program was a two week curriculum focusing on local watersheds at an urban seaside nature center. This study employed a mixed methods design and relied on qualitative data from interviews and quantitative data from rubrics. Pre and post interviews were given before and after the program. Video recording of instruction provided a secondary data source. The interviews and videos were transcribed, analyzed and coded using a critiquing rubric based on the four questions that comprised the interview. Concept maps were then created from the data and used against the rubric for assessment. Each of the four questions scored 0-3 based on response. Both the researcher and research assistant scored the interviews

separately. Paired T-tests analyzed the scores between the pretest and post test interviews.

For all students, and all questions of the assessment, scores increased significantly from the pretest to the post test ($t = 2.12-2.88$), ($p < 0.05$). These results suggest that the participants of this program were able to generate more scientifically complete and correct responses to the questions related to the topics.

The results of this study reflect those found in Bartosh, Ferguson, Tudor, and Taylor (2009), Bartosh, Ferguson, Tudor, and Taylor (2006), Way (2009), Yager, Choi, Yager, and Akay (2009), and Ives and Obenchain (2006). The fact that the data analysis was performed from two separate sources gave reliability to the results. However, the same instrument was used in the pre and post tests and no reliability coefficient provided. This brings to question the reliability of the instrument itself. The sample size was small, however still conducive to the statistics chosen. Failing to address history, maturation, and regression, brings the results into question.

In a quantitative study, Larson, Castleberry, and Green (2010) examined the effects of an environmental education program on environmental knowledge in relation to gender and ethnicity. One hundred and thirty three, six to thirteen year old children from two counties surrounding Athens, Georgia participated in the study. Sixty Four students were in the treatment group, and 69 students were in the control group. The treatment group was 50% boys, 53% age nine or

younger, 40% white. The control group was 54% boys, 51% age nine or younger, 49% white. Control and treatment groups were selected from the same neighborhoods to negate socioeconomic variables.

This study was a pretest-post test design. Before and after six individual five day environmental education camp sessions in Georgia, participants completed an identical pretest-post test instrument called the Children's Environmental Perceptions Scale. Cronbach's Alpha was 0.84 for the pretest and 0.86 for the posttest. A control group consisted of those students who attended a standard after school program. Data analysis used a t-test to compare pre and post test results.

No significant differences occurred among genders with regard to ecological knowledge. However, white children demonstrated greater ecological awareness than black children in the pre test $F(1,124) = 27.11, p < 0.001$. Environmental content knowledge of white children compared to black children was not significant in the pretest. Environmental knowledge improved in the post test with no relationship to gender, or race $F(1,124) = 27.11, p < 0.001$. These results indicate that environmental education has equal effect among all demographic groups.

The results of this study reflect those of Lisowski and Disinger (1991). The Cronbach's Alpha for the pre and posttest were reasonable. Researchers accounted for history in an attempt to minimize the effects of lunch and parent pickup and drop offs. Mortality was transparent as 190 students began the study

yet only 133 were included in the results. These issues give validity to the results. However, with the same instrument used both pre and post test this brings some question to the reliability of the results. Though maturity was not addressed, the short duration of the program may negate possible effects of maturation.

In a quantitative study Perkins, Hazelton, Erickson, and Allen (2010) analyzed the effects of using geographic information systems (GIS) as a part of a place-based education exercise with middle school students. One hundred and fifty six middle schools students from eight Maine schools participated in the study. No grade levels or demographics were indicated.

Students were instructed to make a mental map of their school grounds as a pretest. Students were then instructed on GIS Technology and asked to create a GIS map of their school grounds in a three day workshop. Students were then asked to make another map of the school grounds after the GIS exercise as a post test. Results of the pretest and post test were mailed to the authors from the teachers. Accuracy (spatial literacy) was then analyzed between the pre test and the post test using a control map by measuring the distance from the control to the calculated central point of each student drawn object. An analysis of variance (ANOVA) examined the results.

Both area and distance measures were significantly different between pre test and post test. The difference in area, or error, from the control is significantly lower after the exercise of the GIS Technology ($f = 16.91$, $p < 0.0001$) and

variance also decreased significantly from pre to post test ($f = 35.01, p < 0.0001$). This gives indication that the use of GIS technology has an effect on knowledge of place.

