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The Relationship between Middle Level School Science Programs and a Residential Environmental Learning Center

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of the requirements for the degree of
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Abstract

A multiple case study investigation examines the relationship between a residential environmental learning center and six schools that attend their program. Pre-experience interviews were conducted with teachers to gain understanding of how they integrate the residential experience with formal classroom instruction. On-site observations of teacher participation during the program provided insight into how they foster student learning during the experience. A student questionnaire was used to reveal students' perceptions of three areas of interest: 1) most meaningful aspects of the experience, 2) most confusing aspects of the experience and 3) topics they would like to know more about. These data inform how pre-experience preparation and activity scheduling influence student perceptions of expected outcomes. Interviews with the residential learning center education staff describe the importance and difficulties associated establishing a working relationship with classroom teachers. Results reveal that the residential learning center school programs offer students an opportunity to experience and learn content that is aligned to the ideal curriculum of environmental education including ecological principles, issue identification, solution formation, civic responsibility and motivation. The residential learning center provides students an opportunity to connect with nature and students identified out-of doors science investigations as the most meaningful aspect of the experience. Teachers underestimated the influence of teaching science outdoors and pre-experience preparation impacts student outcomes. Using grounded theory methodology this research identified eight causal conditions, which act as barriers to engaging teachers in onsite instruction. Four of these conditions are specific to teachers and the remaining four are products of the education staff. Recommendation and implications for teacher professional development are discussed.

This dissertation is approved for recommendation
to the Graduate Council.

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Acknowledgements

In 1913, Liberty Hyde Bailey wrote; "Nature-study ought to revolutionize the school life, for it is capable of putting new force and enthusiasm into the school and the child." (in Russell, 1982, p34). I would like to thank all of the Teachers that share in this vision and strive to provide their students science leaning opportunities in nature. I would also like to thank the staff at the Great Smoky Mountains Institute at Tremont for their unconditional participation; my parents for teaching me the importance of enjoying nature and placing a high value on education; and my dissertation committee for their time, effort, support and guidance.

Dedication

This dissertation is dedicated to my loving wife, Sarah. Without your sacrifices, your support and encouragement, I would not have been able to get through the coursework, the research or the writing. I will always be appreciative of what you have given to me and to our family. I love you always.

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CHAPTER ONE: INTRODUCTION

Background of the Study

Environmental education (EE) in one form or another has been around since the dawn of the 20th century. The origin of EE can be found in nature study in the early 1900s; it was influenced by the conservation movement of the 1930s and 1940s, and then began to mature during the environmental revolution of the 1960s and 1970s. EE struggled to maintain its identity with the environmental policy reversals of the 1980s, experienced a rebirth in the late 1990s, and has enjoyed growing support in the new century. Currently, EE is typically represented by a single chapter on ecology in most high school biology textbooks (McComas, 2003), so teachers interested in providing their students with a more complete EE experience have to use supplemental resources in their classroom. EE programs are typically aimed at enhancing environmental attitudes, increasing environmental knowledge, promoting citizenship skills, and encouraging stewardship behaviors. These topics put nature at the center of instruction and are closely linked to both the guidelines for learning as established by the North American Association for Environmental Education (NAAEE, 2004) and the National Science Education Standards (NRC, 1996). Combine this content with the use of inquiry as the primary method of instruction and the result will resemble something similar to nature study. McComas (2008) expands the connection by explaining the importance of "contact" with nature (p. 24). Contact with the environment is an essential component of nature study and EE; each includes both experiential and outdoor education. By incorporating conservation education with these other fields of study, the connections inform a much broader body of knowledge that is EE (Carter, 2010).

Education in the United States has entered the age of accountability. An increased focus on assessment has influenced what is taught in our schools. Our system is poised for a dramatic change not unlike the changes brought about in the 1920s by the Cardinal Principles of Education (Commission on the Reorganization of Secondary Education, 1918). This document called for the restructuring of secondary education. It was recommended that subjects such as science be divided by topics into yearlong courses. This is the origin of the standard sequence of science classes that students take today: physical science, biology, chemistry and physics. These courses were supposed to represent the essential information a student would need to know about the topic. This resulted in classes that stand alone, but lack a unifying theme apart from all being science. In today's classroom EE could establish its niche in our schools, not directly as a course but as a more integrated theme woven throughout the curricula of our schools. Charles Kupchella, a pioneer in the field of EE stated that, "to change human behavior so that it is aligned better with ecological reality will require a major adjustment of the philosophy underlying education in the United States" (in Disinger 2001a, p.11). Studies have shown that integration of EE across disciplines results in overall student learning (Lieberman, 1998). This, in part, could be due to the presence of a unifying theme which brings continuity to our fragmented curricular system by making connections between subjects. Not only is integrating EE content widely recommended by the EE community, but it has also been supported by the research of the National Environmental Literacy Assessment phase II (NELA), which included programs that have adopted this form of subject integration (McBeth, Hungerford, Marcinkowski, Volk, & Meyers 2011).

Statement of the Problem

This study investigated the relationship between schools and a residential environmental learning center. This relationship is an ideal solution to overcoming significant barriers to a student's learning about ecological principles and interacting with nature. These barriers include 1) the interdisciplinary nature of EE, 2) the nature of urbanization, 3) outdoor learning and 4) the best practices of science education. Although many schools offer their students an opportunity to attend a residential environmental learning center and overcome these barriers, there are still issues involved with linking the experience to the formal classroom. This section describes these barriers and their connection to our schools.

Environmental education is interdisciplinary in nature: One of the major challenges facing EE is its lack of a formal niche in the K-12 curriculum. In our educational system EE is typically either ignored or viewed as a supplement to the existing science curriculum. An example of this phenomenon can be found in a review of biology textbooks. In a 2003 study, McComas found that 10 of 13 high school biology textbooks at that time had only a single discrete chapter or section addressing ecology and over half of these books included it in the final chapters, all but guaranteeing that this important content would be covered only if time allowed. Apart from its lack of a home in the core science curriculum, effective EE instruction requires students to address issues beyond science (Disinger, 2001a). Although some aspects of EE do fit into the existing science curricula, some topics would be better taught in social studies. Unfortunately, in our current education system the two are not connected.

Nature of urbanization: Since the time of the industrial revolution of the 1800s, our society has become more urbanized, and this transition is creating barriers to children's exposure to nature. Recognized long ago by Bailey and Comstock (1911), this phenomenon sparked the

creation of the nation's first science curriculum, “nature study.” Nature study was developed in response to a changing way of life in America. An increasing proportion of the population was living in urban areas, with fewer children in each generation growing up on the small farms of the countryside. Stapp (1969) described how this trend continued over the next fifty years. He explained that in 1969, 70% of the United States population lived in urban centers. According to the 2000 United States Census, this had increased to 79%. The report from the 2010 census will be released in October 2012, but this percentage will likely continue to increase (Country Snapshot: US Demographic Data 2009). Richard Louv (2005) coined the term “nature-deficit disorder” to describe the disconnection between children and nature and he raised awareness for how this disconnect has significantly worsened with the distraction caused by gadgets (such as video games and computers) that children have today. Louv’s view was predicted by Smith who said in 1972 “Increased urbanization has deprived many children and youth of contact with the land” (p5).

Outdoor learning: Exposing children to outdoor learning experiences increases their self-confidence and their willingness to participate in future outdoor activities (Palmburg & Kuru, 2000). Students who participate in outdoor learning have more positive attitudes toward the environment and increased cognitive skills (Bogner, 1998; Martin, 2003). Furthermore, students who are taught in natural settings about ecological concepts have a better understanding of those concepts than if taught in a traditional classroom (Cronin-Jones, 2000; Martin, 2003). Unfortunately, when covering ecological concepts, teachers often rely on traditional pedagogies such as lecturing and textbook assignments (Bottinelli, 1976). Failing to bridge the gap between nature and classroom instruction creates a barrier to effective learning of ecological principles.

Best practices: Problem solving and critical thinking skills are supported through the use of inquiry. The American Association for the Advancement of Science (AAAS, 1993), outlines the importance of teaching science through inquiry in their *Benchmarks for Science Literacy*. The National Research Council (NRC, 1996) echoes this philosophy and explains that students not only need to understand inquiry, but also develop the skills required to conduct an inquiry investigation. These skills are essential to the development of critical thinking. They foster the ability to anticipate outcomes or make predictions. Students who learn through inquiry take ownership of their learning, in part because it is driven by personal interest. Athman (2001) explains that effective EE programs must use the best practices available in education generally and in science instruction specifically. Current research addressing the effectiveness of residential EE programs typically focuses on content and rarely investigates methods of instruction. These research projects fail to provide a robust impression of how curricula are delivered and, in turn, cannot infer about what aspects of the program have the most significant influence on student learning.

Purpose of the Study

The purpose of this study is to identify how schools incorporate a residential EE experience with formal classroom instruction. By closely examining how schools incorporate a residential environmental learning experience into the formal classroom, the data will reveal how to best integrate these two essential components of EE and foster student learning. Understanding how teachers prepare their students and participate in instruction during the experience is a critical part of knowing how schools can get the most out of the experience for their students.

Specific Research Questions

This research project will address the following questions:

1) What are the outlined objectives of the residential environmental learning center?

2) What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center?

- **a)** What are the perceptions held by the educational directors and instructional staff at the educational learning center?
- **b)** How do these views compare to the perceptions held by teachers, students, school administrators?

3) What methods of instruction are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?

4) How do schools incorporate a residential environmental learning center experience into their school curriculum?

Significance of the Study

In an era of accountability, effective assessment is essential to understanding what is occurring in our schools and classrooms, and EE is no exception. In 2008, a team of researchers lead by Bill McBeth from the University of Wisconsin-Platteville, established the National Environmental Literacy Assessment project (NELA) which outlined two major goals: (a) to identify baseline levels of environmental literacy and (b) to assess the effectiveness of individual programs. The NELA used a slightly modified version of the Middle School Environmental Literacy Instrument (MSELI) in randomly selected U.S. middle schools to establish a baseline for environmental literacy (McBeth & Volk, 2010). The results of this research provided the EE community with its first look at the level of environmental literacy across the United States and

acted as a baseline for future studies. The second phase of the NELA research was to include the results of the baseline measures of environmental literacy in a comparative study (McBeth, Hungerford, Marcinkowski, Volk, & Meyers, 2011). This phase of the research showed that students who participated in supplemental EE had statistically significant higher scores than the established baseline scores. The NELA focused on schools with formal EE programs as part of the in-school curricula. Some of the programs in their sample did implement informal residential or camp experiences but that was not the focus of this phase. These results provide strong support for the effectiveness of high quality EE.

In 2008, Stern, Powell, and Ardoin conducted an internal assessment of the residential environmental learning center, the Great Smoky Mountains Institute at Tremont (GSMIT). Their research critically analyzed the impact this model program had on student learning. Results included significant positive, short-term effects on all outcomes of interest. Longitudinal influences included 3-month delayed posttests which indicated retention of significant gains in environmental stewardship and awareness, whereas other gains faded. Also, students who participated in the five-day program and had active engagement of visiting teachers in on-site instruction exhibited elevated scores on most outcomes. The authors discuss the influences of pre-visit preparation and group size on participants. The focus of this project was on the learning outcomes of over 4,000 students who attended during the course of the school year, however researchers were unable to look closely at how students were prepared and to what extent the teachers participated.

The findings presented in the current study extend the scope of both the NELA and the Stern et al. (2008) work by closely examining how schools connect the residential experience to the formal classroom. With the school as the unit of analysis, I specifically investigated how

teachers prepared their students, how teachers participated in the instruction during the experience at the site, and how they tied the experience back to classroom instruction once they and the students return to school. Furthermore, I have examined how the model residential program implemented at GSMIT strives to meet its objectives, by including classroom teachers not only in the instruction during the experience, but also how the instructional staff encourage teachers to connect the information to the formal classroom.

Overview of the Method

This investigation used a multiple case study method to investigate the relationship between a model residential EE program and six schools that have well-established relationships with the program. The criteria for a well-established relationship required schools to have attended the program for at least three consecutive years. Data were gathered from three groups: 1) teachers who brought their students to the center during the period of the study, 2) the students who attended, and 3) GSMIT staff. Pre-experience interviews were conducted with teachers to establish a working relationship with participants and gain understanding of how they integrate this experience in to their formal classrooms. On-site observations of teacher participation during the program provided insight into how they foster student learning during the experience and post-experience interviews allowed the teachers an opportunity to reveal if they had connected the experience back to the classroom in any way. A student questionnaire developed by the researcher, in the form of a minute paper, was used to find out students' perceptions of three areas of interest: 1) most meaningful aspects of the experience, 2) most confusing aspects of the experience and 3) topics about which they would like to know more. These data inform how preparation and scheduling influence expected outcomes. Interviews with the GSMIT education

staff describe the importance and difficulties associated with nurturing their relationship with teachers and encouraging their participation in order to achieve the objectives of the program.

Subjects

Schools identified by GSMIT as having a long-established relationship with the residential learning center made up the sample. This purposeful criterion sample of six schools was identified because their teachers participated in the instruction during the experience. Narrowing the sample further, I limited the project to 5th through 8th grades, because these grade levels are typically the targeted age for programs of this nature and also make up the majority of the school programs at GSMIT. From that sample I choose from those teachers who were willing to participate in this research and would be attending the experience in February or March of 2012. This sample represented 10% of the schools that met the established criteria that would attend GSMIT in 2012. This sample accurately represented all subordinate classifications within that population.

Limitations Imposed on the Researcher

Because I collected data from a sample of diverse schools that attend the GSMIT, the findings will likely not represent all of schools that integrate an informal residential EE program into their school curricula. There is a possibility that some findings may reveal that practices could be improved but this does not influence the fact that GSMIT is a recognized model program that other residential centers look to for guidance. These data were collected through interviews, observations, and surveys. The quality of the data collected with this method is largely dependent upon the researcher. Findings may be subject to researcher bias and interpretation.

Delimitations ”Scope of the Study”

This research is a qualitative case study of six middle schools. Purposeful sampling was used to identify schools that have attended a specific model residential EE learning center. Generalization was not the goal of this study and any application of the results are to be used to allow the reader to interpret and apply the findings to his or her own situation. The schools were selected based on the following criteria:

1. The population from which the study sample was drawn was limited to schools with fifth, sixth, seventh, and/or eighth grade students;
2. Each school had a history of participation at GSMIT lasting greater than 3 consecutive years;
3. The residential environmental program was limited to school programs offered at GSMIT. The focus of the program must have EE as the primary objective and students stay on site for a minimum of three days and two nights;
4. Schools that attended GSMIT during the spring 2012 semester;
5. For practical and financial reasons, the number of schools that could be selected into the study sample will be limited to 6.

Theoretical Sensitivity

In my youth, I explored nearly every corner of the northwestern United States. Amazed by the dynamic landscape of this region, I found myself fascinated by the wonders of nature. In my educational training, as in life, I found myself drawn to the sciences, but I have learned that true understanding cannot come from science alone. This is apparent in our current education system, which presents information to the students in a series of unrelated classes that fail to make connections between disciplines. It is my belief that science should be a common thread

that provides our students a sense of cohesion to learning and facilitates the development of a robust, well-rounded education.

This study brought together my passion for nature and the outdoors with my fascination with instructional pedagogies. My background, experience, education and theoretical stance may have influenced me as I interpreted the data, but it also allowed me to make informed decisions as a keen observer. The residential program in this study is located in the pristine natural environment of the Great Smoky Mountains National Park and the novelty of the experience could likely overwhelm the investigator resulting in less than ideal observational data. My background in no way makes me immune to this novelty effect, but being aware of these issues lessened the influence it may have on my results.

Definitions

For the purpose of this study, the following terms are operationally defined as specified below:

Conservation education - "is the wise use of natural resources. It tends to focus on animals, soil, water, and air as single topics in relation to their utilization for timber, agriculture, hunting, fishing and human consumption" (Ford, 1986, p. 5).

Environmental education (EE) - a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO-UNEP, 1976, p. 2).

Experiential education - an educational philosophy which focuses on the importance of the experience in the learning process. The experience is processed through an internal learning format then transformed into working or useable knowledge (Katula, 1999).

Formal education - Teaching and learning that take place in a traditional classroom setting.

Informal education - Teaching and learning which takes place outside of a traditional classroom. Informal education is not necessarily a less structured approach to teaching and learning, it just takes place in an environment that has a potential to offer more to the learning experience than a typical classroom. Formal instruction in an outdoor setting is by this definition still considered informal education.

Inquiry - "A multifaceted activity that involves making observations; posing questions; examining books and other resources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires the identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations" (NRC, 1996, p. 23).

Nature study - The first true science curriculum in our nation's schools, nature-study incorporated the content of nature with an inquiry approach to instruction (McComas, 2008). Nature study was widely utilized in the United States during the late 19th and early 20th centuries. In response to an agriculture depression in the state of New York, nature study was developed by Cornell biologist Liberty Hyde Bailey.

Novelty effect - barrier to learning caused by overstimulation from a new environment or experience. Even though the experience usually becomes a lifelong memory it is difficult for the learner to focus on specific topic or materials of instruction. Steps can be made pre-experience to

reduce the negative effect and harness the positive aspects of the effect. Most residential environmental learning centers have students stay for three days and two nights; this in order to provide students a little more time to adjust to their new environment and focus on learning objectives.

Place-based learning - learning that is highly dependent upon the location where the learning takes place. The curriculum tends to be multidisciplinary and experience based. Coupled with participatory science learning students develop a personal ownership the content and the science that they practice (Malinowski & Fortner, 2010)**.**

Project-based learning - through collaborative fieldwork, group discussions, presentations, and reflections, students plan, implement, and report their own scientific investigations.

Residential environmental learning centers - offer environmental education or natural science as the primary program components in an outdoor setting, where students stay at the site at least one night. A typical program is four or five days. Most programs focus on fifth or sixth grade students, but many programs also serve other grades (Guide to Residential Outdoor Schools, 2003).

Student-centered instruction - Students take an active role in creating new knowledge for themselves and utilizes past experiences and social interactions and often uses cooperative learning groups and authentic assessments. The role of the teacher is that of a facilitator of dialog and asking questions, presenting perspectives and modeling reflection.

Teacher-centered instruction - The role of the teacher is as a disseminator of knowledge and the dominant mode of instruction typically emphasize order and control of the material to be covered (Gallagher & Tobin, 1987).

Organization of the Study

Chapter 1 of the study presents the introduction to my research, the background, statement of the problem, specific research questions, the significance of the study, a brief overview of method and sample, the limitations, delimitations, and operational definitions for terms. Chapter 2 is a review of the relevant literature including a history of environmental education, a review of significant documents in the field, issues and trends in environmental education, and effective instructional methods for environmental education. Chapter 3 presents the research methods for this study including introduction/background, research questions, nature of the study, description of subjects, instruments, research procedure, timeline, data reduction as well as considerations for validity and reliability. Chapter 4 presents the results of the study. Chapter 5 presents discussion of findings and their relevance to the field for both formal and informal environmental education.

CHAPTER TWO: REVIEW OF THE LITERATURE

Introduction

To provide a background for this research I have outlined the history of EE, refined the key principles of EE, and presented a review of relevant research in the field. In their chapter titled *The history and philosophy of environmental education,* Carter and Simmons (2010) provided a complete history of EE. This essay not only includes the work of scholars in the field of EE, but also authors of literature that significantly impacted the environmental movement and our culture. Emerson's (1836) N*ature,* introduced readers to a new way of looking at the raw natural state of the environment. Instead of seeing nature as a wilderness that needed to be tamed, Emerson showed people how to appreciate the natural world with curiosity and amazement. Leopold's (1949), *A Sand County Almanac* introduced the concept of a land ethic and became a cornerstone for conservation efforts. Rachel Carlson's, (1962) *Silent Spring*, illustrated the impact of chemical pollution on the environment and *The Quiet Crisis* (Udall, 1963) examined the environmental costs of man's need for growth. Carter and Simmons (2010) use Richard Louv's (2005) *Last child in the woods: Saving our children from nature deficit disorder,* not only to show us where EE currently stands, but also to signal the direction for future growth of EE.

This review of the literature is divided into four sections. The first provides a history of the development of EE. This includes brief background describing the origins of the field with respect to science education and an in-depth look at the various policy documents and reports that have shaped EE into what it is today. The focus is on the documents that have defined the philosophy, and the laws that not only fund EE, but more importantly establish its place in the classroom. The second section presents common trends and difficulties that confront the field of

EE. The third section has refined the idea curriculum of EE. This includes both the content of EE as described in the literature, a detailed review of the best pedagogical practices in EE, and description of current research at residential EE centers. Finally, a robust conclusion brings these ideas together.

History of environmental education

There are three areas of focus that have established the foundation for what is currently known as EE. These included nature study, conservation education, and outdoor education (Carter, 2010; Hammerman, 1987; Santos, 1987). Nature study, the first true science curriculum in our nation's schools, incorporated the content of nature with an inquiry approach to instruction (McComas, 2008). Some advocates saw nature itself as the source of both scientific thinking and ethical values (Williams, 2011). In response to an agricultural depression in New York, nature study was developed by Cornell University biologist Liberty Hyde Bailey and his protégé Anna Botsford Comstock. During the late 1800s and early 1900s the state of New York could no longer supply an ample quantity of its own food because its residents were flooding from farms in rural areas to the cities to work in factories (Forward Comstock & Gordon, 1939). This migration to urban centers inadvertently caused the children to lose their connection to nature.

In 1911, Comstock published the *Handbook of Nature-Study* which provided teachers/readers with observation-driven investigations to guide their instruction/study of nature and made nature study more accessible to the public. Today her book is still considered a valuable teaching resource and remains in print. Nature study is not only a content area, but also a method of instruction. Comstock illustrates this point by describing the importance for teachers to use effective questioning when encouraging students' investigations (Comstock & Gordon, 1939). Nature study was widely used in the United Sates during the late 19th and early 20th

centuries, but in the 1920s education in the United States was undergoing a dramatic change that would ultimately limit the use of nature study in the classroom.

The Cardinal Principles of Secondary Education is a report from the Commission on the Reorganization of Secondary Education. Written in 1918, this document completely changed the structure of education in the United States. The elementary years would thereafter be focused on the fundamental skills of reading, writing, and arithmetic. By the age of 12 or 13, students should enter a time of specialization and begin to define an area of interest which they can possibly pursue as a career. Secondary education would be further divided into junior and senior sections. The junior section should help the students explore their aptitudes and make provisional choices about the kind of work to which they will devote themselves. The senior section should then provide training in that chosen field.

Nature study no longer fit into the new system. Elementary schools focused on the fundamental skills and the high schools on the need for vocational training. The science classes offered in our nation's schools became specialized with little integration between subjects. Furthermore, subjects were organized so that a year of school work would provide all the information vital to the understanding of the particular content area. These changes made it difficult for EE to establish a niche.

The Cardinal Principles of Secondary Education outlined the key objectives which would guide the development of the new curriculum of both elementary and secondary education. The objectives included health, command of fundamental processes, worthy home membership, vocation, citizenship/civic education, worthy use of leisure, and ethical character. It was believed that curricula centered on these objectives would prepare students to be healthy, active members of society who were civic minded and prepared for employment. Some criticized

the report, claiming that it was responsible for diluting the curriculum by shifting the focus from traditional subjects to personal skills (Feldmann, 2005). Others focused on the positive, describing how it allowed for schools to meet the needs of all students with a variety of talents and backgrounds (Wraga, 2001). The reform that followed the publication of this document resulted in high schools offering college preparation and vocational education in the same institution. The intention of this was to make school more accessible to more students, but also allow for a wider variety of courses.

In response to these new objectives, in particular the worthy use of leisure, many schools developed camping programs. In 1918, a Los Angeles school set up a campsite where students cleared the land and built crude log cabins. In 1919, a resident outdoor camp was established by the Chicago Public Schools. It was organized through the regular school program and funded by the Board of Education (Hammerman, 1978). As this trend continued into the 1930s, the educational value of school camping was written about and talked about but, still, few programs were actually implemented. At this time, the idea of camping during school was not widely accepted so the programs that were established resembled summer camps and were not used as part of the regular curriculum. In a 1938 issue of Phi Delta Kappan completely devoted to school camping, editor Raleigh Schorling commented that "the educator of the year 2000 A.D. will look back upon us and wonder why we failed to include the experiences in nature as an integral unit of our educational system" (in Hammerman, 1987).

In the late 1940s, school camping programs began to operate during the regular school year. The focus of the curriculum changed from camp-like activities (horseback riding, canoeing, etc.) to those which could act as an extension of the classroom (Hammerman, 1987; Nash, 1950). A 1947 bulletin from the United States Office of Education stated that camping can help bring

about a re-examination of the [then] current curriculum practices (in Hammerman, 1987). The W.K. Kellogg Foundation was a major contributor to research in this area. During the 1940s the foundation had established three year-round camps for use in an experimental health program for children (Smith, 1950). Michigan and New York led the way in the development of school camping programs with curricula focused on conservation education (Hammerman, 1987). It is important to note that these curricula looked nothing like that of nature study; it was specifically targeted at solving or preventing ecological problems of the time. The reason for this shift was partly due to raised awareness of some of the detrimental environmental effects of agriculture, such as soil erosion.

Conservation curricula closely followed the view of conservation proposed by Aldo Leopold, who pushed for balance between sensible resource consumption while maintaining habitat quality (Carter, 2010). During the post-World War II era there was rapid growth of camping programs. California, Texas and Washington paralleled Michigan and New York in the promotion of school camping programs to teach conservation education. Out of concern for the future of the environment, these states recognized that they had a responsibility to teach conservation concepts to their students (Santos, 1987). During this period, the publication of many manuals, guides and handbooks referred to the field as outdoor education. Outdoor education became simply "education which takes place outdoors" (Hammerman, 2001, p. 5). Throughout the 1960s the content of programs offered in outdoor education were no longer united under just conservation, but ranged from wilderness survival to landscape painting and art (Hammerman, 1987).

In the 1950s Aldo Leopold's book, *A Sand County Almanac* (1949), gained a considerable following, helped to develop a more environmental mindset in the American public, and would

eventually be considered the cornerstone of the environmental movement of the 1960s and 1970s (Carter, 2010). He was not alone in this endeavor as two other books had equal impact on the public's understanding of environment problems. These included Rachel Carlson's S*ilent Spring* (1962), and Stuart Udall's *The Quiet Crisis* published in 1963 (McComas, 2002; Carter, 2010). Together these pieces of literature sparked an environmental revolution of the 1960s as represented by an increase in environmentally focused legislation such as the Endangered Species Act (1966) and the Clean Air Act (1965). These laws and regulations set the stage for what became known as EE.

Review of significant documents

In the first issue of the Journal of Environmental Education, William Stapp described not only the need for environmental education, but also outlined objectives for the field (Stapp, 1969). He described a shift in our culture to urban population centers, not unlike the concerns of Bailey and Comstock (1911) that prompted the development of nature study and those that drove the restructuring of secondary education. The shift to increased urbanization fundamentally alters our society. Consequently, less of our population is in contact with rural living, and this places limits on modern life because;

> direct daily contact with the basic natural resources…. and interaction with natural resources diminished and, with it his awareness of his dependency on them….Our communities are being plagued with problems such as: lack of comprehensive environmental planning; indiscriminate use of pesticides; community blight; air and water pollution; traffic congestion; and the lack of institutional arrangements needed to cope effectively with environmental problems (Stapp, 1969, p. 33).

Stapp explains that responsibility for these issues rests ultimately on the public. Urbanization compounds these issues because an ever increasing portion of our population is distanced from the natural environment. There is a need to educate the population on these

topics, because informed citizens will be required to vote on policies that directly influence the health of our environment. Carter and Simmons (2010) outlined the significant amount of environmental legislation passed during this period, including The Wilderness Act of 1964 (P.L. 88-577), The Solid Waste Disposal Act of 1965 (P.L. 89-272, 79 Stat. 992), The Clean Air Act of 1965 (P.L. 88-206), The Species Preservation Act of 1966 (P.L. 89-669), The Wild and Scenic River Act of 1968 (P.L. 90-542), and ultimately The National Environmental Policy Act of 1969 (P.L. 91-190). Taking effect on January 1, 1970 the National Environmental Policy Act (NEPA) mission statement not only represented the environmental concerns of the 1960s, but it was also considered a triumph for environmental protective efforts. This Act is still the environmental law in the United States today (Carter, 2010). The NEPA purpose statement reads,

> To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality (P.L. 91-190).

As the 1960s were coming to a close Stapp wrote an article that stressed importance of EE in our society (1969). He explained that the purpose of EE "is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Stapp, 1969, p34). It is clear that Stapp saw that EE was essential to maintaining the pro-environmental efforts of the 1960s.

April 22, 1970 was recognized as the first Earth Day. Twenty million people demonstrated their support of the environmental movement. From a science education perspective this marked a rare event. Until this point, only the Scopes evolution trial and the Sputnik launch have been met with as much emotion and concern for science teaching (McComas, 2002). Carter and Simmons (2010) describe 1970 as one of the biggest years in the

history of EE. Beyond the celebration of Earth Day and the NEPA, there were two other significant contributions that year. The first was a study published The National Science Teachers Association which found that there were only 54 programs with an EE component among all of the schools and districts in the 50 states (in Carter, 2010). Before the end of the 1970s all 50 states would have EE as part of their public school curricula.

The second significant contribution came in October 1970 when President Nixon signed the National Environmental Education Act into law (United States Public Law 91-516). Under this Act, the Office of Environmental Education was established and funding was provided for states to implement EE within the K-12 system. The National Environmental Education Act of 1970 defines EE as "…the educational process dealing with man's relationship with his natural and manmade surroundings, and includes the relation of population, conservation, transportation, technology, and urban and regional planning to the total human environment" (United States Public Law 91-516, p1).

The International Workshop on Environmental Education was held in Belgrade, Yugoslavia in October of 1975. The product of this meeting has become known as the Belgrade Charter and has become one of the founding documents for EE. It described the goals, objectives, audiences, and guiding principles of EE. The Belgrade Charter also included the most widely accepted definition of EE:

> Environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO-UNEP 1976, p2).

The world's first intergovernmental conference on EE was held in Tbilisi, Georgia, USSR in October of 1977 and produced a document known as the Tbilisi Declaration. This declaration clearly outlined the goals of EE:

1. To foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
3. To create new patterns of behavior for individuals, groups and society as a whole towards that the environment (UNESCO, 1978, p26).

These goals are perhaps the most widely accepted of EE both in the United States and internationally. The Tbilisi objectives include categories of awareness, knowledge, affect, skills, and participation. "When these categories of objectives are viewed in the context of the Tbilisi goals, they represent stepping stones to prepare and enable citizens, including students, to become actively involved in the prevention and resolution of environmental problems and issues" (McBeth et al., 2008. p2).

Unfortunately, in the 1980s momentum for EE slowed dramatically. With President Ronald Reagan in office, the Omnibus Budget Reallocation Act (OBRA) of 1981 reversed many of the programs set in place by the National Environmental Education Act. Although reinstituted by President Bush in 1990 and supported by President Clinton for the next eight years, EE struggled to remain part of public education (Carter, 2010). Once again, the National Environmental Education Act charged the United States Environmental Protection Agency (EPA) with providing national leadership for increasing environmental literacy. Since 1992, the EPA has spent almost 100 million dollars on this goal, but many believe that the Act is outdated and was not written to provide systematic change (Potter, 2010).

The 1980s and 1990s would become known as the era of the academic standards movement. Standards first originated in mathematics as benchmarks or goals for instruction

(Carjuzaa & Kellough, 2012). The concept of standards made it into other disciplines and soon they were required for every subject. Being multi-disciplinary in nature makes it difficult for EE to fit into a standards-based disciplinary curricular system that is responding more and more to the "basics only" (Ramsey & Hungerford, 2002, p.148). The North American Association of Environmental Education (NAAEE) proposed to develop standards for EE. The National Project for Excellence in Environmental Education was born from this organization and today provides benchmarks for student learning in EE, guidelines for development and assessment of materials (NAAEE, 2004).

The educational climate of the early 21st century has not been favorable to EE. The 2001 Elementary and Secondary Education Act, also known as the No Child Left Behind Act (P.L. 107–110), essentially ignores EE by placing the majority of focus on reading and math. Another setback occurred with several failed attempts to reinstate the National Environmental Education Act. It is at this point Carter and Simmons (2010) bring their history to a close with the mention of Richard Louv's (2005) *Last child in the woods: Saving our children from nature deficit disorder*. This book raised awareness for the importance of children's contact with nature and has been used to rally support for the Reauthorization of the Elementary and Secondary Education Act, also known as the No Child Left Inside Act (H.R. 3036, 110th Congress). This bill proposed that a portion of the school curricula be taught out-of-doors, provide teacher training for outdoor instruction, and provide support for EE that include: 1) advancing content and achievement standards; 2) developing or disseminating innovations or model programs; and 3) research. The proposed NCLI bill currently includes $500 million for state educational agencies to distribute to equip teachers with the skills, knowledge, and confidence they need to integrate the environment into their curricula. Only states with qualifying Environmental

Literacy Plans (ELP) would be eligible for a percentage of this funding. To help states meet this requirement, the NAAEE published a guide which addresses the benefits of a having a state level ELP, the elements of a state level ELP, and recommendations for implementation and funding (NAAEE, 2008).

Another pertinent issue EE has faced in the recent years is the need for quality assessment. The National Environmental Literacy Assessment (NELA) project met this challenge head-on by developing a multi-phased study. The first phase was designed to identify baseline levels of environmental literacy among sixth and eighth grade students in randomly selected U.S. schools with middle grades (McBeth & Volk, 2010). This NELA used the Middle School Environmental Literacy Instrument (MSELI) developed and refined by Hungerford, Volk, Bluhm, McBeth, Meyers, and Marcinkowski. This project focused on specific environmental literacy variables including 1) ecological knowledge, 2) verbal commitment, 3) actual commitment, 4) environmental sensitivity, 5) general environmental feelings and 6) environmental issue and action skills (McBeth & Volk, 2010). The results of this research provided the EE community with its first look at the level of environmental literacy across the United States and acted as a baseline for future studies. McBeth and Volk (2010) describe their interpretation of the results;

> [U.S. sixth and eighth grade students] …as a group, they are moderate to high in their ecological understandings…Their attitudes also appear to be moderately positive, especially in terms of positive feelings toward the environment and willingness to take positive actions toward the environment… all students, in a pattern echoing that of adults, their report of undertaking actual behaviors to remediate environmental conditions falls short of their verbal commitment and feelings. Lower still is their grasp of critical thinking and decision-making skills that might be useful in helping to resolve environmental issues in their own communities and in society at large (p.63).

The second phase of this research was to utilize the results of the baseline measures of environmental literacy in a comparative study (McBeth & Volk, 2010). This phase of the

research focused on two research questions. The first was to determine the level of environmental literacy of 6th, 7th, and 8th grade students across the U.S. who have participated in exemplary EE programs at their schools. Again, they used a modified version of the MSELI. Their second question sought to determine how the level of environmental literacy of students in these programs compared to the established baseline level of environmental literacy. Results identified statistically significant differences on all variables except between those that have had exemplary EE programs at their schools and those that did not. Only issue identification failed to show a positive effect of the treatment (McBeth et al., 2011). These results provide strong support for the effectiveness of high quality EE and should encourage EE educators and policy makers to push forward toward the goal of an environmentally literate society. In what seemed like a time of doubt, there is evidence that this once lofty goal could now be attainable and that these effective programs should be developed for and implemented at a local level across the United States.

Issues and Trends in Environmental Education

Response to urbanization: Nature study was developed in response to a changing way of life in America. In the early 1900s a greater proportion of the population lived in urban areas compared to earlier times in U.S. history, resulting in fewer children growing up in the small farms of the countryside. Stapp (1969) described how this trend has continued over the next fifty years. At the time he published his paper, 70% of the US population lived in urban centers. Stapp explains: "Consequently, the independent rural-oriented living that once characterized this country's social and political heritage is no longer a dominating influence in the lives of most Americans" (p33). Howarth (1996) expands on this idea of isolation from nature, stating that only 10% of the population is responsible for producing food and resources for the remaining

90%, and that is due to the expansion of large scale commercial farms, with small scale family farms all but extinct.