The significance of the interval raises questions as to the ability of the authors to calculate to this confidence without specific statistical analysis given. The absence of a control group in this study provides less reliability that GIS technology had an influence on the results. The short duration of the curriculum may negate some influences of history, maturation, and mortality, but these were not addressed. Regression toward the mean is of concern due to the short time duration between the pre test and post test. However, the results of this study reflect those of Bodzin (2011).

In a quantitative study, Bodzin (2011) analyzed to what extent a geographic information system (GIS) curriculum affects student spatial skills in an urban middle school. Five eighth grade earth science classes in Pennsylvania participated in this study. All were taught by the same teacher. The majority were low income urban students ($N = 110$). Eighty one percent qualified for free and reduced lunch. Sixty seven percent were Hispanic, 19% were white, 13% were black, 1% was Asian American, and 11 students have an IEP. All students are in tracked programs. Tracking in this science class was based on math scores: low track ($n = 25$), middle track ($n = 52$), upper track ($n = 29$).

This was a pretest-post test study. Students were given a pretest and post test concerning a GIS curriculum containing 32 items that measured spatial

thinking and reasoning. Cronbach's Alpha for this instrument was 0.81. Earth and space specialists also reviewed this instrument. The project concerned a case study in which the students had to determine using GIS Technology the best placement of a proposed Wal-Mart superstore in regards to the least environmental and urban affects. Results were analyzed using paired t-test analysis.

Four students did not complete the post test resulting in $n = 106$. Paired t-test analysis for pre test vs. post test showed a significantly higher score in the post test: low track $t = 3.55$, $p = 0.002$; middle track, $t = 7.05$, $p < 0.001$; upper track $t = 3.61$, $p = 0.001$; overall $t = 8.50$, $p < 0.001$. These data indicated that GIS Technology can help urban middle school students understand land-use change concepts.

Following review by specialists, the instrument had an acceptable Cronbach's Alpha at 0.81. This gives validity to the instrument. The sample size for the middle track was not conducive to T statistics as it was larger than 30 making the statistics questionable. However, the statistics were applicable for the other two tracks. History, maturation, regression, and mortality were not addressed in the study. The results of this study reflect those found in Perkins, Hazelton, Erickson, and Allen (2010).

The analysis of student motivation and knowledge increase resulting from place-based education programs suggests that these programs in general result in a positive affect with regard to student knowledge and enthusiasm to learn.

The studies conducted by Lisowsky and Disinger (1991), Ballantyne, Fein and Packer (2000), Way (2009), Yager, Choi, Yager, and Akcay, (2009), and Buxton (2010) all illustrated that place-based education programs result in a significant increase in environmental content knowledge among students and an enthusiasm to continue this knowledge outside of the program. The study by Athman and Menree (2004) suggested that this knowledge increased achievement motivation after participation in a place-based education program. Resulting knowledge increase may translate into further cognitive development as suggested by the studies by Ives and Obenchain (2006), Perkins, Hazelton, Erickson, and Allen (2010), and Bodzin (2011). This knowledge increase is not limited to environmental knowledge alone as place-based education results in increased knowledge across all content areas resulting in greater achievement on standardized tests as illustrated in the studies of Bartosh, Tudor, and Ferguson (2006) and Bartosh, Ferguson, Tudor, and Tayler (2009). Furthermore, Larson Castleberry and Green (2010) illustrated that these positive effects of place-based education are independent across all demographic groups.

Summary

Chapter two was a critical review of the research concerning Place-Based education. These studies, and their findings, were reviewed, summarized, and analyzed to determine the effects of place-based education on the achievement of secondary science students. The research in the section on Student Perceptions found that place-based education has the ability to encourage increased enjoyment with regard to the environment and learning. The research in Teacher Perception and Practice indicated that teachers were aware of the advantages of place-based education yet felt they had various hurdles to overcome in order to implement it. The research in Environmental Perception Increase and Place Attachment Development indicated that place-based education can be culturally effective, and affected by culture with regard to its outcome. However, the research in this section indicated place-based education can give greater awareness of environmental issues to students and this attachment to place and the environment can be quantified. The research in Motivation and Knowledge Increase indicates that place-based education can encourage student interest in learning and this interest is reflective in increased scores on standardized tests. Chapter three outlines the summary of the findings of this chapter with regard to the themes Student Perceptions, Teacher Perception and Practice, Environmental Perception and Place Attachment, and Motivation and Knowledge Increase as well as implications for the classroom and suggestions for future research.