According to the 2000 United States Census, 79% of the population lives in urban areas. The report from the 2010 census will be released in October 2012, but reports suggest that this number will continue to grow (Country Snapshot: US Demographic Data, 2009). Since the time of the industrial revolution our society has continually progressed toward more urbanization, and it is this transition that is creating barriers to children's exposure to nature. Bailey and Comstock (1911) recognized this phenomenon and developed the nation's first science curriculum. Stapp (1969), among others, used the environmental movement to focus the public attention on the need to address EE through education. Richard Louv (2005) convincingly coined the term "nature-deficit disorder" to raise awareness for how children are disconnected from nature. Although not a true medical condition, Louv explained that this disconnect has significantly worsened with the gadgets like handheld game systems and other modern devices that compete for children's attention and leisure time that was formerly spent engaging in outdoor activities. Smith (1972) simply states: "Increased urbanization has deprived many children and youth of contact with the land" (p5).

Environmental education is interdisciplinary in nature: One of the major challenges facing EE is that it lacks a formal niche in the K-12 curriculum. Being interdisciplinary in nature makes it difficult for EE to fit into the disciplinary curricular system that has been in place since the Commission on the Reorganization of Secondary Education in 1918. The commission's vision of secondary education was a comprehensive high school that embraced all curricula in one unified organization. The curricula were geared toward preparing students for vocational training. The reorganization involved reducing the number of sciences offered in high school to

accommodate college entrance requirements. Lines were drawn and high school science subjects were divided up into what we often see today: general science followed by biology, chemistry and physics (DeBoer, 1991). Furthermore subjects are organized so that a year of school work will complete the material for that course, covering all the information vital to the understanding of the content area. By isolating the sciences in this manner, it is difficult to have continuity on the areas that overlap the margins of the between various science domains and other subjects disciplines.

In our educational system EE is usually either ignored or viewed as a supplement to the existing science curriculum. An example of this phenomenon can be found in a review of biology textbooks. McComas (2003) found that 10 of 13 secondary biology textbooks at that time had only a discrete chapter or section addressing ecology and over half of these books included it in the final chapters, all but guaranteeing that this important content would only be covered if time allowed. Apart from its lack of a home in the core science curriculum, effective instruction of EE requires students to address issues beyond science (Disinger, 2001). Although some aspects of EE do fit into the existing curricula of science, civic mindedness would be better taught in social studies. In our current educational system, the two are not connected.

EE concepts are often included as a relatively loose grouping of subjects that can be found sprinkled throughout the K-12 curriculum. These concepts are interdisciplinary so they can be found in subjects ranging from life science, earth and space studies and chemistry. Although a unifying theme approach, is the method supported by the *Ideal Standards of Excellence in Environmental Education* (NAAEE, 2004) as well as the national science standards (NRC, 1996) there is no guarantee of continuity of theme will accompany the delivered science content from one year to the next.

Perceptions from outside formal science education: EE is in itself interdisciplinary in nature, but beyond that its values are interpreted differently among various social groups in our society. Disinger (2001a) provides an example of this in the development of the National Association for Environmental Education (NAEE). This group was formed in 1971 by a group of community college teachers who were interested in the development of high-quality instructional materials in EE. In a short time, membership in this organization swelled with representatives of different facets of society, each claiming an interest in what should be EE. Environmental activists believed that education could provide NAEE an opportunity to disseminate pro-environmental propaganda. Government agencies wanted to push an agenda of resource management. Industry and business wanted to clarify or justify their position on specific environmental issues, such as pollution. NAEE grew so large that the original group of teachers not only lost control of their organization, but also found that it no longer served their original purpose. The founding environmental educators started a new organization, one that had their curricular objectives clearly outlined in their founding documents. The new organization became the North American Association for Environmental Education (NAAEE).

The interests of industry representatives and environmental activist are often at opposite ends of the spectrum. These groups approach EE from dramatically different perspectives and, even today, continually fail to agree with one another on issues facing the field of EE. The two big issues they cannot seem to agree upon are: 1) the proper relationship between humans and the environment and 2) what education is, is not, should be and should not be. Disinger (2001a) describes three worldviews that individuals hold that influence their positions on these issues. They include:

- Cornucopian: Harvest the world of unlimited resources and utilize its unlimited capacity to hold waste;
- Utilitarian conversationalist: Focus on human needs and wants but resources must be scientifically managed to maintain a sustainable natural world;
- Preservationists: Believe that if the environment needs to be managed, then it should be to keep the natural systems in a pristine state.

All people fit somewhere on this spectrum of worldviews, and these worldviews often clash in relation to the field of EE. A person's worldview is strongly influenced by his/her background and rooted deeply in emotion. For most people this worldview is typically based on information that is less than complete and more than likely never critically analyzed (Disinger, 2001a).

Teachers also have a worldview and often they are not well-versed in the intricacies of environmental issues. Today's teachers are not formally prepared to teach EE concepts. Less than 15% of science teachers have taken a formal course in EE. Currently, there are few, if any provisions for preparing preservice teachers, nor are there ongoing in-service professional development programs to specifically address the content and methods for effective teaching of EE (Ramsey & Hungerford, 2002). Without resources to broaden their worldview, teachers may be unable to effectively support the multiple perspectives required of EE (Disinger, 2001a). This is a crucial component of EE and failure to express both sides of an issue limits student exposure to critical information they need to establish their own worldview. Disinger, explains that "Teachers need to teach about the environment so that their students understand it as it is, and will be, and it might be, and how what they do as individuals and collectively affects it" (p.6). Teachers must also work with students to develop critical thinking skills and communication.

Curriculum in Environmental Education

The interdisciplinary nature of EE makes it difficult to fit into a traditional K-12 curricular system (Disinger, 2001; Ramsey & Hungerford, 2002). The core content areas in this traditional system typically include science, social studies/history, math and English, but effective EE instruction must include subject matter from several different content areas (NAAEE, 2004). This section of the literature review will attempt to define the most significant content areas that form the foundation of EE. Together these content areas represent the subject matter and methods of instruction that should be included in all EE curricula. First, I will establish a historical background to identify the content areas within the field of EE. Then I will provide a section for each content area, describing the subject matter of each as indicated in the defining documents as well as the current literature that is guiding practice. I will address why each should be included and, more specifically, what topics within that content area should be included. I will then describe specific pedagogical strategies used to teach each subject area. The content areas that are essential to effective EE programs have been clearly defined, while also identifying research supported specialized methods of instruction for each area. By doing so, I have established a standard by which EE programs could evaluate their teaching practices.

Background

The definition of EE has evolved over the years, but central components have remained constant. Stapp (1969) explains that the purpose of EE "is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (p.34). In this definition are found two major components: knowledge and action. The knowledge segment is represented by two areas: ecological principles and problem solving skills. The action

component in Stapp's definition is simply explained as motivation to work toward a solution. Other documents used to establish a definition for EE include The Environmental Education Act of 1970, the Belgrade Charter, the Tbilisi Declaration and the NAAEE *Excellence in Environmental Education: Guidelines for Learning* (2004). By reviewing these historical documents of environmental education I have identified three specific content areas, 1) Knowledge of Ecological Principles, 2) Issue Identification and Solution, and 3) Civic Responsibility and Motivation. The essence of each document and specific content areas found in EE are shown in Table 2.1. Following this table is a discussion that expands upon these content areas by defining the specific subject matter for each as well as research based recommendation of the most effective teaching methods.

Table 2.1
Historical Background for Defining the Content Areas of Environmental Education.

Document	Stapp (1969)	Belgrade Charter (1975)	Tbilisi Declaration (1977)	NAAEE Guidelines (2004)
Ecological Principles	Knowledge of the biophysical environment and its associated problems	Knowledge of the total environment	Knowledge of the environment and the ecological interdependence in urban and rural areas.	Knowledge of Environmental Processes and Systems
Issue Identification and Solution	Understand how to help solve environmental problems	Understand problems associated with the environment.	Create new pattern of behavior for individuals, groups and society as a whole towards that the environment	Questioning, Analysis and Interpretation Skills; Skills for Understanding environmental issues
Civic Responsibility and Motivation	Motivated to work toward a solution	Attitudes, motivations, commitments, and skills to work individually and collectively toward solutions	Knowledge, values, attitudes, commitment and skills needed to protect and improve the environment	Skills for Addressing Environmental. Issues Personal and Civic Responsibility

The Three Content Areas of Environmental Education

Ecological Principles

Knowledge of ecological principles is the foundation on which students build understanding in EE (Athman & Monroe, 2001). The content should encompass the total environment: It must be relevant to the everyday lives of the students and demands understanding of content across a range of scientific disciplines (McComas, 2003). To better understand what ecological subject matter should be included in all EE curricula, I have compiled relevant historical documents to the field as well as more recent papers that guide practice.

Hungerford et al. (1980) outlined 10 ecological subject areas that would provide students sufficient ecological knowledge to build a solid foundation on which they can make sound decisions about environmental issues. These subject areas include 1) interaction and interdependence, 2) succession, 3) individuals and populations, 4) the community and ecosystem concepts, 5) environmental influences on limiting factors, 6) homeostasis, 7) energy cycling, 8) biogeochemical cycling, 9) man as an ecosystem component, and 10) the ecological implications of man's activities and his communities. In a 1989 issue of *Ecological Concepts*, Cherrett identified the 20 most important concepts in ecology by surveying members of the British Ecological Society (in McComas, 2002). Cherrett's ecological concepts include: 1) competition, 2) food webs, 3) predator prey interactions, 4) ecosystem fragility, 5) population cycle, 6) succession, 7) ecological adaptation, 8) life history strategies, 9) niches, 10) environmental heterogeneity, 11) species diversity, 12) community interactions, 13) density dependent regulation, 14) limiting factors, 15) carrying capacity, 16) ecosystems, 17) energy flow, 18) materials cycle, 19) conservation of resources, and 20) maximum sustainable yield.

McComas referenced Cherrett's work in his review of the National Science Education Standards (NSES). In fact, he found that the NSES accurately represented this subject matter. McComas used a reductionist qualitative view to extract ecological subject matter from the NSES and group it into categories. He identified 40 ecological principles which he then reduced into 17 topics. McComas identified four dominant ecological themes for these topics: 1) population ecology, 2) food chains, 3) energy flow and 4) human impact. The NAAEE *Guidelines for Learning* (2004) have also specified four major themes of ecological subject matter in Strand 2: Knowledge of environmental processes and systems. These four sub-categories include: 1) the living environment, 2) the Earth as a physical system, 3) humans and their societies and 4) environment and society.

These documents identify the essential subject matter that represents ecological content necessary for inclusion in all EE programs. I have classified these topics into three categories; 1) biodiversity, 2) biotic and abiotic interaction, and 3) anthropogenic influences (Table 2.2). For students to understand the environment around them, they must have a solid foundation in these subject areas. Table 2.2 presents an alignment of ecological science content for environmental education as indicated by defining documents and current research. These data have been organized to show the consensus among pioneers, researchers and organizations.

Table 2.2
Ecological Science Content for Environmental Education.

	Hungerford et al 1980	Cherrett 1989	McComas 2002 (17 topics)	McComas 2002 (4 themes)	NAAEE 2004
Biodiversity	Interaction and interdependence	Competition, food webs	Food Chains Issues	Food chains	The living environment
		Predator prey interactions	Predator, Producer, Consumer, etc		
		Ecosystem fragility, population cycle	Population Defined	Population ecology	
	Succession	Succession, ecological adaptation, life history strategies, niche	Overpopulation, Population Density & Consequences		
	Individuals and populations	Environmental heterogeneity, species diversity	Population Change, Growth (reasons & types)		
	The community and ecosystem concepts	The community	Organisms Interact		
	Environmental influences on limiting factors	Density dependent regulation, limiting factors, carrying capacity	Limits on Growth & Carrying Capacity		
Biotic and Abiotic interaction	Homeostasis	Ecosystem	Ecosystem Defined	…	The Earth as a physical system
			Environment Defined		
	Energy flow and materials cycling	Energy flow, materials cycle	Energy Flow (sun), Cycles (water, geochemical, nitrogen, etc.)	Energy flow	
	(biogeochemical cycling)	…	Organisms Impact on the Environment	…	
			Biotic & Abiotic Factors / Issues		
Anthropogenic influences	Man as an ecosystem component	Conservation of resources	Humans Use Natural Resources	Human impact	Humans and their societies impact the environment
			Humans Impact the Environment		
	The ecological implications of man's activities and his communities.	Maximum sustainable yield	Pollution - Causes, Risks & Consequences		
			Resources Are Limited		
			Environmental Decisions Should Be Based on Science		

The NAAEE (1996) expresses the importance for factual accuracy, explaining that materials should reflect sound theories and well-documented facts. In our schools the topics of ecology need to be organized so that underlying concepts are targeted at early ages, and these concepts are expanded upon as students' progress through their schooling (McComas, 2002). This process allows students to experience the content that is developmentally appropriate for their grade level and ultimately gain deeper understanding by building on their prior knowledge. Studying ecology and nature support the development of ethical values toward the environment (Williams, 2011). Evidence for the inclusion of this subject matter into the K-12 curriculum is drawn from two well-respected documents in science education: the Benchmarks for Science Literacy (AAAS, 1993) and the National Science Education Standards (NRC, 1996).

Issue Identification and Resolution

When teaching students to identify problems or issues in the environment it is important to recognize that this not only requires some creativity from the student, but also a well-defined set of investigation skills (Colley, 2006; National Research Council, 1996). Science -- A Process Approach (SAPA) was a post-Sputnik curriculum project that focused solely on the development of science process skills; typical science subject matter was of secondary focus, if present at all (Bredderman, 1983). These process skills include the ability to (a) identify and pose research questions, (b) identify and formulate hypotheses, (c) identify variables, (d) define variables operationally, (e) design investigations, (f) implement investigations, (g) collect, analyze and interpret data, (h) draw conclusions from data and (i) report findings orally and/or in writing (Colley, 2006). This subject area is supported by strands 1 and 3 of the NAAEE guidelines for learning (NAAEE, 2004). This document explains that EE has a responsibility to teach students

how to ask questions, speculate, and hypothesize about the world around them while seeking information, and develop answers to their questions. In a broader sense, the NAAEE is advocating that students need skills for analyzing and investigating environmental issues to inform the decision making process. Table 2.3 presents the topics in the content area of issue identification and solution formation. This table aligns the science process skills identified by SAPA with the recommendations from the NAAEE guidelines of learning.

Although this subject matter is closely related to the previously mentioned ecological principles, they represent two distinctly different content areas. Both should be taught as part of a larger body of scientific knowledge, but it is important to note that often science curricula are absent of subject matter that focus on science processes (Abimbola, 1983). Without this connection there is the potential to lead students to develop misconceptions of how science works.

Table 2.3
Topics in the Subject Area of Issue Identification and Solution Formation.

	Colley 2006	NAAEE 2004
Issue identification and solution formation	(a) Identify and pose research questions;	Students know how to ask questions and seek information
	(b) Identify and formulate hypotheses;	Students can speculate, and hypothesize about the world around them.
	(c) Identify variables;	Students have skills for investigating environmental issues
	(d) Define variables operationally;	
	(e) Design investigations;	
	(f) Implement investigations;	
	(g) Collect, analyze and interpret data;	Students have skills for analyzing results.
	(h) Draw conclusions from data; and	Students develop answers to their questions to inform decisions
	(i) Report findings orally and/or in writing	

Civic Responsibility and Motivation

Civic Responsibility and Motivation is one of the EE content areas that could be taught outside the field of science. That being said, civic responsibility does have an important role in the science classroom. Even though scientific reasoning should be used to support decision making, the civic responsibility content area is needed to teach students how they can influence change. Athman and Monroe (2001) point out that effective EE programs empower learners with skills to help them address environmental issues with a sense of personal and civic responsibility. This subject area is supported by strand four of the NAAEE guidelines for learning.

> Environmentally literate citizens are willing and able to act on their own conclusions about what should be done to ensure environmental quality. As learners develop and apply concept-based learning and skills for inquiry, analysis, and action, they also understand that what they do individually and in groups can make a difference (NAAEE, 2004, p6).

Strand four clearly expressed the importance for EE to provide students with the skills and knowledge needed to act on their own conclusions, also reinforced the concept that students must recognize that their choices, ether individually or in groups, have an influence on the environment (NAAEE, 2004).

The three essential EE content areas identified in this section of the report include: 1) Knowledge of Ecological Principles, 2) Issue Identification and Solution, and 3) Civic Responsibility and Motivation (Table 2.1). Although the roots of EE are bound in the science of ecology, it is truly interdisciplinary in nature and requires understanding of political and civil rights, policies, and history. To some extent this also includes reading, writing and speech just as much as they will involve mathematics, graphing, and calculations. Teachers of EE have a responsibility to guide their students' learning across the lines that divide disciplines, connecting subjects in new ways. Disinger (2001) explains that “Teachers need to teach about the

environment so that their students understand it as it is, and will be, and it might be, and how what they do as individuals and collectively affects it" (p6). This is a tall order, but with effective pedagogy it is possible.

Methods of Instruction

The instructional theory of Piaget involves the act of arranging experiences in a way so that they are just above the cognitive level of the student (Gredler, 2005). This process continues toward an intended objective until the goal is achieved. This philosophy of learning is similar to Vygotski's Zone of Proximal Development (ZPD) which describes a range of reasoning that advances as the student encounters new learning experiences (Gredler, 2005). Both of these theorists take into account not only the learners' prior knowledge, but they also recognize a limit just beyond one's current level of reasoning. All people possess prior knowledge and experiences, and it is on this framework that they build new understandings. As with any subject, EE needs to be delivered to the students at or just above their current level of understanding, but it is also important that the materials are not too advanced. This could discourage learning and make students resistant to new ideas (Gredler, 2005). In EE, students come to the classroom with prior knowledge, as they have an established worldview with respect to environmental issues. This worldview is strongly influenced by their background and experiences, deeply rooted in emotion and, more often than not, based on information that is incomplete or never critically analyzed (Disinger, 2001).