CHAPTER THREE: CONCLUSION

Introduction

Chapter one introduced the concept of place-based education as a means of continuing with a hands-on approach to science in secondary schools as is found in elementary schools thereby increasing the enthusiasm for science and its relevance. Chapter one justified the idea of place-based education as a way to increase this enthusiasm and relevance in order to achieve increased environmental motivation, knowledge, and place-attachment across all content areas. Chapter one recognized several different names for place-based education and introduced its ability to alleviate the stress confronted with students who are expected to participate in a society that promotes change. Chapter one also revealed criticisms of place-based education as conflicting with the growing trend of standardized testing, as well as the assumed limitations of this type of curriculum due to cost, time, and administrative support. This type of curriculum also affects teachers as an influence encouraging collaboration and freedom of content. Furthermore, chapter one reviewed the history of environmental education and its evolution toward the ideas of place-based education today. Given this, chapter one presented the reader with the rationale for considering the implementation of place-based education and introduced the question for this paper: What are the effects of place-based education on secondary student achievement? Chapter two reviewed the research concerning different styles of place-based education and its influences. This review of the literature explained the influence of place-based education in four categories with

regard to four themes found in the research: Student Perceptions, Teacher Perceptions and Practice, Environmental Perception Increase and Place Attachment Development, and Motivation and Knowledge Increase. Each of the studies reviewed in this chapter were summarized and reviewed with regard to results, strengths, and weaknesses in design. These studies were reviewed to examine the effect of place-based education programs on student achievement. Chapter three is the concluding chapter of this paper. This chapter summarizes the findings of the previous chapter with regard to the guiding question. Next, this chapter will address these findings with regard to classroom practice and give suggestions for further research. Finally, a conclusion in this chapter will summarize this paper as a whole.

Summary of Findings

How does the use of place-based education actually contribute to secondary student achievement? This was the question that guided the review of the professional literature in this paper. The importance of this question may lie in the face of traditional education. However, traditional education may, or may not, be able to address 21st century environmental issues. This question is also worthy of thought considering the influence of the public educational system on future behavior of the current generation. Twenty first century environmental issues have less to do with history, yet more to do with future behavior. This future behavior is based on the ability of this generation to inevitably make decisions to be able to think critically, out of the box, and consider an ownership of their environment. Lieberman and Hoody (1998) introduced the idea of using

the real and outside environment to equalize the potential of all students. This paper began the idea of place-based education as a potential and easily accessible foundation for an effective curriculum. Subsequently, literary authors such as Sobel (2005), and Suzuki (2007) focused on use of the local environment with regard to student achievement. Compared to other ideas in education, this one is new within the professional literature, yet names like these have begun a trend to understand the implications of place-based education as society has begun to understand the need to educate a generation that is not only aware of environmental needs and consequences, but are able to critically think about them.

Student Perceptions

This section began with Battersby (1999). This is the appropriate beginning for this discussion since Sobel (2005) identified awareness of the environment as the first step toward change. Battersby (1999) found in the basic sense that students enjoyed learning about the environment when given the chance and as a result develop an increased awareness of the complexity of the world and systematic consequences of their personal actions. Studies by Russel and Burton (2000), Ernst and Monroe (2004), and Harmon and Gleason (2009) found similar improvements in student's awareness of self and the world. Since student perception is an open ended idea, many of the studies were qualitative. Those that were quantitative described specific programs that were easily controlled due to voluntary participation outside of the school institution. These studies generally employed a pretest-post test design with similar results. Both

the qualitative and quantitative studies worked with schools in which established place-based education programs existed generally in the 10th to 12 grade years. However, Ernst and Monroe (2004) asked the question if student perception and critical thinking with regards to the environment was in relationship to demographic or age and found it was not. This study has more strength than the others due to its longevity, diverse demographic, and comparison between levels of education. This study should be used as an example in comparison to the others due to its completeness and inclusion of all demographics. However, many of these studies included surveys and Likert-style responses that bring question to the honesty of the responses and reliability to the data.

Teacher Perception and Practice

The influence on teacher perceptions and practice with regard to place-based education revealed that teachers from a variety of school environments shared the same concerns and considerations in implementing a place-based curriculum. The studies in this section included both qualitative and quantitative designs. Concerns among teachers in implementing place-based education had to do with basically content knowledge, collaboration, state standards and testing, and time/transportation. The qualitative studies by Powers (2004) and Ernst (2009) give compelling information do to their comprehensive analysis of a broad range of approaches to place-based curriculum and seem to come to the same conclusion. However, the Likert-style approach to their instrument gives question with regards to the reliability of the data. There seems to be a consensus among the qualitative and quantitative studies in this section

concerning the positive effect the educators observe in their students. For the purposes of this paper only those studies concerning middle in secondary students were analyzed. Yet the results from the studies seem to support each other. Meichtry and Smith (2007) studied teacher enthusiasm with regard to place-based education with particularly interesting results. This study stands out as an example of the similarity between students and teachers enthusiasm for place-based education as a result of exposure to this type of curriculum. However, the personal Likert-style survey brings into question the reliability of the results. It should be noted that this study is the only one in this paper concerning teacher apprehension regarding the use of place-based education and exposure to workshop training. Although the results regarding student perception after exposure to place-based education are similar to those of teachers in this study, the demographics are certainly different. Most studies in this section documented state standards and testing as a barrier to the use of place-based education. The study by Thomas (2005), however, found this was not the case. This issue needs to be explored further as the environment in study was very different from the typical public school-- small school with a very uniform demographic and isolated community. This weakens the argument that standardized testing and state standards are not a factor in the use of place-based education in the public school system. The common thread amongst the other studies is that teachers recognize the benefits of place-based education. However, it seems that a lack of administrative encouragement and support does

not allow educators to overcome their fears regarding that which they recognize as beneficial to student achievement.

Environmental Perception increase and Place Attachment Development

The section on student environmental perception increase and place attachment development indicates that these qualities are promoted when students are exposed to a place-based curriculum. Early on, Bradley, Waliczek, and Zajicek (1999) quantified environmental perception. Later, Semken and Freeman (2007) introduced place attachment as a variable that can be measured quantitatively. There seems to be a trend in the research towards quantifying these variables concerning place-based education. One study by Ballantyne, Fien, and Packer (2001) in this section was of qualitative design and found similar results to those studies that quantified the same variables. The ability to statistically measure and emotional quality innately brings questions. However, all of these studies have come to the same conclusion. Place-based education increases environmental perception and attachment among students. All but two of the studies included secondary public school students as the subjects. Two of the studies included undergraduate students as their subjects, Semken and Freeman (2007) and Semken, Freeman, Watts, Neakrase, Dial, and Baker (2009). These undergraduate students, however, were involved in an introductory freshman course. As such, they may be comparable to 12th grade secondary students. However, the age demographics of these two studies using undergraduates were not included which weakens the results comparatively. The significance of this study by Semken et al. (2009) lies not in the age of the

subjects but in the fact that it illustrates place attachment is independent of past personal history of the student, and place-attachment can be instilled within the student with exposure to this style of curriculum. These findings found in the studies by Semken and Freeman (2007) and Semken et al. (2009) are stronger than those found in the other four studies included in this section. This is based upon the solid foundation of their instrumentation and methods in previous professional literature, and the controlled environment in these two studies. The fact that studies of both quantitative and qualitative design, across a wide variety of demographics seem to come to the same conclusion, gives credibility overall that place-based education has a positive effect on student environmental perception and place attachment. However, the results of these studies were based on personal responses and bring question to the reliability of the data.