Current research does show that exposing students to outdoor learning experiences increases their self-confidence and willingness to participate in future outdoor activities (Palmburg & Kuru, 2000). Students who participate in outdoor learning have more positive attitudes toward the environment and increased cognitive skills (Bogner, 1998; Martin, 2003).

Furthermore, when learning about ecological concepts these students have better understanding than those taught in a traditional classroom (Cronin-Jones, 2000; Martin, 2003). These studies collectively reinforce the importance of using outdoor education in content areas such as ecology.

The National Society for Experiential Education (NSEE), founded in 1971, describes experiential education as an educational philosophy which focuses on the importance of direct experience in the learning process. The NSEE claims that the experience is processed through an internal learning format and then transformed into working or useable knowledge (Katula, 1999). Ford (1986) defines experiential learning as simply "learning by doing" (p8) and he also suggested that outdoor education may be considered experiential learning. Katula's definition describes a philosophy and methodology in which educators purposefully engage learners in direct experience and allow for reflection in order to increase knowledge, develop skills, and clarify values (Katula, 1999).

There are several instructional approaches that science educators can use to help students acquire issue identification, solution formation and science process skills. These include, but are not limited to the authentic investigations of inquiry-based science instruction (Colley, 2006). The American Association for the Advancement of Science (1993) and the National Research Council (1996) explain the importance for teaching science in an inquiry fashion. However, students need to not only learn what inquiry is, but also develop the skills required to do inquiry. These skills are essential to the development of critical thinking. They foster the ability to anticipate outcomes or make predictions. Students who learn through inquiry take ownership of their learning which is driven by personal interest. Athman and Monroe (2001) make it clear that effective EE programs must use the best practices, including inquiry. It is important to note

that the use of inquiry as a method of instruction is not limited to the field of science instruction, and not all of the subjects in EE fall into the fields of science; some are better addressed in disciplines like social studies.

Reviewing case studies can help students making connections between the various aspects of an issue and the action to more thoroughly understand their choices and consequences (Athman & Monroe, 2001). This approach is also supported by the NRC, who recommends the use of history in school science programs to illustrate the human aspects of science and better define the role that science has played in the development of various cultures (NRC, 1996). This should also include environmental history.

The pedagogical techniques discussed in this section are not exclusive to any one subject area. Most of them lend themselves to any subject area, but are especially effective methods when teaching science. Scientific teaching incorporates materials from other disciplines to meet the needs of a specific step or process in an investigation. Involving students in reporting the results of a scientific investigation could require teaching students writing and communication skills. It is for this reason that when it comes to instructional methods for EE, we look to science education. Table 2.4 aligns the recommended methods of instruction to the subject areas outlined in the previous section. From this table, it is evident that no one method of instruction or delivery can be used to teach all of the subject areas of EE. In fact, effective EE instruction would include a variety of these techniques.

Table 2.4
Alignment of Recommended Methods of Instruction to the EE Subject Areas

Subject Area	Method of instruction	References
Ecological Principles	Outdoor education	(Palmburg & Kuru 2000; Bogner, 1998; Martin, 2003; Cronin-Jones, 2000)
	Experiential education	(Ford, 1986; Katula, 1999)
Issue Identification and Solution	Inquiry Investigations	(Athman& Monroe, 2001; Colley, 2006; NRC, 1996; AAAS, 1993)
Civic Responsibility and Motivation	Analysis of Case Studies	(Athman & Monroe 2001; NRC, 1996)

Students need to have an outdoor experience on which to frame their learning of ecological principles. They need to conduct inquiry based investigations to develop ownership of the information and they need analyze case studies to guide their decisions formulated from that new understanding. This process leads to deeper levels of understanding and requires a larger level of commitment from both the teacher and student.

The three content areas that are the most important components in an EE program include 1) Knowledge of Ecological Principles, 2) Issue Identification and Solution, and 3) Civic Responsibility and Motivation (Table 2.4). The most effective methods of instruction that can be used to teach the subject matter of these content areas are outdoor education, experiential education, inquiry investigations and analysis of case studies. All of these components need to come together for effective EE. This is explained by McComas (2003) in an outline of the ideal environmental science curriculum: "An environmentalist who takes action without understanding the science behind his cause is just as uninformed as the student who scores high marks on the ecology test and fails to understand that there are rational causes worth fighting for" (p. 178). From this example, one can see how the absence of one component would not only limit the success of program, but also it could actually be detrimental to its mission. Effective EE

includes using appropriate pedagogical strategies to facilitate student learning in all three of these content areas.

Research at Residential Environmental Learning Centers

Much of the research conducted at residential environmental learning centers has been focused on measuring how the experience influenced students' knowledge of a specific topic. These projects typically include a weak instrument used to collect pre- and post-data from a relatively small population. While this research is useful when looking at specific outcomes of a specific sample, they do not answer the really difficult questions related to how the residential experience influences student learning or how the curriculum is delivered at the learning centers. Fortunately, there have been a few studies in recent years that have asked these bigger questions.

Smith-Sebasto and Cavern (2006), in collaboration with the New Jersey School of Conservation (NJSOC), assessed how pre- and post-activities influenced students' attitudes toward the environment. They found that students who received both pre- and post-trip activities had statistically higher scores corresponding to more positive attitudes about the environment. In 2009, Smith-Sebasto and Obenchain investigated longitudinal effects of the NJSOC. Immediately prior to the students' departure and again 6 months later, they used the minute-paper assessment techniques to administer an instrument that explored what students found most meaningful about their experience, most confusing about their experience and what aspect of their experience they would like to repeat. Findings revealed that students' perceptions of their experience changed over time and the way in which they change can be influenced pre- and post-experience classroom activities. They were also able to determine that the overall objectives designed into the experience were being met (Smith-Sebasto & Obenchain, 2009). These

research projects not only asked difficult questions but they also implemented unique and effective methodologies.

Another project that asked difficult questions and used innovative methods for research on effective EE was the work of Stern, Powell, and Ardoin (2008). In collaboration with the Great Smoky Mountains Institute at Tremont (GSMIT), the site of the research presented in this study, a residential environmental education facility located in eastern Tennessee, they set out to measure constructs that were much more difficult to define than the commonly used attitude scale or content measures. They identified four key constructs that were essential to understanding how the GSMIT objectives aligned with student perceptions of the experience. These constructs include: 1) Connection with nature (Nature), 2) Environmental stewardship (Stewardship), 3) Interest in learning and discovery (Discovery) and 4) Knowledge and awareness of the Great Smokey Mountains National Park (GSMNP) and biological diversity (Awareness). They found that the residential EE experience at GSMIT was achieving short-term success in all of the measured outcomes. Analyses of 3-month follow-up surveys revealed that increases in students' commitment to stewardship and their knowledge and awareness of GSMNP and biological diversity remained significant. However, increases in students' interest in learning and discovery and their connection with nature faded over time. The authors suggest that although GSMIT provides immersive EE experiences and achieve their desired objectives in the short term, long-term influences on students' attitudes may be reduced. Follow-up programming at schools or other supporting activities, may be necessary for students to retain their newly acquired interests (Stern, Powell, & Ardoin, 2008). This project reinforced the need for curricular alignment between formal and informal learning environments but is not what makes this project so unique. The reason this project stands out in the literature of assessment in

EE is because the researchers worked closely with the GSMIT staff to develop their understanding of effective assessment. They wanted the staff to develop an understanding of the assessment strategies, so that they could validate that the instruments were measuring the intended construct. By doing so, the researchers established a partnership that nurtured a rich conversation between the assessment team and the field instructors. The GSMIT staff could translate their field experiences with the children directly into the formation of the constructs. Also, GSMIT staff developed a deeper understanding for the importance for effective assessment.

The importance of working closely with residential program staff has been recognized by other researchers at other settings. For example, Erickson (2006) interviewed a group of 23 residential environmental learning center directors to determine the most influential factors for success. The results indicated that a good staff, strong curriculum, and quality facilities were the factors most frequently mentioned. Although the directors were the participants in this study, they understood the benefits that could be gained from investigating their field of expertise.

Summary

This review of the relevant literature has revealed several issues facing the field of EE. These issues include 1) students' disconnect from nature, 2) alignment of EE into the current education system and 3) how informal EE can be connected to the formal classroom. In this section I have summarized the information presented in this chapter that pertains to these issues.

In response to urbanization, our society has changed. Students have less opportunity to investigate the natural environments than those of previous generations. This phenomenon has been observed for over a hundred year period. It was this issue that sparked the creation of nature study by Bailey and Comstock (1911) and it is at the core of EE today in current educational

legislation. Schools should provide students an opportunity to experience natural environments so that they can apply the content delivered in a didactic classroom lesson to the real world.

The defining documents of EE and current research in the field have clearly outlined the ideal curriculum of EE. Yet, EE fails to find a niche in our school curriculum. Schools and educators interested in providing their students with EE, can incorporate supplemental resources or informal environmental learning centers into their school curricula. The National Environmental Literacy Assessment Project has shown that students attending schools with EE programs have significantly higher levels of environmental literacy than students at schools that do not.

In an internal assessment of a model residential environmental learning center at GSMIT, Stern (2008) identified that the level of connection between the informal and the formal classroom had a significant impact on student learning. This connection was contributed to pre- and post-activities, the duration of the experience and teacher participation in instruction during the experience at GSMIT. Although Stern's work was able to identify these factors and successfully measure their impact on student learning, the scope of the project did not include a detailed look at how the schools incorporate these aspects into the experience. The dissertation research presented here accomplishes this task. Chapter 3 explains the research methods used in this study. This includes a detailed description of the participants, instruments, data collection and data analysis.

CHAPTER THREE: METHODS

This chapter describes the multiple case studies used to investigate the relationship between six schools and a residential EE program they attend. Data for this investigation included: interviews, field observations and questionnaires. Participants consisted of all stakeholders including teachers, students, school administrators, informal education directors, and residential center instructional staff. The purpose of this inquiry is to understand how schools integrate a residential program with their formal classroom instruction and to describe how participation in cooperative teaching influences student learning before, during, and after the Great Smoky Mountains Institute at Tremont (GSMIT) experience.

Participants

Purposeful criterion sampling is designed to identify cases that are information rich. The unit of analysis for this project is the school, but includes perceptions of teachers, administrators, and students. To describe each school's participation at GSMIT, I have used observational data and staff interviews (Appendices D and E) that I collected during the visit at GSMIT. In this section, I will describe the criteria for selecting the residential learning center and then I define the criteria for selecting the schools. Finally, I will explain how the marriage of the school and GSMIT into paired groups provides not only deep understanding of the relationship between the formal classroom and the informal residential experience, but also the role of teacher-staff cooperative teaching.

Residential Environmental Learning Centers

There are more than a thousand public and private nature centers across the United States. Of these centers, about 330 offer residential programs (Guide to Residential Outdoor Schools, 2003). In this study residential learning centers will be defined as programs that offer EE or natural science as the primary program components in an outdoor setting. In these programs students stay at least one night at the facility with a typical program lasting four or five days. Most programs focus on fifth or sixth grade students, but many programs also serve other grades (Guide to Residential Outdoor Schools, 2003). Personal communication with the director of the Association of Nature Center Administrators (ANCA) and other expert opinions reduced the sample from 330 to 5 of the top programs in the field. The criteria for this reduction included programs that served the largest number of students and that are supportive of education research. These programs included Nature Bridge Yosemite Institute (NBYI), Teton Science School (TSS), The New Jersey School of Conservation (NJSC), The Pocono Environmental Education Center (PEEC), and The Great Smokey Mountains Institute at Tremont (GSMIT). A review of the research conducted at residential environmental learning centers identified two of these programs (NJSC and GSMIT) as having an active research agenda. After contacting both organizations, GSMIT was identified as the program for this project, not only because of their interest in the research topic, but also their willingness to accommodate the extensive amount of onsite observations required for this project.

Established in 1969, GSMIT is considered to be not only a leader in residential environmental learning centers, but also it is also one of the longest running programs in the United States. GSMIT has an active research agenda designed to improve instruction and evaluate impact on student learning. This project will help GSMIT better understand the

relationship between the GSMIT experience and the schools that attend their programs. Data collected from GSMIT include: Lesson plans, interviews with 3 members of the educational leadership, interviews with 6 teacher naturalists, and an interview with the director.

Participant Schools

Annually, 62 schools attend programs at GSMIT with participating students in grades 6th through 8th. The "school season" runs from September through November and again from February through May. Of these schools, 39 are public and 23 are private. The length of stay ranges from 3 to 5 nights and the average stay is 3.53 days. Furthermore, 86% of these schools participate in cooperative teaching, which requires classroom teachers to teach during a portion of experience. From this population, a purposeful criterion sample of six schools were identified which: 1) participate in cooperative teaching; 2) four schools that stay for three nights and two schools that stay five nights; 3) three public schools and three private schools; and 4) schools that attend during the months of February and March. Only one school failed to respond to invitations to participate, so an alternative school was selected that would maintain the same sample profile as the population of schools that attend GSMIT annually. It is important to note the purpose of the investigation reported here is not generalization to the larger population. These schools were selected to provide an information rich sample to inform the topic of the investigation. Data collected from schools included; 7 interviews with lead teachers, which coordinate travel and participate in instruction during the experience, and 6 interviews with school administrators for each school.

Grouped Pair "The Cases"

This study involved analysis of data collected on two sides of a dynamic relationship. The contributions from both the school and GSMIT have been interpreted together as a grouped pair. This unit of analysis was essential because none of schools had the same experience at GSMIT. GSMIT is able to tailor their program to meet the individual needs of each school, its students and teachers. So, my impressions of field observations are specific to each case study. These data inform the grounded theory analysis of the cooperative teaching model, and thus represents the unique interactions between each teacher and each naturalist instructor that occur during each collaborative lesson. Data include: observations of 34 teachers/chaperones; observations of 10 naturalist instructors; field observations of 42 lessons totaling over 300 hours.

Data Collection

After receiving dissertation committee and IRB approvals, I contacted officials at GSMIT to establish a research relationship. In a communication with their education director, I received instructions for obtaining a required research permit from the National Parks Service. Once all documentation was in order I worked with GSMIT to identify schools using the established selection criteria provided in the previous section. I contacted the lead teacher form each school and solicited their participation in this study. After receiving consent from teachers and school administrators, I scheduled pre-experience interviews with lead teachers. These interviews were conducted in person, on location at the schools. They were scripted to follow the instrumentation outline (Table 3.1) for alignment to the research questions. This process allowed for an audit trail to be established for trustworthiness of the information. The teacher interviews were conducted at the schools for two reasons. The first was to meet the teachers and other participants at their school where they are most comfortable. This allowed them to meet me before they arrived at

GSMIT thereby reducing any observation anxiety and allowing me to get a more realistic impression of the experience. The second reason was to complete the background portion of the data collection before field observations began at GSMIT. By completing the interviews related to the residential experience I was able to shadow each group pair through the entire experience without having to cause any additional distraction for the teachers or naturalist-instructors. Taking these two issues into consideration allowed for effective well-informed observations of the teachers during the experience.

During the field observations at GSMIT, I followed an established criterion for prioritizing the different daily activities. Using this criterion, I assigned a higher priority to the lessons that provided better observational data with respect to the research questions. When there were schedule overlaps, this ensured that I was able to attend the most meaningful aspect of each program. The highest priority and least frequent lessons observed were taught by teachers providing all instruction without assistance from the naturalist instructors. The second priority and most common lessons observed were taught by classroom teachers and naturalist instructors engaged in cooperatively teaching. The third priority was GSMIT staff providing instruction on their own, and finally, the fourth priority was hired entertainment such as storytellers or musical guests. The focus of these observations was directed at teacher participation, teacher interaction with the students and the collaboration between the teacher and the naturalist instructor. I also observed the instructional methods of the GSMIT staff. These observations were included as field notes and have been reviewed to identify areas of tension and anxiety within the cooperative teaching model.

Interviews with GSMIT staff members took place during their down time while I was on site at the GSMIT campus. These interviews were scripted and follow the instrumentation outline

(Table 3.1) for alignment to the research questions. This process established an audit trail for data collection ensuring trustworthiness and repeatability of data collection from different sources. Data collected from GSMIT staff interviews revealed; 1) staff perceptions of the ideal relationship between schools and GSMIT, 2) their perceived objective and motivations for the experience, 3) their perceptions of the cooperative teaching model and 4) any pre-experience or post-experience activities.

Immediately after the residential program students were asked to complete an open-ended questionnaire (Appendix F), which is a variation of the minute-paper and muddiest-point assessment technique used by Smith-Sebasto and Obenchain (2009). Students responded in writing to the following questions: (a) What was the most meaningful thing you learned? (b) What was the most confusing aspect of your experience? and (c) What was the experience you would like to repeat or topic about which you would like to learn more? Smith-Sebasto and Obenchain (2009) explain that because this technique only requires students to respond using one or two sentences, it is effective with all students, including those who struggle with writing or are reluctant to speak. They also reinforce that it is important for the individual administering the questionnaire to demonstrate respect for the students' thoughts and opinions. These data were then transcribed, coded and analyzed. Parental consent was included with camp participation and medical forms.

I have conducted a review of GSMIT's curricular materials used to deliver instruction. This included analysis to identify specific content areas, instructional methods, and inclusion of leaning cycles. These materials are provided to teachers prior to their visit to GSMIT. Curricular materials consisted of 24 lessons designed for use not only at the GSMIT facility, but also as a teacher resource for outdoor instruction at their schools. Lesson plans were evaluated for the

level of inquiry, organization and EE content. Each lesson was assigned a value of 0 through 3 based classification system developed by McComas (1994). The lowest levels of inquiry (value=0) are confirmation experiences in which students verify known scientific principles by following a given procedure. A slightly higher level of inquiry (value=1) is referred to as structured inquiry in which the teacher provides a question, a procedure to follow and the students complete the inquiry to find the answer. In guided inquiry (value= 2), teachers provide students with a problem to investigate but the students develop the methods and then solve the problem. In open inquiry (value=3) the teachers allow students to develop their own questions and design their own investigations (Windschitl, 2003). In addition to reviewing lessons and instruction for levels of inquiry I have also included a discussion about the organization of lessons and implementation of learning cycles.

Instruments and Measures

The instrumentation in this study consists of four structured interview protocols (Appendices B through E), field observations and open-ended student questionnaire (Appendix F). The instrumentation outline (Table 3.1) aligns each research question to the corresponding instrument. This audit trail added to the trustworthiness and internal validity of the study by allowing for the triangulation of information between different sources which ultimately provided the understanding of the relationship between the formal and the GSMIT. The dependent variables in the study are focused on 1) the cooperative teaching model, and 2) the connection between the formal classroom and the GSMIT with respect to EE curriculum.

The Interview Protocols

Structured interview protocols were used during interviews with all stakeholders. Separate protocols were developed for each group including: school administrators, classroom teachers, education leadership team and naturalist instructors.

School administrators provided information about the school's history with GSMIT and also about their perceptions of students' experiences at the residential environmental learning center. Interviews with school administrators followed the interview protocol in Appendix B. Classroom teachers at each school were interviewed to elicit information about the history of their participation with the residential program as well as their perceptions of students' experiences at the GSMIT. These interviews also focus on the content integration between the formal and informal aspects. Interviews with classroom teachers followed the interview guide in Appendix C.

The educational leadership team includes the executive director, the education director and the school programs coordinator. They provided information about their role at GSMIT. Questions asked about the history of the center, a description of the mission, goals and objectives of GSMIT, and an explanation for how their educational practices strive to meet those goals. Within the constructs of educational practices, the educational leadership team was asked about how they develop and train program staff, how decisions are made with reference to curriculum and activities, and what assessment techniques they have implemented to gauge GSMIT effectiveness. Interviews with the Education leadership team followed the interview protocol in Appendix D.

Interviews with naturalist instructors focused on their interaction with students. This included a background of any educational training, professional development resources available

to them, their perceptions of what students are learning, and opinions of student's EE knowledge upon arrival. Interviews with naturalist instructors followed the interview protocol in Appendix E.

Data Analysis

The research questions in this study target specific areas of interest which play key roles in the effective instruction of EE and the connection to the formal classroom. These questions have been designed so that the answers will slightly overlap among participant groups, thus providing a robust understanding of the relationship between each of the group pairs. Responses were coded and analyzed by a reductionist approach to reveal overarching themes of each case. In this section each research question is broken down into its components connected to the dependent variables of this investigation.

In this research I used a case study guide (Appendix A) for each of the schools to ensure that I acquire the required information needed to answer the research questions. The instrumentation outline (Table 3.1) aligns each research question to the corresponding answer. This audit trail adds to the trustworthiness and internal validity of the study. The use of multiple structured interview protocols allowed for the triangulation of information between different sources which provided the understanding of the relationship between formal and informal environmental education.

Table 3.1
Instrumentation Outline for Data Collection

Research Question	Secondary Questions	Data source for answer
What are the outlined objectives of the residential environmental learning center?		Interview Educational Leadership Team Interview Naturalist Instructor GSMIT Published Resources
What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center?	What are the perceptions held by the educational directors and instructional staff at the educational learning center?	Interview Educational Leadership Team Interview Naturalist Instructor
	How do these views compare to the perceptions held by teachers, students, school administrators?	Interview School Admin Interview Lead Teacher Student Questionnaire
What methods of instruction are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?		Interview School Admin Interview Lead Teacher Interview Educational Leadership Team Interview Naturalist Instructor Student Questionnaire
How do schools incorporate a residential environmental learning center experience into their school curriculum?		Interview School Admin Interview Lead Teacher Interview Educational Leadership Team Interview Naturalist Instructor Student Questionnaire

Research question one: What are the outlined objectives of the residential learning center and how are these objectives met? This question was answered by reviewing the organizational documents including an internal assessment and the GSMIT website. I have identified themes that run throughout their curricular resources and also benchmarks for which they measure impact on student learning.

Research question two: What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? This question

has two sub components: a) what are the perceptions held by the educational directors and instructional staff at the educational learning center? and b) how do these views compare to the perceptions held by teachers, students, school administrators? The information used to answer these questions has been taken from interviews with both teachers and staff and the students' most meaningful responses on the questionnaire.

Research question three: What methods of instruction are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula? To answer this question I had to divide it up into three sections: 1) analysis of the cooperative teaching model, 2) elements of the experience that go beyond regular instruction, and 3) alignment to the school curriculum.

The analysis of the cooperative teaching model includes a detailed history of its development, an explanation of the goals and the connection to the objectives at GSMIT. Furthermore, I developed a grounded theory for cooperative teaching model which is based on observed core phenomena, a continual analysis of interviews and alignment to foundation principles. The use of this methodology has been proven to be an effective tool for understanding the complex interdisciplinary nature of EE (Smith-Sebasto & Walker, 2005). Developing a grounded theory requires the researcher to constantly evaluate information throughout the data collection process. This process should be fluid allowing for flexibility for clarification in a discussion; it should not be forced upon a rigid structure or format (Strauss & Corbin, 1998). In this investigation I followed the methodology established in advance that included: 1) Open coding to forming an impression of the main idea, 2) a literature review after identification of an emerging theory appears, 3) data where grouped and defined using primary labels, 4) axial coding was used to establish relationships between groups, defining characteristics for each

category, and 5) Selective coding to provide a cohesive view which outlines core categories and the accompanying theory.

When discussing the elements of the experience that go beyond regular instruction, I draw from teacher and staff interviews as well as onsite observation of student participation. Understanding the alignment to the school curriculum is rooted in the review of GSMIT lesson plans and an analysis of lesson schedules and the correlation to student perceptions of the most confusing aspects of the experience and their desire to repeat certain activities.

Research question four: How do schools incorporate a residential environmental learning center experience into their school curriculum? This question investigates the relationship between how schools prepare their students for the experience and the students' perceptions of the most meaningful aspect of the experience. I coded student responses to the most meaningful question on the questionnaire into the categories of expected outcomes as identified by both GSMIT staff and classroom teachers. Using data collected from Teacher interviews I established four categories for the types of preparation present in the sample cases, 1) Content, 2) Duties, 3) Experience, and 4) None. A chi-square was used to analyze pre-experience preparation and its influence on student's perception of the experience

Summary

Chapter 3 describes the multiple case approach used to investigate the relationship between six schools and the model residential EE programs they attended. This includes a detailed description of the participants, instruments, data collection and data analysis. Chapter 4 presents the results of the study.

CHAPTER FOUR: RESULTS

This chapter presents findings of a multiple case study of six middle level schools and their participation at a model residential environmental learning center, Great Smoky Mountains Institute at Tremont (GSMIT). These results were revealed through qualitative analysis of data collected from interviews, field observations and questionnaires. These data have provided an opportunity to not only better understand how schools integrate an informal EE experience into their curricula, but also an insight into a unique element of the informal program, cooperative teaching.

Data Findings, Analysis and Discussion

Question One

What are the outlined objectives of the residential environmental learning center?

GSMIT identifies their main objective as connecting people to nature. There are three strands at the heart of this mission: 1) sense of place, 2) diversity, and 3) stewardship. These concepts are woven through all aspects of the GSMIT experience and the curriculum. Sense of place involves participants' realization that they are part of a bigger system. A students sense of place extends beyond a simple geographical location; it includes much deeper concepts such as how one's actions influence ecosystems or how choices and behavior influence culture and community. Sense of place consists of some very broad and loosely connected constructs, but it represents a major component of the GSMIT experience. Therefore, the nature of this concept has presented some difficulties with respect to both providing a clear definition and directly measuring the impact of the experience on this objective. This issue is addressed in the next paragraph with the topic of measurable impact on student learning. The strands representing diversity and

stewardship are much more easily defined. Participants gain an understanding of diversity when they are able to perceive the infinite complexity of natural systems and how all components are interconnected and dependent upon one another. Biodiversity plays a large role in understanding this concept because life itself impacts how ecosystems work and each organism, no matter how small, has a purpose. The concept of stewardship involves mankind's responsibility to not only protect these natural systems, but also to learn about them and gain understanding of the interactions between systems.

In an internal assessment of GSMIT's impact on student learning, the educational leadership at GSMIT developed more concrete constructs that closely represented the original objectives. These constructs could be measured with a greater level of accuracy. Table 4.1 presents the abbreviations that will be used in the discussion of results, the measurable construct, and a description of the published objectives for student learning (Stern, 2008). The GSMIT internal assessment project produced meaningful results that represented the substance of their impact on student learning, not a touchy feely affective measure (Stern, 2008). They identified four independent categories that represented the original three strands: 1) Connection with nature (Nature). The connection-with-nature construct, was based on four premises: (a) Students feel comfortable in the outdoors; (b) students feel that they are a part of nature, rather than separate from it; (c) students actively engage in observing their surroundings when in natural settings; and (d) students show interest in outdoor activities. 2) Environmental stewardship (Stewardship). The stewardship index measured participants' attitudes toward environmental conservation and their intentions and actions regarding environmental behaviors. 3) Interest in learning and discovery (Discovery). The discovery index gauged students' degree of interest in learning about natural history and cultural heritage and their degree of interest in directly exploring these topics in

various settings. 4) Knowledge and awareness of GSMNP and biological diversity (Awareness). The awareness index measured knowledge of exotic species, biological diversity, and the national park.

Table 4.1
GSMIT Measurable Constructs of Impact on Student Learning

Abbreviation	Construct	published objectives for student learning at GSMIT (Stern, 2008)
Nature	Connection with nature	(a) Students feel comfortable in the outdoors; (b) students feel that they are a part of nature, rather than separate from it; (c) students actively engage in observing their surroundings when in natural settings; and (d) students show interest in outdoor activities.
Stewardship	Environmental stewardship	The stewardship index measured participants' attitudes toward environmental conservation and their intentions and actions regarding environmental behaviors.
Discovery	Interest in learning and discovery	The discovery index gauged students' degree of interest in learning about natural history and cultural heritage and their degree of interest in directly exploring these topics in various settings.
Awareness	Knowledge and awareness of the Great Smoky Mountains National Park and biological diversity	The awareness index measured knowledge of exotic species, biological diversity, and the national park.

These four constructs, when utilized together, provide an accurate measure of how the GSMIT experience impacts student learning. This investigation used these categories to inform the analysis of research question two and research question four.

Question Two

What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? What are the perceptions held by the educational directors and instructional staff at the educational learning center?

Interview data collected from the naturalist instructors (N=6) and education leadership team

members (N=3) all concur with the published objectives listed in the response to research question one. These objectives include: 1) Connection with Nature; 2) Stewardship; 3) Discovery; and 4) Awareness. Findings from these interviews revealed an objective category that was not included in the assessed constructs. This additional objective represented the desire for participants to acquire life skills form the experience. This objective is not represented in the curriculum in any way, but it is more or less a product of the students' experiences and is derived from taking responsibility for personal actions. For many of these students, it is their first time away from home or away from their parents. This is a powerful experience for some, allowing them to recognize their own independence and autonomy by requiring them to take care of themselves and be directly responsible for their own choices.

Table 4.2
GSMIT Staff Perceptions of the Delivered Objectives

Stated GSMIT Objective	Number of Staff	Percent	Representative Quote
Nature	9	100	"Tremont's mission is connecting people and nature . . . For some it can be a huge challenge for being outside that long. But being unplugged they are in a completely different social context, because there no texting, there is no access to the internet, there no distractions using electronics, everything they do here, they do outside and they are getting dirty, and they are getting exhausted, and they worn-out from running around and not from sitting in a classroom all day"
Stewardship	9	100	"[help students] develop a sense of place and to empower stewardship in the future."
Discovery	9	100	". . . hopefully we are not just reinforcing some of the vocabulary [students learn] in the science classrooms. We are allowing them to experience doing real science. Doing the things they are learning about in books. Seeing how it is relevant. Seeing how scientists work, or what naturalists do. I think one of the biggest things that we do is be a good example for the kids, and to let them see that learning is lifelong."
Awareness	9	100	"To get them [students] to develop a sense of biodiversity. So that means, even when we are talking about salamanders we are going to talk about their relationship with everything else. We talk about Geology, we are going to talk about living things that impact geology, we are going to talk about our relationship with Geology"
Life Skills	9	100	"Students learn self-reliance and in some cases overcome a sense of entitlement"

Data collected from teacher interviews confirms the importance of students gaining life skills. Table 4.3 presents teacher perceptions of the take home message. These data include the number of teachers who identified each category, the percentage of responses and quotes for all four of the GSMIT objectives and the additional life skills category. All teachers responded that

they wanted their students to develop a connection with Nature (N=6). A third of the teachers responded that they wanted their students to develop a sense of Stewardship (N=2). Half of the teachers responded that they wanted their students to develop a curiosity for the natural world and a sense of Discovery at a frequency of (N=3). No teachers specifically mentioned that they wanted their students to develop an increased awareness of the national park, but we cannot assume that they perceive this to be an undesirable objective. All teachers responded that they wanted their students to develop life skills during the experience (N=6). The quotes provided in this table provide an example of the types of responses that were coded into each category.

Table 4.3
Teachers Perceptions of the Delivered Objectives

Stated GSMIT Objective	Number of teachers	Percent	Representative Quote
Nature	6	100	"I want them to develop a greater appreciation for nature and to know that it's not a scary place."
Stewardship	2	33	"[the students]... to develop habits of stewardship that will go beyond Tremont to home and the community."
Discovery	3	50	"I want them to know it is ok and it is fun to be out there to touch things and to get dirty. That's part of science, and that's what makes it cool, all of those things."
Awareness	0	0	N/A
Life Skills	6	100	"Life skills, we are building the responsibility, mom and dad are not there to take care of them so it is building that independence."

During the experience, one teacher pointed out how the experience helps build life skills: "Nature has a way of sorting things out. In the classroom students can scrounge up a pencil or paper, but if the only thing you brought [to GSMIT] was a hoodie you're going to be cold." Two-hundred and fifteen students completed the student questionnaire, and these data confirm the

importance of developing these life skills. Table 4.4 presents student perceptions of the most meaningful aspect of the experience. These data include the number of students that responded in each category, the percentage of responses and a representative quote for all four of the GSMIT objectives, and life skills, as well as an additional "other" category for student responses that did not align with the established objectives.

Table 4.4

Student Questionnaires: Students Perceptions of the Delivered Outcome

Tremont Category	Number of students	Percent	Representative Quotes
Nature	41	19.1	"The most meaningful thing that I learned is that you should take time to stop, look around, and enjoy nature."
Stewardship	30	14.0	"To be careful with nature and that everything around you is to help us live."
Discovery	69	32.1	"When you look at things with a child's glance you learn more, and you have a better time."
Awareness	27	12.6	"I learned that the Smokies have the most diverse population of salamanders"
Life Skills	26	12.1	"I learned that if you work together, you can do anything"
Other	22	10.2	"It is the memories with my BFF's [friends]"
TOTAL	215	100	

Students perceptions revealed that 19% (n = 41) of students found the most meaningful aspect of the experience was having the opportunity to develop a connection with Nature. Fourteen percent (N=30) of students identified developing a sense of Stewardship as the most meaningful aspect of the experience. Thirty-two percent (N=69) of students responded that the most meaningful aspect of the experience was having the opportunity to develop a curiosity for the natural world and a sense of discovery. Over twelve percent (12.6%; N=27) indicated that developing an increased awareness of environmental issues in the national park was the most meaningful aspect of the experience. Twelve percent (N=26) of students responded that the most

meaningful aspect of the experience was having the opportunity to develop life skills during the experience. Ten percent (N= 22) of students responses did not align with the established objectives. The student responses in the "other" category did not have an underlying theme that would support the development of an additional category. The quotes provided in table 4.3, give an example of the types of responses that were coded into each category.

Data collected from school administrators (N=6) revealed that they have had little influence on the participation in the GSMIT experience. All administrators identified their lead teacher as the individual who is most responsible for the success of the GSMIT experience. They all described students returning from the experience with a new appreciation for learning. They see GSMIT as an experience that enriches classroom learning by providing students an opportunity to see firsthand aspects of nature they have learned about in their textbooks. Two of the administrators spoke of the experience as part of the school culture, meaning that it was an expected part of the school experience that students looked forward to. The school administrator from Case 1, spoke specifically of the success of the after school program and it has positively influenced students standardized test scores. The school administrator from Case 3 spoke specifically about not only connecting students with nature, but also taking charge of their own learning. These data provide support for some of the positive impacts the GSMIT experience can have on student learning, but there was no evidence for active involvement of administrators in the experience. GSMIT has identified their client as the school and that the ideal relationship with the formal classroom starts with a strong connection to the school and the community. If the administrator were more involved this could strengthen the connection between GSMIT and the schools. This topic is addressed in the discussion.

Results from teacher interviews (Table 4.3) support the inclusion of Life Skills category into the GSMIT objectives. Data from the most meaningful question on the student questionnaire (Table 4.4) indicate that this is an important aspect as well. These data suggest that the delivered curriculum and student perceptions align with the GSMIT objectives. Data also reveal that a third of students identified discovery and learning as the most meaningful aspect, when the teachers expect the appreciation for nature to be the most important category. Administrators did not speak directly to these objectives but they did identify several positive influences the experience has on student learning.

Question Three

What methods of instruction are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula? To answer this research question required discussion of three main components: 1) the cooperative teaching model; 2) aspects of the experience that extends beyond regular instruction; and 3) content alignment to the school curriculum. In this section, I have explained how these factors influence the learning objectives.

The cooperative model is something unique to GSMIT. It has been included as a major part of the vision for GSMIT for the past 27 years. At the inception of GSMIT, there were essentially two instructional models used by environmental educators to deliver outdoor EE: 1) those that provided resources to teachers and allowed them to teach the material, and 2) those that provided the resources to teachers, but used their own staff to deliver the instruction. From the beginning, the GSMIT staff has recognized the importance of including teachers in the instruction through the cooperative model. They see this model as a central component for achieving the objective of connecting people to nature.