Motivation and Knowledge Increase

The influence of place-based education on student content knowledge and motivation for knowledge is illustrated in numerous articles in this paper. With few exceptions the overall results illustrate a significant increase in content knowledge and motivation to continue this knowledge with exposure to a place-based education program. Of the 12 studies referenced in this section only one is qualitative in design. Nearly all the studies concluded secondary students as the subjects or included a mix of secondary and middle students. However, all of the studies in this section can be argued to have overlap in their application to secondary education, especially in light of the increase in advance college tracking where late middle school students are being exposed to early high

school classes. Lisowsky and Disinger (1991), Ballantyne, Fein, and Packer (2000), Way (2009), and Yager, Choi, Yager, and Akcay (2009) conducted studies that documented an increase in academic content knowledge after exposure to a place-based curriculum. The qualitative study by Ballantyne et al. (2000) resulted in the same conclusions as the quantitative studies addressing the same question of student achievement and motivation. Any increase in content knowledge is facilitated by the motivation to achieve that content knowledge. The Athman and Menree (2004) study illustrated the ability for place-based education to accomplish this. According to this study, students not only gain knowledge, but a desire to further that knowledge. The strongest research regarding content knowledge in achievement among students who participated in place-based education came from the studies by Bartosh, Ferguson, Tudor, and Taylor (2009), and Bartosh, Tudor, and Ferguson (2006), both of which measured the effect of place-based education on state standard performance. These two studies were conducted among Washington State schools in relevance to Washington State standardized tests that crossed all content areas. These studies showed a positive effect in a situation that is locally relevant and regionally applicable with quantitatively sound analysis of the data and care of comparison with control schools. The results of these two studies are reflected in the literature and relevant to regional practice.

Classroom Implications

The low number of public schools that achieve yearly science requirements has brought attention to how science education is implemented in the classroom. This attention is underscored with the emphasis and requirement by Washington State that environmental sustainability be integrated across all content areas. New curriculum models need to be created to instruct students in the skills needed to support ecologically healthy, socially just, and economically sustainable communities (Eaton, Davies, Williams, MacGregor, 2011). The idea of bringing the community into the classroom as well as the classroom into the community has been suggested as a beneficial way to address the issues of science curriculum while supporting a developing sustainable philosophy among students (Sobel, 2005). This idea of "place-based" education has taken on many names, and many styles. Surveys of these various styles have shown positive results regarding student achievement, not only in science, but across all content areas by a comprehensive report from Lieberman and Hoody (1998). Since this report, a body of research has developed concerning the effect of place-based education on not only student achievement, but on teacher practice, student enthusiasm for learning, and student motivation to create positive change in their community. The overlying theme of all these studies was that place-based education, regardless of the form or name, promotes positive effects among students and teachers. The studies bring to light many implications regarding the classroom and teachers practice.

The study by Battersby (1999) showed that students can actually enjoy science when given the chance and that science is made tangible by real learning experiences outside the classroom. These results were reiterated by Harmon and Gleason (2009) study which showed an increase in student engagement in the learning process following a place-based educational program. Many science teachers are faced with a lack of enthusiasm among students. Maybe this is because of the content difficulty. However, studies addressed in this paper have shown that this attitude among students may be a result of curriculum and teaching style. To help further build enthusiasm for science among students, appreciation for collaboration and interpersonal skills need to be developed. This is also a potential effect of place-based education (Russel and Burton, 2000). This is extremely important with regard to the classroom because as these skills develop the ability to broaden and diversify curriculum increases as well. The ability for students to address difficult issues and think critically involves a promotion of self efficacy in the classroom. Place-based education has found to be a vehicle for the promotion of self efficacy according to the studies of Davison (2001) and Ernst and Monroe (2004). These studies also indicated that these results are independent of various student demographics and can be effective for all students. When faced with apparent lack of enthusiasm and disengagement among students place-based education has been shown to be an effective method to reverse these conditions in a classroom. However, the issues of teacher perception and ability to practice

place-based education need to be addressed as well for an effective curriculum to be developed.

Many teachers have perceptions about place-based education which limits their implementation of it in the classroom. Powers (2004) and Ernst (2009) studies suggest that standardized testing, content knowledge, time constraints, collaboration, planning, and transportation are potential barriers to the use of place-based education in the classroom. These barriers are real and present in every schooling environment in which a teacher practices. When faced with budget shortfalls and increased pressure from the political arena for students to perform according to standards, teachers find themselves limiting their teaching styles out of perceived necessity. This has the potential to negate collaboration among teachers when an individual teacher wants to initiate place-based education within their curriculum. This lack of potential collaboration can become even more pronounced where cross-content integration is required. The perceived need to streamline curriculum in the face of performance standards may be unfounded as shown by the Thomas (2005) study which documented teachers' ability to implement place-based education in spite of standardized testing. Although the school in which this study occurred was rural in nature, the potential to implement place-based education is real. It does not strain a budget, nor does it tax available transportation to take a classroom outside. The environment and community is all around us no matter what the location. This is an inexpensive and available resource that should be used. Planning and ability to implement place-based education in a collaborative manner was also shown to