The underlying philosophy of simply providing teachers the support they need to successfully teach in an outdoor setting, acts as positive reinforcement and, thus, teachers will apply what they have learned not only at GSMIT but at their school when they return. This in turn broadens the scope of GSMIT because those teachers will be providing students an opportunity to connect with nature even if the students could not attend. There is also a financial incentive for schools to participate in cooperative teaching. Because GSMIT can assign fewer staff members to the group, the school receives a reduced rate. However, in order to receive the reduced rate teachers must attend a professional development workshop. These weekend retreats offer an opportunity for teachers to meet one another, exchange ideas and get to know GSMIT staff members. For GSMIT, it is an opportunity to showcase new lessons or provide professional development. The professional development up until this point has failed to meet the expectations of the staff, and they acknowledge that they need to do more in this area. Teacher perceptions of the escape weekends range from the most enlightening experience of their career to a waste of time they tolerate in order to get the discount for their students. Suggestions for improving the professional development at the teacher escape weekends have been addressed in the next chapter.

The use of grounded theory methodology to understand GSMIT's cooperative teaching model resulted in the identification of eight causal conditions that act as barriers to successful implementation of this teaching strategy. These data are presented on Table 4.5 along with the coping strategies for the participants and the observed influences on instruction. Organization of Table 4.5 follows a grounded theory model presented by Strauss and Corbin (1990). The intervening conditions for difficulties in the cooperative teaching model originate from both the classroom teacher and the teacher naturalist. Four of the eight causal conditions are specific to

the classroom teachers: 1) Lack of experience teaching in the outdoors; 2) lack of understanding of their expected responsibilities; 3) lack of content knowledge; and 4) the teacher level of interest. The remaining four causal conditions are recognized as contributions of the naturalist instructors**,** 5) desire to meet GSMIT curricular objectives, 6) reluctance to overstep teachers' classroom management strategy, 7) desire for all students to have a uniform experience and 8) observations of chaperones and teachers modeling less than ideal behavior. In response to these causal conditions participants take action or respond in particular ways and these responses would have an observed influence on instruction.

Table 4.5
Participant's Ways of Thinking About the Cooperative Teaching Model

Contextual & Intervening Conditions: *Broad and specific situational factors that influence the strategies*	Causal Conditions**:** *Factors that caused the core phenomenon*	Strategies**:** *Actions taken in response to the core phenomenon*	Consequences**:** *Outcomes from using the strategies*
Teacher Perception Cooperative Teaching Model	Experience teaching outdoors	Anxiety	Teachers dumb down questions asked by Naturalist instructors
		Inflated sense of perceived difficulty	Provide hints
			Answer for students (protect them)
	Understanding of expected Responsibilities	Ad Hoc Teaching	Micro-manage students
			Disconnect from lesson and take students with them
	Lack of Content Knowledge	Perceived sense that they need to be the expert	Children lose confidence in instruction
		Use of vague language	Unclear instruction, fast-paced, requires students to keep up.
	Level of Interest	Appear unengaged, inattentive or distracted	Students lose interest
		Lack of enthusiasm	Model inappropriate behavior
Naturalist Instructor Perception Cooperative Teaching Model	Desire to meet GSMIT curricular objectives	Take sole responsibility for instruction	Teacher fails to have success teaching outdoors
			Large group size
	Reluctance to overstep teachers classroom management strategy	Are tolerant of inappropriate behavior	Unable to provide experiences that require a certain degree of safety
	Desire for all students to have a uniform experience	Limit options for instruction for teachers	Reduces creativity component for teachers
			Discourages teachers from developing skills
		Spend excessive energy explaining role for teacher at last minute	Affirms teachers' anxieties toward teaching lesson
			Limits teachers time with materials
	Observed behavior of chaperones and teachers	Shut down to the idea of teacher participation	Teachers become disengaged and withdrawn

The classroom teacher's lack of experience teaching in the out of doors caused them to experience anxiety and develop an inflated sense of perceived difficulty for their students. The observed influence on instruction that resulted for these actions included teachers simplifying or watering down questions asked by the teacher naturalists, providing hints, or even answering for students. This phenomenon was regularly observed in 4 of the 6 cases. These responses are possibly an attempt to protect themselves from the embarrassment caused by the possibility that the students couldn't answer the question. This unwarranted assistance became a barrier to learning because students were not allowed an opportunity to think about the information being presented. They just simply waited until the teacher made it easier for them instead of struggling with the new information. This phenomenon was observed in most cases, but in Case 3 one teacher explained that she was in what she called "accommodation mode." She explained, "I can't help but to give them hints to find answers. I know I need to let them work it out for themselves, but it's hard not to help." [In the classroom, do you accommodate this easily?] "No I don't, because I know what they are capable of. The children are being challenged in different and new ways, and I respond to their difficulties. I am learning to resist that temptation to swoop in and help." This teacher recognized that this action was negatively impacting student learning, but she failed to see that she falsely perceived that the students were anxious or uncomfortable when, in fact, the students were fine. They were being challenged in new and different ways, but these new ways of learning were not causing problems; it was the teacher's own anxiety that caused her to falsely perceive these difficulties.

The classroom teachers' lack of understanding of their expected responsibilities caused them to resort to ad hoc teaching strategies. The observed influences on instruction caused by this action included classroom teachers micro-managing of students' behavior, disconnecting

from lesson and distracting students with unrelated information. These actions became a barrier to student learning because the teachers would stray off topic and away from the intended objective of the lesson.

Micro-managing student behavior resulted in classroom teachers failing to recognize larger safety concerns because they were focused on issues which were less significant, but possibly more obvious. An example of this phenomenon comes from a teacher in Case 2 who claimed, **"**You just can't take kids outside, you will lose control . . . there are sticks and stuff out there, they could get hurt…the classroom is safe." This teacher was constantly nagging students to "put that down, don't touch each other." But she failed to recognize that the students were not following trail rules by walking single file. These rules are in place to ensure the safety of the students and allow them to get the most out of the experience. By micro-managing student behavior many of the teachers over looked other important safety issues.

When a school group arrives at GSMIT, one of the first things that happen is that the students go with the staff to learn about the facilities and the logistics of the daily activities. At this time the teachers and chaperones attend a meeting of their own to discuss any special needs or considerations for their students. During this meeting each teacher is given the curricular resources for the lesson they will be expected to teach. These resources were also included as part of the pre-trip information packet sent to the school when they confirmed their schedule of activities. Although classroom teachers had ample time to prepare for their lesson, many did no such thing. Often, I observed teachers thumbing through the information moments before they were expected to teach this lesson. The staff would typically approach the classroom teachers before every cooperative lesson and explain the teachers' role and answer any question they may have. Out of all cases and every lesson observed, no teacher asked any questions related to their

expected role. Many of the classroom teachers indicated they had taught the same lesson for the past several years and they relied on that experience to remember the materials. This resulted in teachers leaving out significant portions of the lesson and glossing over key concepts.

The classroom teachers' lack of both content and pedagogical knowledge for teaching in informal settings causes them to develop a perceived sense that they need to be the expert. Classroom teachers try to hide the fact that they are not content experts. This phenomenon was regularly observed in 4 of the 6 cases. They use vague language, which results in unclear instruction. This is masked by proceeding through the lesson at a fast pace, requiring the students to struggle keep up and actually reducing the number of questions the students can ask. The students are quick to see through this facade, and once they do everything the classroom teacher says is questioned. The students typically ask the teacher naturalist if they have a specific question, but at times during cooperative instruction the teacher naturalist are not around. This means the student's question is not immediately addressed and often goes unanswered. When teachers approach their role as someone who is learning along with the students it would create a more stable learning environment in which the teacher and the student learn from the Naturalist when they return.

The classroom teachers' level of interest is possibly the most influential causal condition that impacts student learning. When classroom teachers appear to have a lack of enthusiasm, or are unengaged or inattentive the students become distracted and, in turn, use the same inappropriate behavior modeled by the teachers. This influence on student learning was most commonly observed during portions of the lesson that were taught by GSMIT education staff. This phenomenon was present in all cases and ranged in levels of severity. The most detrimental to the learning environment was teachers' bobbing their heads as they listen to iPods at the back

of the group which was observed on multiple occasions in one case. The least detrimental was quiet side conversations between adults about unrelated topics, which was observed in all cases. Both of these examples are a distraction to student learning, but observations of teachers actively engaged in learning elicited the opposite responses from the students by actually creating interest.

The naturalist instructor's desire to meet the GSMIT curricular objectives often results in them taking sole responsibility for instruction. This action prevents classroom teachers from having success teaching outdoors and thus creates a barrier to GSMIT's goal of connecting their message back to the school. When naturalist instructors take this action the group size increases significantly and large group size was identified as having a significant negative impact on student experience (Stern, 2008).

The naturalist instructor's reluctances to overstep teachers' classroom management strategies prevents them from addressing inappropriate behavior that they feel should be handled by the teacher or chaperones. This action caused naturalist instructors to avoid aspects of an activity that required an elevated level of safety and, therefore, the students did not receive the full instructional experience. GSMIT's executive director explained that at the core of this issue there are two things going on. First is the belief that the classroom teachers are experts in classroom management. The teachers know the individual students' personality and temperament which reinforces the naturalist's feeling that the teachers should handle any behavioral issues. The second is the age difference between the naturalist instructors and the classroom teachers. The executive director explained that, in his experience "the naturalist instructors are typically in their early twenties, fresh out of college and the teachers are typically more seasoned veterans of the classroom." This complicates the previous issue further due to a sense of respect and

inadvertently reinforces the false perception of the teacher as the expert. All of the naturalist instructors have had extensive training in outdoor education as well as wilderness first responders. With their focus on the safety of the group they understand that when a student gets injured away from campus they are responsible for not only stabilizing the injury but also keeping the rest of the group out of harm's way. The classroom teachers don't think of these issues, and reinforce the fact that they are not the expert and that the naturalist instructor needs to take the lead. The naturalist instructors do use discretion and they would never allow students to engage in risky or dangerous behavior, but the teachers may inadvertently allow a student to do so. To complicate the issue further, often classroom teachers "check out" when they arrive at GSMIT, handing over responsibility for the students and instruction to the staff. Teachers feel that the time and effort they put in making the trip possible was sufficient and now they get to enjoy their time away from school and their responsibilities as a teacher. Observations of schools participation during the experience revealed that this perception was held by half of the teachers and chaperones in the sample. These observations contradicted data collected from teacher interviews that related to handling discipline, managing students time, and the teachers role in the cooperative teaching model.

The naturalist instructor's desire for all students to have a uniform experience causes them to take over the majority of instruction which limits activity options for teachers. This reduces the creativity component for teachers, preventing them from taking ownership of the lesson and discourages teachers from developing outdoor teaching skills. Another course of action taken by teacher naturalists in response to this causal condition is that they spend excessive energy explaining the role of teachers at the last minute. This reaction is in response to seeing classroom teachers fumble through the lesson plan at the last minute, but it also affirms

the teachers' anxieties toward delivering the lesson. Observations of this phenomenon reveal that this last minute assistance results in confusion and possibly causes the teachers to doubt themselves further. The teacher naturalists do have the best intentions when offering assistance, as the teachers have had plenty of time to review their roles and ask questions prior to delivering instruction. During observations I witnessed this exchange happen early in the day after breakfast. This took place with Case 1: A naturalist instructor approached the classroom teacher and asked about an astronomy lesson he would be teaching that evening. In this situation the teacher accepted the help. The teacher asked the naturalist instructor if they had seen any modifications to the lesson that seemed to work well. Many times I observed the teachers turn down assistance because they did not want to appear unprepared, but in this case the teacher and the naturalist instructor traded some ideas and parted ways. That evening the classroom teacher had slightly changed the astronomy lesson to include his own ideas; by doing so his students actually got more out of the lesson. This was a positive example of how the classroom teacher and the teacher naturalist come together to make the cooperative teaching model work, but unfortunately this was an isolated incident.

The naturalist instructor's observations of chaperones and teachers modeling less than ideal behavior caused them to reject the idea of teacher participation. This action shut down communication between the classroom teachers and the naturalist instructors in the cooperative teaching model. Observations during the experience revealed that the level of teacher buy-in to the GSMIT objectives had a major influence on instruction. The naturalist instructors make it a point to model appropriate behavior showing respect for the environment, the national park, the community and its visitors. The naturalists identified this as a major source of frustration. Some teachers and chaperones failed to see the importance of this type of instruction and reinforced

less than ideal behavior. At that point it became an opportunity for the teacher naturalist to show the students that it is okay to act differently, having respect for nature and the environment. It is important to point out during my observations that I never saw a naturalist instructor call attention to one of these situations, but on more than one occasion students directly confronted their teacher, pointing out behaviors that were less than ideal. An example of this comes from Case 2 when a student informed the teacher that it was inappropriate to pick flowers. The student provided the teacher a clear, accurate rationale for why it was inappropriate and the teacher accepted this criticism gracefully. The importance of modeling appropriate behavior is discussed in detail in the next chapter. This is an essential component that needs to be addressed in order to successfully implement the cooperative teaching model.

Aspects of the experience that go beyond instruction: During the GSMIT experience students participate in many activities that are aligned with the objectives and themes, but are not explicitly taught. These lessons or activities are an implicit part of the experience and extend beyond regular instruction. Observations at the camp have revealed several of these implicit learning opportunities including: 1) zero food waste at meal times 2) custodial captains and 3) data connection at the weather station. As part of the experience these aspects play an influential role for the students receiving the delivered curriculum.

At the first meal time the GSMIT staff explains to the students how the logistics of meal time work. They explain where students will get the food, how they can get seconds, and how they will be expected to clean-up after themselves. Furthermore, they explain that food is energy and that we should conserve energy any way we can. They inform the students that food waste is excess food that you take but don't eat. They encourage students to make sure they like something first before they load up their plate with it, and even then they should only take what

they can eat comfortably. The staff then reminds the students that if they want more they can have seconds, thirds and fourths. The staff then explains that they will be collecting food waste at the end of each meal and that they will chart the amount accrued by the group over the duration of the visit.

Teacher interviews revealed that this aspect of the experience offers students an opportunity to see firsthand how wasteful they are in their daily lives, and also how much they take for granted that there is an abundance of inexpensive food. Students can also begin to understand how their choices add up and that collectively they can make a difference. One teacher in this study down played the significance of this experience by expressing concern for students who already experience social pressures related to eating disorders. This teacher sees the competitive aspect of achieving zero food waste as putting unnecessary guilt on students, forcing them to overeat even though they are full. This concern is addressed by the staff daily by reminding the students it is not a competition and that the reason for doing this is to raise awareness. The majority of the schools in this study challenge their students to make wise decisions, to be accountable and to improve. This perspective is in line with that of the GSMIT staff; they understand if there is some food waste, but want to see the amount of student food waste decrease throughout the duration of the experience. This would indicate that the students were thinking critically and making informed decisions.

During the experience students are expected to take responsibility for not only the cleanliness of the facility but also the day to day functioning of the facilities. This is accomplished through the implementation of custodial and table captains. Each student assumes these roles at least once during their experience at GSMIT. Custodial captains coordinate the cleanup of dormitories and table captains direct the family style meals and cleanup of the

cafeteria. All teachers in this study confirm that this is an important aspect of the experience that helps the students develop life skills and responsibility. One teacher pointed out that these expectations often conflict with the students' perception of entitlement, and by doing so allows them to see that they can be self-reliant.

Every morning at GSMIT students meet at 7:45 am to collect weather data. This experience is usually voluntary, but some schools require students to participate at least once during their time at GSMIT. This experience allows students an opportunity to not only collect data, but also read instruments, interpret results, and make predictions. The staff member that leads this activity makes sure to explain to the participating students that they are scientists and are collecting data for a longitudinal study. This allows the students to see themselves as scientists and encourages them to explore other science related experiences if they are interested. After students record their measurements and make a few calculations, they present their findings to the rest of the group and make a forecast. All of the students, teachers and staff then use this information to inform how they will dress and what supplies they will need to take with them to be prepared for the day. Having the students present this information reinforces how science is connected to their daily lives. Participating in the scientific data collection process allows students to create new knowledge and expand their thinking beyond the role of a consumer of scientific information. Although the latter is an important objective for the experience and it is accomplished with the majority of the students, my observations revealed that several of the students repeated the weather experience more than once. This subset of the students really connected to this aspect of experience and it was clear that they enjoyed contributing to the process.

Teachers have identified that the aspects of the program that go beyond regular classroom instruction are essential to the success of the experience. A teacher from case 6 stated, "The things kids learn at Tremont can't be taught. They have to be experienced." This teacher explained that the implicit aspects of the outdoor learning environment are often overlooked in the formal classroom. "In today's classroom we don't allow students time to learn from experience." Teachers believe that the increased testing in schools has forced them to use more explicit instruction, just teaching what will be tested. When teachers were asked about issues related to attending GSMIT, all of them expressed frustration with state or standardized testing. They felt that the pressure to cover all of the standards and benchmarks takes up too much class time to allow for deep experiential learning. A teacher explained how this impacted the way children learn,

> Experiencing something it is different than looking on page 4 [of a textbook], learning this word or this fact. Students today are experts of finding answers in the book. I could give my students a college Spanish book, and they could find the answers…. That it doesn't mean they know anything about it. Out there [at Tremont] what is the answer? What are you really looking for? The world, the content, is a lot bigger, and students find their own questions (Case 1).

The experiential component of GSMIT is an important aspect for all of the teachers and, more specifically, they want their students to experience natural wild places.

All of the teachers recognized that the pristine environment of the national park was an essential part of the experience, but unfortunately few teachers thought that they could achieve a similar effect in natural spaces near the school. This view is not supported by GSMIT staff. They want students to actively engage nature and make new discoveries when they return home. They don't want students to experience nature only at GSMIT; they want them to find it at home. A member of the instructional staff described how the GSMIT experience could be a powerful part to establishing lifelong learning:

> "Ideally the Tremont experience should complement the formal classroom, because in formal classroom the student is given the structure to fill their curiosity in an efficient way. They can establish background knowledge. When they come to Tremont that structure is still intact, but there is also the opportunity to be a little bit looser with it. To allow them to really go in whatever direction they want with questions, and with the curiosity…. It gives them the opportunity to see that education is valuable and it can also be fun, and it can be relevant to their personal life both here and at home."