be a barrier according to Powers (2004). This idea within education is relatively new and the idea of wandering outside standardized curriculum can be intimidating for some educators. This may be more so for those educators who do not practice science content, increasing the number of problems that can occur with regard to collaboration. These concerns can be alleviated by the opportunity for professional training and workshops as shown in the study of Meichtry and Smith (2007). This study also illustrated that these workshops can be enjoyable and exciting experiences. In the idea of continual professional development, educators need to take advantage of such opportunities. As teachers recognize the benefits of place-based education through workshops and training their sense of environmental perception and attachment is also affected and increased. This sense of environmental perception and attachment amongst teachers can in turn increase that amongst students.

Student environmental perception and attachment is instrumental in creating a generation of citizens that is motivated and willing to promote sustainable, positive change within society. Place-based education can be effective in creating a positive environmental perception among students as shown by Bradley, Walicek, and Zajicek (1999). This effect of place-based education on positive environmental perception among students was reaffirmed by Bogner's (2002) study. Place-attachment, or the personal feelings a student has concerning a particular environment has been shown to be promoted as well with a place-based curriculum (Semken and Freeman, 2007). In order to promote the emphasis of citizenship and community activism in the schooling environment

teachers need to look at place-based education as instrumental. This place based education curriculum can be in the form of outdoor education, problem-based learning, or even service learning to introduce students to the environment around them and the community they need to support. Educators need not be concerned about the ability to promote a student's appreciation and attachment to their surrounding environment as these attitudes develop more as a factor of proximity as opposed to history has shown by Semken, Freeman, Watts, Neakrase, Dial and Baker (2009) study. However, particular community-wide ethnic cultural background has the potential to influence a student's environmental appreciation and attachment (Ruiz-Mallen, Barraza, Bodenhorn, and Reyes-Garcia, 2009). These issues need to be addressed in designing a place-based curriculum for maximum effectiveness. Student environmental perception and place-attachment are important attributes to promote. However, student knowledge, and the motivation to gain that knowledge is the required foundation.

The body of research conducted on place-based education has overwhelmingly illustrated that place-based education can result in an increase in student content knowledge and motivation. An early study by Lisowski and Disinger (1991) found significant gains in knowledge of the environment after participation in a place-based program. In an era where science programs are coming under scrutiny for their lack of progress in meeting academic goals educators must consider place-based education as part of their repertoire to use in the classroom. Content knowledge increase as well as motivation in

enthusiasm for this new knowledge has also been shown to be an effect of place-based education (Ballantyne, Fein, and Packer, 2000). This is significant as it is not only important for educators to increase content knowledge among students, it is also important to motivate the students to become creators of knowledge and pursue it on their own. The greater the sense of motivation given to students the more efficient and effective the relatively short period of time educators have with students becomes. Athman and Menree (2004) confirmed this increase in motivation for learning and achievement among students after participation in a place-based education program. Since standardized tests are the measure in which educational systems gage student achievement, the fact that performance on these tests across all content areas is increased amongst students when exposed to a place-based curriculum underscores the importance of this practice being included in a teacher's repertoire. This has been shown to be the case in studies by Bartosh, Ferguson, Tudor, and Taylor (2009) and Bartosh, Tudor, and Ferguson (2006) which showed a significant increase in student performance on Washington State standardized tests across all content areas after inclusion of place-based curriculum within the classroom.

Suggestions for Further Research

The analysis of research regarding student perceptions in place-based education revealed areas that need further research. First of all, more schools in the urban environment need to be included. Much of the research had to do with schools of the suburban or rural demographic. Urban schools have just as much opportunity to engage in place-based education. In fact, the ability to use place-based education is independent of environment as all schools are a part of an environment and community. Furthermore, studies included in this analysis concerned programs already instituted. A suggestion would be to have new programs instituted in schools in which they have not historically existed in order to see a direct effect of place-based education on student perception of the environment. The research base needs to include a more direct inclusion and emphasis on schools in which the ethnic minority is the majority of the student body. Davison (2001), for example, used an all-boys Catholic school for the subjects of this study. A more representative sample of various schools in demographics would be more informative. Fox and Avramidis (2003) study would have benefited from a larger sample size and more inclusion of demographics across the district in which the study was performed. There seems to be an issue amongst studies concerning student perception of the environment with regard to addressing history through the duration of the studies. It would be more informative to include attrition as well as addition including their reasons for such when discussing the results. There seems to be a lack of research concerning high school students, especially in the 11th and 12th

grades, with regard to student perception and place based education. This is interesting considering the push for further academics after high school and the influence this may have on future performance. More research within this grade level needs to be considered. Overall, studies concerning this topic in place-based education concerned programs that were already in place. Research that involves introducing new programs and the results of such programs needs to be proposed to address this gap.

Studies involving teacher perception and practice, in general need to be increased. Many questions are left in the body of research concerning this issue. What are the concerns regarding place-based education with teachers in individual content areas? Is there an overall strategy or will to include, and persuade teachers from all content areas to involve themselves in continuing education regarding place-based education? What are the consequences and effectiveness of continuing education programs in place-based education? Educators across the country seem to have an issue according to the literature regarding standard based curriculum and place-based education. More research needs to be done on this subject. Thomas (2005) used a small isolated school and a small sample of teachers to determine that standards based education is possible within a place-based curriculum. This study needed to include schools across different socio-demographic backgrounds and a larger sample size. A study that involves this inclusion of socio-economic backgrounds is recommended. The study by Scales, Roehlkepartain, Neal, Kielsmeiser and Benson (2006) introduced the idea that administrators recognize the importance

of place-based education. However, the response was greater among administrators from low-income, urban schools. The question remained, "What about rural schools?" If the effectiveness of a place-based program was greater in an urban school as opposed to a rural school, why? This question needs to be researched further.

Research concerning student environmental perception and attachment seems to follow a common theme. This research mainly concerns middle school, and Caucasian students with some level of privilege. More research needs to be done on the upper high school grades concerning student environmental perception and attachment. Furthermore, specific targeting of the affects of place-based education upon schools with a majority-minority population needs to be the theme of future research. Much of the research concerning this subject is either based on a rural or urban setting. Research needs to be done that involves a comparison between these two settings. Bradley, Walicek, and Zajicek (1999) did not include demographics of the students involved in their study. Demographics would have made this study more comparable to other research and allowed a greater chance for questions concerning further research. Ballyantyne, Fein, and Packer (2001) used an all girls school for the basis of their study. A more representative sample of various demographics should have been done to create more validity of the results.

Much needs to be done concerning the correlation between place-based education curriculum and increased student knowledge and motivation. This is not due to gaps in the research base as much as a continuing changing of

expectations and achievement standards in the science curriculum by state bureaucracies. Research analyzed in this paper related place-based education to student achievement in Washington State standardized tests (Bartosh, Tudor, and Ferguson, 2006). Research needs to be done in other states concerning place-based education and standardized test achievement. This subject regarding place-based education is focused on secondary school with regard to standardized tests. Although not the focus of this paper, there seems to be a lack of emphasis on elementary content knowledge in place-based education. This is a suggestion for future research. Furthermore, the effect of place-based education on student achievement is not addressed concerning the increasing number of English language learners in the public school system. Research needs to be performed concerning this increasing demographic. For example, Lisowski and Dillinger (1991) included no demographics of subjects in their study. Did some ethnic groups perform better than others? If so, what are some recommendations concerning those groups? These questions also arise in the Ballentyne, Fein, and Packer (2000) study. This study focused on private schools and consequently the limited demographic that result from such a sample base. A more comprehensive and inclusive sample of subjects that represented the entire population would have given the study strength if used for evidence of the need for change in the public school system. Research that specifically addresses the achievement on standardized tests and increase in content knowledge for all ethnic and socioeconomic demographics represented in the public school system is needed. Furthermore, research that relies less on

Likert-style, personal responses needs to be developed that can measure the effects of place-based education without the question of potentially biased responses. In a final note, emphasis within the research seems to be concerned with the effects of place-based education with regard to the benefits it has on the achievement of students. Research needs to be conducted that emphasizes the social influences that have made the use of place-based education necessary.