This staff member continued by explaining how all children have a natural curiosity, like a small ember, and schools should support and encourage that ember to grow into a flame. The GSMIT experience in this metaphor would be a fuel that when added would ignite a much larger desire for learning, and like fire this excitement for learning is also catching. In this explanation the staff member expresses how the GSMIT experience is intended for students to take what they have learned back to their school and community. Although most of the schools supported this idea of connecting what the students learn back to their school and home, only one school acknowledged that students bring back an excitement for learning. In fact, one school intentionally schedules the trip to GSMIT the week before spring break to reduce this level of excitement. Their rationale was to reduce levels of jealousy and resentment for students who could not attend.

Content Alignment to School Curriculum: An important part of understanding the relationship between the formal classroom and the GSMIT experience requires knowing how the activities, content and timing of the experience align with the school curriculum. In this section I present data from teacher interviews, student questionnaires, onsite observations and an analysis of curricular resources. From these data I make connections that illustrate how these aspects of the experience may influence student perceptions of the GSMIT experience. I first provide information related to the timing of the experience within the school year. Second, I present

findings from a review of GSMIT curricular resources and, finally, I describe how student to student perceptions of the experience are influenced by the activities in which they participate.

The schools in this investigation all attended GSMIT during late winter or early spring. Most of the schools in this sample specifically attend at this time because it allows them sufficient class time to cover science content that will be presented to the students at GSMIT. By doing so, all of the teachers feel that they are providing their students with essential background knowledge they will need in order to get the most out of the experience. At the same time, only half of the cases prepared students with content that went beyond that of the state standards for their grade. In other words, half of the cases did not modify curriculum or instruction in any way in preparation for GSMIT. One school had a difficult time arranging chaperones during the fall semester so they had no choice; they had to attend in the spring. The rest of the schools used the experience to reinforce the content delivered in the classroom. All of the teachers described the experience as a form of enrichment. They explained that when students can see content in real life (e.g. actually touch rocks) they can make connections to the bigger picture and gain a sense of understanding for their place in the world. Without that experience science is reduced to facts found in the pages of their textbook.

Curricular resources provided by GSMIT all follow the same format. An example lesson has been provided in Appendix M. Each lesson outlines the essential questions and desired learning objectives. Then, within each lesson there are several activities that can be used to teach aspects of the lesson. Observations of instruction revealed all of the lessons were taught using various levels of inquiry. The staff instructors were able to modify the level of inquiry to accommodate the needs of the students. More specifically, they could teach the same lesson using a more structured or guided inquiry methodology for younger or less experienced students,

and a more open style of inquiry with other groups. None of the lessons observed during the school programs were truly open inquiry. There was no evidence for the consideration of learning cycles in the development of these lessons, but this was taken into account by some of the instructional staff. Professional development on this topic could be beneficial for staff members and enrich the value of the lessons.

Student perceptions of the experience are influenced by the activities in which they participate. This section presents results from an analysis of GSMIT schedules of instructional activities, student perceptions of the most confusing aspects of the program, and the activities they would like spend more time doing. The list of GSMIT activities that the sample schools participated in were coded into content areas that reflected the major theme or topic of the lesson. This coding scheme revealed nine initial categories: 1) Astronomy; 2) Wilderness Navigation; 3) Ecology/Ecosystems; 4) Friends/Social; 5) Geology; 6) History; 7) Physical Exercise; 8) Teamwork; and 9) Wildlife. Student questionnaire responses for both the most confusing aspect of the experience and topics they would like to know more about fall into these categories. Two additional categories developed from the coding process: 10) Other and 11) Nothing. Also, there were three categories that emerged that did not align with the content of the lessons specifically, but to that of the experience its self. These included: 12) Duties/facility/scheduling; 13) Connection to nature and; 14) Self awareness. Table 4.6 presents the categories and percentages for student responses for aspects of the experience students found most confusing. Only students who participated in the lesson or activity were included when calculating percentages.

Two hundred fifteen students participated in this study. Analysis of students' responses for the most confusing aspect of the camp revealed that 133 students participated in the

astronomy lesson and 5.3% (N=7) of the students found this lesson to be confusing. The number of students who participated in wilderness navigation was 177 and 10.7% (N=19): of the students identified this as the most confusing aspect of the experience. The number of students who participated in ecology or ecosystem themed lessons was 196 and 9.2% (N=18) of the students identified this as the most confusing aspect of the experience. All 215 students participated in social activities, including hired entertainment and 4.7% (N=10) identified this as the most confusing aspect of the experience. The number of students who participated in geology actives was 129 and 4.7% (N=6) of the students identified this as the most confusing aspect of the experience. The number of students who participated in history actives was 152 and 5.9% (N=9) of the students identified this as the most confusing aspect of the experience. The number of students who participated in the all day hike was 133 and 5.3% (N=7) of the students identified this as the most confusing aspect of the experience. These responses are included in the physical exercise category. The number of students who participated in teamwork actives was 106 and 12.3% (N=13) of the students identified this as the most confusing aspect of the experience. All 215 students participated in actives that addressed topics of wildlife and 13% (N=28) of the students identified this as the most confusing aspect of the experience. Seven percent of student responses did not align with these topics or any specific GSMIT activities (N=16). These responses are included on Table 4.5 in the category other. Nineteen percent of students indicated that there was no aspect of the experience that they found confusing (N=42). All 215 students participated in aspects of the experience that were not part of a specific lesson but are considered to be important aspects of the experience. Over sixteen percent of Student responses aligned to these aspects are included in the topic Duties/Facility/Scheduling/Meals/Weather (N=36). No students identified the connection to nature objective of the GSMIT experience as confusing.

GSMIT activities specifically were designed to provide students an opportunity to interact with nature on their own. All of the students participated in these aspects of the program; 1.9% of the students responded to this part of the experience as confusing. These responses are included on Table 4.6 in the topic self-aware (N=4).

Table 4.6
Student Perceptions of the Most Confusing Aspect of the Experience.

TOPIC	TREMONT ACTIVITIES	Total	Students	Percent
Nothing was confusing	n/a	215	42	19.5
Duties/Facility/Scheduling/ Meals/Weather	Incorporated into the Experience	215	36	16.7
Wildlife	Stream Life, Wildlife, Salamander Monitoring and the scientific method, Insect Search, Night walk	215	28	13.0
Teamwork	Cooperation Course	106	13	12.3
Wilderness Navigation	Wilderness navigation, Explorations	177	19	10.7
Ecology/Ecosystems	Life in the forest, Little Creatures, Trees are Tremendous, Freddie the Fungus, Eco-Jeopardy	196	18	9.2
Other	All Things Tremont, Why do we go home so early,	215	16	7.4
History	Cades Cove, Native American Cultures + History, Little Greenbrier School, Walker Valley living history	152	9	5.9
Physical Exercise	All Day Hike	133	7	5.3
Astronomy	Astronomy	133	7	5.3
Friends/Social	Campfire, Games, Hired Entertainment, Storytelling, Music	215	10	4.7
Geology	Geology Hike to the falls	129	6	4.7
Self-Aware	Solo Sit, Solo Hike, Getting Lost on Trails	215	4	1.9
Nature	Unplugged, Explore, View/Scenery	215	0	0

Analysis of students' responses for the most confusing aspect of the program supported the following:

- 10.7% of students had difficulties understanding concepts in wilderness navigation.
- 12.3% of students failed to make connections to the need for the teamwork and cooperation course.
- 13% of the students found aspects of the wildlife lessons confusing which were mainly focused on citizen projects and finding or locating wildlife.
- 16.7% of the students had difficulty understanding the day to day operations of the camp, this mainly included issues involving meals and student responsibilities.
- 19.5% of the students found no aspect of the experience confusing.

Table 4.7 presents topics, GSMIT activities and percentages for student responses with respect to experience they would like to do more often. Only students who participated in the lesson or activity were included when calculating percentages. Analysis of students' responses revealed that nine percent of the 133 students who participated in the astronomy lesson wanted to do this again (N=12). The number of students who participated in wilderness navigation was 177 and 1.7% of the students identified this as something they would like to do more of (N=3). The number of students who participated in ecology or ecosystem themed lessons was 196 and 9.7% (N=19) of the students identified this as something they would like to do more of. All 215 students participated in social activities including hired entertainment, 12.1% (N=26) of the students identified this as something they would like to do more of. The number of students who participated in geology activities was 129 and 22.5% (N=29) of the students identified this as something they would like to do more of. The number of students who participated in history activities was 152 and 12.8% (N=17) of the students identified this as something they would like to do more of. The number of students who participated in the all day hike was 133 and 3.8% (N=4) identified this as something they would like to do more of. These responses are included in the physical exercise category. The number of students who participated in teamwork

activities was 106 and 25.6% (N=55) of the students identified this as something they would like to do more of. All 215 students participated in activities that addressed topics of wildlife and 4.2% (N=9) of the students identified this as something they would like to do more of. One student response that did not align with these topics or any specific Tremont activities indicated that he/she would not like to repeat any aspect of the experience. All 215 students participated in aspects of the experience that were not part of a specific lesson but are considered to be important aspects of the experience. Eleven students' responses that align to these aspects are included in the topic Duties/Facility/Scheduling/Meals/Weather (5.1%). Another eleven students identified that having the opportunity to connect with nature was something they would like to do more of (5.1%). GSMIT activities were specifically designed to provide students an opportunity to interact with nature on their own. All of the students participated in these aspects of the program. Sixteen of the students responded to this as something they would like to do more of (7.4%). These responses are included under the topic self-aware.

Table 4.7
Student Perceptions of the Aspects They Wanted to Experience More Often

TOPIC	TREMONT ACTIVITIES	Total Responses	Percent
Wildlife	Stream Life, Wildlife, Salamander Monitoring and the scientific method, Insect Search, Night walk	215	55	25.6
Geology	Geology Hike to the falls	129	29	22.5
Physical Exercise	All Day Hike	133	17	12.8
Friends/Social	Campfire, Games, Hired Entertainment, Storytelling, Music	215	26	12.1
Ecology/Ecosystems	Life in the forest, Little Creatures, Trees are Tremendous, Freddie the Fungus, Eco-Jeopardy	196	19	9.7
Astronomy	Astronomy	133	12	9.0
History	Cades Cove, Native American Cultures + History, Little Greenbrier School, Walker Valley living history	152	12	7.9
Self-Aware	Solo Sit, Solo Hike, Getting Lost on Trails	215	16	7.4
Nature	Unplugged, Explore, View/Scenery	215	11	5.1
Teamwork	Cooperation Course	106	4	3.8
Wilderness Navigation	Wilderness navigation, Explorations	177	3	1.7
Nothing	n/a	215	1	.5
Duties/Facility/Scheduling/ Meals/Weather	Incorporated into the Experience	215	1	.5

Analysis of students' responses for aspect of the program they would like to do more of supported the following:

- 25.6% of the students wanted to spend more time interacting with wildlife.
- 22.5% of student said they would like to learn more about the geology of the park and repeat the hike to the falls.
- 12.8% of the students wanted to repeat the all-day hike because they enjoyed the physical challenge component of that experience.
- 12.1% of student wanted to repeat the social activities like the campfires, storytelling and musical performances.

Question Four

How do schools incorporate a residential environmental learning center experience into their school curriculum? To answer this question I have presented case outlines which provide detailed information about each school and their relationship with GSMIT. Also, to better understand how pre-experience preparation influences the delivered objectives I have included a Chi-square analysis (Table 4.10). Furthermore, I have included a detailed review of the naturalist instructors and educational leadership team perception of the ideal relationship between GSMIT and the formal classroom. These data describe the complex nature of the experience and revealed ways to bridge the gap between the formal classroom the GSMIT experience.

Case outlines (Appendices E through L) contain information collected from interviews and onsite observations at GSMIT. These data are organized into nine categories that address specific components of the schools relationship with GSMIT: 1) Description of the school; 2) History with GSMIT; 3) Preparation; 4) Funding; 5) Issues related to participation; 6) Alignment to curriculum; 7) Follow-up activities; 8) Expected outcomes; and 9) Schedule of activities. These data have been discussed throughout this chapter and they will not be addressed in further detail in this section.

The influence of student preparation on outcomes was analyzed using data collected from teacher interviews and student questionnaires. These data revealed how different types pre-experience preparation influenced student perceptions of the most meaningful aspects of the GSMIT experience. Table 4.8 provides the number of student responses from each case and the corresponding category that aligns to the established GSMIT objectives from research question two. Forty-one (19%) student responses coded into the connection with nature category. Thirty students identified stewardship as the most meaningful aspect of the experience at 13.9%. Sixty-

nine students (32%) identified the discovery category as the most meaningful aspect of the experience. Twenty-seven students (12.5%) identified that gaining awareness of the national park was the most meaningful aspect of the experience. Twenty-six students (10.2%) identified the life skills category as the most meaningful aspect of the experience. The remaining student responses did not align with the established GSMIT objectives, nor did they justify the creation of an additional category.

Table 4.8
Student Perceptions of the Most Meaningful Aspects of the Tremont Experience.

Category	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Total	Percent
Nature	16	9	4	0	0	12	41	19.0
Stewardship	7	2	1	3	3	14	30	13.9
Discovery	15	16	6	5	14	13	69	32.1
Awareness	15	6	3	2	1	0	27	12.5
Life Skills	11	5	6	2	1	1	26	12.1
Other	3	9	0	7	0	3	22	10.2
TOTAL	67	47	20	19	19	43	215	100

Schools prepare their students for the experience in different ways. Stern (2008) found students who conducted activities at their school prior to their visit to GSMIT got more out of the experience. Data from classroom teacher interviews revealed the schools in this sample prepare their students by providing them with: 1) no additional information beyond that of the regular school curriculum; 2) content that specifically prepares them with background knowledge for things they will experience at GSMIT; 3) experience hiking, packing or conducting investigations in the outdoors; and 4) preparation that helps students to understand behavior, and routines that are expected of them during their time at GSMIT. Table 4.9 presents the types of preparation for each case, the number of students who responded each GSMIT objective and the total value for each type of preparation. The total value for each type of preparation was used in a Chi-square analysis to measure the influence of preparation on expected outcomes.

Students from Case 5 and Case 2 had no preparation for the Tremont experience beyond that provided as part of the regular school curriculum. These students make up the "None" category under types of preparation. The None group had 9 students respond that establishing a connection was the most meaningful aspect of the experience. Five students identified stewardship as the most meaningful aspect. Thirty students identified the discovery category as the most meaningful aspect of the experience. Seven students identified that gaining awareness of the national park was the most meaningful aspect of the experience. Six students identified the life skills category as the most meaningful aspect of the experience and the remaining 9 students' responses in the None category did not align with the established GSMIT objectives. The total value for the None category is 66. This value represents the number of students that received no additional preparation beyond that provided by the regular school curriculum.

Students from Case 1, Case 4 and Case 6 received content preparation that specifically helped them develop background knowledge for experience they would have at GSMIT. These students make up the Content category under types of preparation. The Content group had 28 students respond that establishing a connection was the most meaningful aspect of the experience. Twenty-four students identified stewardship as the most meaningful aspect. Thirty-three students identified the discovery category as the most meaningful aspect of the experience. Seventeen students identified that gaining awareness of the national park was the most meaningful aspect of the experience. Fourteen students identified the life skills category as the most meaningful aspect of the experience and the remaining 13 students' responses in the Content category did not align with the established GSMIT objectives. The total value for the Content category is 129. This value represents the number of students who received content

preparation that specifically helped them develop background knowledge experience they would have at GSMIT.

Students from Case 1, Case 3, Case 4 and Case 6 received experiential training such as hiking, packing or conducting investigations in the outdoors that would specifically prepare them for things they would be doing at GSMIT. These students make up the Experience category under types of preparation. The Experience group had 32 students respond that establishing a connection was the most meaningful aspect of the experience. Twenty-five students identified stewardship as the most meaningful aspect. Thirty-nine students identified the discovery category as the most meaningful aspect of the experience. Twenty students identified that gaining awareness of the national park was the most meaningful aspect of the experience. Another 20 students identified the life skills category as the most meaningful aspect of the experience and the remaining 13 students' responses in the Experience category did not align with the established GSMIT objectives. The total value for the Experience category is 149. This value represents the number of students received experiential training such as hiking, packing or conducting investigations in the outdoors, which would specifically prepare, things they would be doing at GSMIT.

Only students as part of Case 1 received preparation that helped them to understand what was expected of them during their time at GSMIT. These students make up the Duties category under types of preparation. The Duties group had 16 students respond that establishing a connection was the most meaningful aspect of the experience. Seven students identified stewardship as the most meaningful aspect. Fifteen students identified the discovery category as the most meaningful aspect of the experience. Fifteen students identified that gaining awareness of the national park was the most meaningful aspect of the experience. Eleven students identified

the life skills category as the most meaningful aspect of the experience and the remaining 3 students' responses in the Duties category did not align with the established GSMIT objectives. The total value for the Duties category is 67. This value represents the number of students who received preparation that helped them to understand what was expected of them during their time at GSMIT.

Table 4.9
Types of Preparation and the Corresponding GSMIT Objectives Value Scores.

Case #	Type of preparation	GSMIT Objective						
		Nature	Stewardship	Discovery	Awareness	Life skills	Other	Total value
5, 2	None	9	5	30	7	6	9	66
1, 6, 4	Content	28	24	33	17	14	13	129
1, 3, 4, 6	Experience	32	25	39	20	20	13	149
1	Duties	16	7	15	15	11	3	67

NOTE: GSMIT Objective Value informs the above table.