Conclusion

Chapter one introduced the issues concerning the lack of achievement amongst secondary science students with regard to state academic standards and the questions educators and administrators have been asking about what could be done to alleviate the problem. Issues concerning curriculum in the classroom are the basis of these questions. Place-based education has been increasingly implemented with success that addresses these issues. Therefore, the question is: What is the effect of place-based education on secondary science student achievement?

Place-based education brings back the concept of learning by doing, the concept that traditionally is represented in the elementary classroom but not in secondary education. Washington State is making a push for curriculum that promotes sustainable ideals in students and empowers them to be responsible citizens prepared to make positive changes within society. This is complicated with the increase of complicated environmental problems facing future generations. Furthermore, state standardized testing has become the basis for

measuring student achievement in science, as well as other content areas.

Students, community, and the educational institution have become disconnected from each other. A connection with students, community, and the educational institution is vital for students to be advocates for the community in a sustainable fashion (Sobel, 2005). To achieve this, integration of students, community, and education need to be a part of the classroom curriculum in a new "mental model" called place-based education (Eaton, Davies, Williams, MacGregor, 2011).

Chapter one also addressed the history that led to this idea of place-based education. At the beginning of the educational system in this country students spent as much time outdoors as in the classroom. Place-based education had its roots in the works of John Dewey and Harold Rugg. The environment came into the spotlight with conservative education and its promoters such as Aldo Leopold. This brought a new form of education called "Experiential Education" that promoted moving students outside and tried to bring back the idea that not all learning, or even the best learning, can occur within a classroom alone. This type of learning is now called many things; community-based learning, service-learning, project-based learning, and environmental education.

Chapter two reviewed the literature on place-based education, organized into four themes: Student Perceptions, Teacher Perception and Practice, Environmental Perception Increase and Place Attachment Development, and Motivation and Knowledge Increase. These themes were used to answer the guiding question concerning the effect of place-based education on secondary science student achievement. The research reviewed in Student Perceptions

revealed an increase in positive perception of the environment within students after exposure to a place-based curriculum. The research reviewed in Teacher Perception and Practice revealed that educators consider; collaboration, transportation, state standards, testing, content knowledge, and time when considering whether or not to implement place-based education. However, the research showed many of these considerations can be accounted for. The studies reviewed in Environmental Perception and Attachment revealed that place-based education can make environmental awareness possible in students and place-attachment can occur amongst students regardless of prior history. The research reviewed in Motivation and Knowledge Increase revealed that place-based education has a positive impact regarding content knowledge, and can help increase scores on state standardized tests. Chapter three included: Summary of Findings, Classroom Implications, and Suggestions for Further Research. Summary of Findings concluded that the effects of place-based education were positive in relation to; student perceptions, teacher perception and practice, environmental perception and attachment, and motivation and knowledge increase. Classroom Implications summarized the need for educators to include place-based education as a means to not only increase student content knowledge in standard test scores, but to instill a sense of motivation and increased environmental perception in order to educate students to be responsible citizens that will work for a sustainable, and just society. Suggestions for Further Research examined issues concerning the body of research on place-based education and suggestions for future inquiry. More

research needs to be done concerning place-based education and specific student ethnic demographics and cultures. Comparison studies need to be done to reveal effects of place-based education on urban as opposed to rural school systems. There is a question of the effects of place-based education on student environmental perception and motivation in the higher grades of secondary education, which reveals a need for more research in this area.

Place-based education has become forefront in educators' minds thanks to individuals like Sobel (2005). The importance of this type of curriculum has been brought into view by researchers such as Eaton, Davies, Williams, MacGregor, (2011). The encouraging fact is that place-based curriculums show a consistent positive outcome in the research. The idea of using local community and the environment has positive effects for students, teachers, and administrators. It is inexpensive, easily accessible, and with limited training can be implemented by educators from all content disciplines. However, the underlying question is what has changed within society that has made purposeful place-based education necessary for student success?

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