EXAMPLE: The number of students with No Preparation or (None) is Case 2 and Case 5. The connection to nature variable (Nature) would have a value of 9. This is achieved by adding the number of students in Case 2 and Case 5 or 9+0=9 from Table 4.7

To better understand how the type of preparation in the formal classroom can influence the student preceded outcomes, the GSMIT objective values (Table 4.9) were subjected to a Chi-square analysis. This statistical test compared perceived student outcomes with types of school preparation. Analysis revealed that there was no significant difference between students that received content preparation and those that did not (Chi-Square value of 10.95, df= 5, p= 0.0523, Cramer's V= 0.2257). Only one school in the sample provided their students with duties preparation Chi-square analysis of this variable would only reflect differences within this case and could not inform the influence of this type of preparation. The schools that provided students experience preparation are represented by the same schools that provided any type of training and those that provided none. To determine if students who received preparation had different outcomes than those who received no preparation, the GSMIT objective values (Table 4.9) were

used in a Chi-square analysis. This statistical test compared perceived student outcomes for schools that conducted any type of preparation with schools that did none. Table 4.10 presents the frequencies and percent for each outcome and school type. There was a significant difference between students who had received preparation and the perceived outcomes of the students (Chi-Square value of 11.6254, df=5, $p<.05$, Cramer's V=0.2325). These results agree with those of Stern (2008). Detailed descriptions of how each school prepared their students for the experience can be found in the case outlines Appendices E through L.

Table 4.10
Frequency and Percent of Students Perceived Outcomes with or without Preparation

Prep	Outcome						
Frequency Row Pct	Nature	Stewardship	Discovery	Awareness	Life Skills	Other	Total
No preparation	9 13.85	5 7.69	30 46.15	7 10.77	6 9.23	9 12.31	66
Preparation	32 21.62	25 16.89	39 26.35	20 13.51	20 13.51	13 8.11	149
Total	41 19.25	30 14.08	69 32.39	27 12.68	26 12.21	20 9.39	215 100.00

Analysis of students' perceived outcomes with or without preparation (Table 4.10) revealed 45% of students that received no preparation identified the GSMIT's discovery objective as the most meaningful aspect of the experience. Table 4.11 presents the frequencies and percent form a two by two analysis of the discovery objective value with all other objective values. There was a significant difference between students who had received preparation and the perceived outcomes of the students (Chi-Square value of 7.8016, df=1, p<.01, Cramer's V=-0.1905).

Table 4.11
Two by Two Analysis of Preparation on the GSMIT Discovery Objective

Prep	Outcome		
Frequency Row Pct	Discovery	Other	Total
No preparation	30 45.45	36 54.55	66
Preparation	39 26.17	110 73.83	149
Total	69 32.09	146 67.91	215 100.00

Staff perceptions of the ideal relationship between the schools and GSMIT are used to better understand how their goals connect to not only the students, but also to the schools and communities. Analysis of staff interviews revealed three main topics related to the ideal relationship between schools and GSMIT: 1) A need for more pre- and post-activities; 2) proper equipment and physical preparation; and 3) multiple visits. Although GSMIT has made steps to incorporate many of these elements into the experience they offer, at this point they were unsure if these efforts are translating to the classroom. For the most part it is up to the school to prepare their students for the experience.

Results show that the GSMIT staff understand the importance of pre- and post-activities, but speculate that the lessons provided to the teachers at the teacher escape weekends go unseen by the students. I was able to confirm this issue during teacher interviews. The staff at GSMIT is working on developing online distance education lessons that teachers could ether use in their classroom or assign as homework. These video based lessons will address content aligned with state standards and help to prepare students for the experience in two ways: 1) connect real life examples of the content in the GSMIT lesson to some of the more abstract ideas presented in the classroom and 2) provide students an opportunity to get to know staff members before the visit

and stay connected after. Teachers would access lessons through the GSMIT website, allowing GSMIT to keep track of what schools were using this resource. In addition, with this form of data collection GSMIT could also include some form of quiz or test for the students and provide that information back to the classroom teacher.

Staff perceptions of the school ideal relationship also revealed that students need to be prepared physically for the experience and have proper gear. These two aspects could impact the students' experience while at the center. In fact, lack of physical preparation and having the right gear could cause students to have a negative experience in nature, going against the objectives of the program.

At GSMIT students walk or hike to every activity. For many of them this is very different from their usual daily routine. As one teacher pointed out, “These kids spend so much time sitting at computers or watching TV. They will break a sweat walking to their next class, and at that point they are done, that was exercise.” Students at GSMIT can’t just give up halfway through a hike; they have to get back to the camp somehow. This physical challenge is a major issue for some students, but it can also be rewarding. Thirteen percent of students in this project stated that the physical challenge aspect of the experience was something they would like to do more of. In the words of one student, “I would love to hike more. I might complain, but it pushes me to the limits and I like that.” So, it is important for schools to prepare for this aspect of the experience.”

GSMIT can supply essential supplies (backpack, water shoes, water bottle, etc…) if students arrive without them. Some schools have funds that help to provide students with equipment the student may not be able to otherwise afford. These include equipment such as

hiking boots or rain gear. This investigation revealed that having access to the equipment is not necessarily the issue. Rather, having access to the right equipment means that students have them available when needed. Often students were so burdened with supplies they weren't going to need that it interfered with their ability to function and participate. During field observations a teacher pointed out this phenomenon to me. I saw a student standing at the outskirts of a small group listening to the instructional staff explain something they had found on the trail. This student had a walking stick in one hand and binoculars in the other. The staff member reminded the students to stay hydrated, so this student removed his back pack to retrieve his water bottle. Placing the walking stick under his arm, he held the back pack and binoculars in one hand and used the other to open the pack. As the student scrounged around in the pack he removed three additional items before the water bottle emerged; a flashlight, a pair of winter ski gloves and a wool stocking cap. These items were added to the walking stick under the arm. Finally, when he got to the water bottle he didn't have a free hand to unscrew the lid. He paused for a second to consider his predicament then set everything down and took a drink. By this time the staff member had finished discussing the topic and the student quickly repacked his backpack with the water bottle buried at the bottom. The lesson this school group was engaged in was three hours long and the students hiked about 2 miles in total. The weather was sunny, 65 degree with clear skies. Every morning after breakfast students participated in forecasting the weather for that day, so there was no reason for the student to have cold-weather gear and a flashlight. This was an opportunity for the student to learn about being prepared appropriately, but it is unclear if this singular incident influenced the student's thinking. One school addresses this issue as part of their preparation for the experience. The teachers instruct students on how to efficiently pack their bags and reinforce the idea that students will just need to be prepared for the specific

activity. They can repack after lunch or dinner, if necessary. Observations of this school's participation revealed varying degrees of preparedness of students, but compared to other schools the difference was obvious. There is no way of knowing if this pre-experience instruction alone was responsible of the difference because teachers and chaperones took a proactive approach to handling this issue. They would ask the students to think about what they were going to be doing and anticipate what their needs might be. There is connection between teacher involvement and what students get out of the experience. Preparing students to be accountable for their choices and also making them aware of the physical expectations helps them succeed during the experience.

Another category that emerged from staff interviews was this importance of multiple visits to GSMIT. This pertains not only to the students, but also the school. When looking at the experience from the perspective of the student, it is easy to see how returning to GSMIT multiple times could influence a student's perception of the experience. With a reduced novelty effect on each subsequent trip there is a greater potential for learning. But, when analyzing this issue at the school level three different components emerge: 1) Teacher experience; 2) School culture; and 3) Connection to the greater community. These categories are closely linked to the overarching goals and objectives of GSMIT.

The GSMIT staff members believe that developing a strong relationship with classroom teachers is essential to the success of GSMIT. Teachers are the direct connection between GSMIT and the school; they handle all aspects of the experience from preparation and planning to fund raising and connecting information to the classroom. When teachers are successful at GSMIT, they take that experience back to the school and it interests their colleagues. Then those colleagues want to get involved and over time the GSMIT experience becomes part of the school

culture. At this level of involvement the relationship between the school and GSMIT is strong and involves administrators, students and teachers alike. In this situation, teacher turnover will not be responsible for ending the relationship. When attending GSMIT becomes part of the school culture, teachers are hired with the understanding that this is an expected part of their role as a teacher at that school. When more people are involved at the school there is a greater potential for community to connect to the GSMIT objectives.

SUMMARY

The results presented in this chapter reveal the complex nature of the relationship between the GSMIT and the formal classroom. These data were collected, analysis was conducted and finding were presented; all in alignment with this project's purpose and methods to answer the four research questions. The data revealed the GSMIT objectives, perceptions of the delivered curriculum, methods of instruction and how schools incorporate the GSMIT experience into their formal classroom to enhance and deepen student learning. Chapter 5 will present a summary of these findings, conclusions, implications and recommendations for future research.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary of the Background

The origins of environmental education (EE) can be found in nature study, a science curriculum that encouraged methods of instruction that would become outdoor education, science inquiry and experiential learning. The content of nature study was the natural environment. In our current educational system the content of EE is either lightly sprinkled throughout the K-12 curricula, or it is absent altogether. Teachers interested in providing their students with an EE experience often find that they need to locate supplemental resources to use in their classrooms. These supplemental resources are typically aimed at enhancing environmental attitudes, increasing environmental knowledge, promoting citizenship skills, encouraging stewardship behaviors and stress the importance students coming in contact with nature. Current research shows that students learn ecological principles better in an outdoor setting and positive leaning experiences in the outdoors encourage students to participate in future outdoor activities (Bogner, 1998; Cronin-Jones, 2000; Martin, 2003; Palmburg & Kuru, 2000). These studies collectively reinforce the importance of using science inquiry and outdoor education when teaching the content areas of EE; however, in today's classrooms many students are not getting these unique experiences. If they do, it is typically because their teacher has made the decision to provide them with opportunities to connect with nature.

Purpose of the Study

The purpose of this study is to identify how 6 middle level schools incorporate a residential EE experience with formal classroom instruction. By closely examining the relationships between a model residential environmental learning center and the formal classroom, data have supported critical aspects of the relationship that need to be considered

when integrating these two essential approaches to EE. Understanding how teachers prepare their students and participate in instruction during the residential experience is a critical part of knowing how schools can optimize the experience for their students.

Data Collection and Analysis

This project used data collected from interviews, observations and a student questionnaire. The research methods closely followed case study guides (Appendix A), instrumentation outline (Table 3.1) and interview protocols (Appendices B through E) to ensure the trustworthiness of these data. In this section I have summarized how these methods were used to collect the appropriate data and how those data were analyzed to reveal answers to the specific research questions.

Interviews were conducted with classroom teachers, school administrators, teacher naturalists, and GSMIT's educational leadership team. These interviews followed interview protocols (Appendices B through E) to ensure that adequate information would be collected to answer the research questions. Teacher interviews were conducted at the school so that the teachers and other participants were met in a location where they were most comfortable. This allowed them to get to know me before they arrived at GSMIT, thereby reducing any observation anxiety and allowing me to get a more realistic impression of their experience. Interviews were then transcribed and coded using both a reductionist and grounded theory methodology for analysis and alignment to specific research questions.

Observations of the schools participation at GSMIT followed an established observation protocol; the first priority for observation was teachers instructing students on their own, and the second priority was teachers and GSMIT staff cooperatively teaching. The third priority was GSMIT staff providing instruction on their own, and finally, the fourth priority was hired

entertainment such as storytellers or musical guests. The focus of these observations was directed at teacher participation and their interaction with the students, thus if teachers were not involved with the activity that activity would have a low priority. During observations I also made notes on the instructional methods used by the naturalist instructors. These observations were included as field notes and have been reviewed to identify areas of tension and anxiety within the cooperative teaching model.

Interviews with residential learning center staff took place during their down time while I was on site at the GSMIT campus. These interviews were scripted and follow the instrumentation outline (Table 3.1) for alignment to the research questions. Again, this process allowed for an audit trail to be established for trustworthiness and repeatability. The information from the GSMIT staff interviews revealed: 1) staff perceptions of the ideal relationship between schools and GSMIT, 2) their perceived objective and motivations for the experience, 3) their perceptions of the effectiveness of the cooperative teaching model and 4) any pre-experience or post-experience activities.

Immediately after completion of the residential program students completed an open-ended questionnaire, a variation of the minute-paper and muddiest-point assessment technique used by Smith-Sebasto and Obenchain (2009). The use of this instrument allowed me to quickly assess students' perceptions of the experience. Students responded in writing to the following questions: (a) What was the most meaningful thing you learned? (b) What was the most confusing aspect of your experience? and (c) What was the experience you would like to repeat or topic about which you would like to learn more? Smith-Sebasto and Obenchain (2009) explain that because this technique only requires students to respond using one or two sentences, it is effective with all students, including those who struggle with writing or are reluctant to speak.

Parental consent was included with camp participation and medical forms. The student questionnaire is provided in Appendix F.

I have conducted a detailed analysis of GSMIT's curricular materials used to deliver instruction. These materials were evaluated to determine their level of inquiry, format and evidence of learning cycles. In addition to reviewing lessons plans, observation of instruction informed my perception of not only the intended curriculum but also the delivery.

The information collected during this research is a product of the methods used for data collection and the participation of a data rich sample. These data were collected through interviews, observations, and surveys. The quality of the data collected with this method is largely dependent upon the researcher and findings may be subject to researcher bias and interpretation. Analyses of these data were conducted to inform the specific research questions. Generalization was not the goal of this qualitative study and any application of the results are to be used to allow the reader to interpret and apply the findings to his or her own situation. In the next section I summarized the results from each research question to provide a base for the discussion of the implications and recommendations.

Summary of Findings

A summary of key finding for each of the four research questions are presented here. Also included is a description of the primary source of the data collected that informs each of the key findings.

Question One

What are the outlined objectives of the residential environmental learning center?

GSMIT has outlined four independent objectives, 1) Connection with nature (Nature). The

connection-with-nature index was based on four premises: (a) students feel comfortable in the outdoors; (b) students feel that they are a part of nature, rather than separate from it; (c) students actively engage in observing their surroundings when in natural settings; and (d) students show interest in outdoor activities. 2) Environmental stewardship (Stewardship). The stewardship index measured participants' attitudes toward environmental conservation and their intentions and actions regarding environmental behaviors. 3) Interest in learning and discovery (Discovery). The discovery index gauged students' degree of interest in learning about natural history and cultural heritage and their degree of interest in directly exploring these topics in various settings. 4) Knowledge and awareness of GSMNP and biological diversity (Awareness). The awareness index measured knowledge of exotic species, biological diversity, and the national park. These four constructs when utilized together have been able to provide an accurate measure of how the GSMIT experience impacts student learning.

The ideal curriculum for EE outlined by the historical documents (Table 2.1) in the review of the literature review identified three content areas: 1) Ecological Principles, 2) Issue Identification and Solution, and 3) Civic Responsibility and Motivation. The GSMIT objectives are perfectly aligned with the established three content areas of EE. Table 5.1 presents this alignment.

Table 5.1
GSMIT objectives alignment to established EE content areas

	Connection with nature (Nature)	Environmental stewardship (Stewardship).	Interest in learning and discovery (Discovery)	Knowledge and awareness of GSMNP and biological diversity (Awareness)
Ecological Principles	Students feel that they are a part of nature, rather than separate from it;	…	…	Knowledge of exotic species, biological diversity, and the national park
Issue Identification and Solution	Students actively engage in observing their surroundings when in natural settings;	…	Interest in learning about natural history and cultural heritage and their degree of interest in directly exploring these topics in various settings.	…
Civic Responsibility and Motivation	Students feel comfortable in the outdoors; Students show interest in outdoor activities.	Attitudes toward environmental conservation their intentions and actions regarding environmental behaviors.	…	…

Data used to inform these findings were collected from a review of GSMIT internal documents, current research and interviews with the education director. Together these sources provided a robust impression of the goals and objectives of GSMIT and the alignment to the ideal EE curriculum.

Question Two

What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? What are the perceptions held by the educational directors and instructional staff at the educational learning center?

Interview data collected from the instructional staff, education leadership team and the executive director all concur with the published objectives listed in the response to research question one. These objectives include 1) Connection with Nature, 2) Stewardship, 3) Discovery and 4) Awareness. Findings from these interviews revealed an objective category that was not included in the assessed constructs. This additional objective represented the desire for participants to acquire life skills form the experience. This objective is not represented in the curriculum in any way, but it is more or less a product of the experience and is derived from students taking responsibility for their own actions and thoughts while at the center. Data collected from teachers confirm that they see the importance of students gaining life skills. Students' perceptions of the most meaningful aspect of the experience also confirm the addition of this category. The student questionnaire also revealed that 32% of the students felt that gaining an appreciation for discovery and learning was the most meaningful aspect of the experience. These students were conducting science inquiry in the natural environment, not unlike children learning with nature study 100 years ago. In 1913, Liberty Hyde Bailey wrote; "Nature-study ought to revolutionize the school life, for it is capable of putting new force and enthusiasm into the school and the child." (in Russell, 1982, p34). Students at GSMIT gain this enthusiasm for learning and discovery. The lead teacher from Case 1 described how students bring this excitement for learning back to the school after the experience. She explained that this phenomenon was contagious, spreading to students who didn't have the opportunity to attend GSMIT. "It is amazing, students come back from Tremont and learning is cool." But only half of the teachers identified this as an important aspect of the experience. In Case 2, the lead teacher actually schedules the trip to GSMIT the week before their school goes on spring break so students have a week off before they return to school. This was done deliberately to reduce the

level of enthusiasm and excitement of those students who went and protect the feelings of those who didn't.

The difference between these two cases does not end here. Case 1 does extensive preparation with their students including content, experience, duties and responsibilities. Case 2 does nothing to prepare their students beyond the regular classroom instruction. Results from this project confirmed those from Stern (2008), indicating school preparation had a significant impact on student learning during and after the experience at GSMIT. In response to why she doesn't do any preparation with her students, the lead teacher from Case 2 said, "There's that fine line of getting them excited and giving them the background knowledge without making the other kids feel like they're missing out of something that is really cool."

Professional development for teachers offered by GSMIT should address these issues. If teachers could see the value of embracing the enthusiasm for learning that the GSMIT experience can bring to a school, then this could help GSMIT achieve their goal to connect to the local communities from which the participants come.

Question Three

What methods of instruction are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?

The analysis of field observations, interviews, school schedules and student questionnaires revealed that both implicit learning opportunities, explicit learning opportunities and content alignment to the school curriculum directly influence the learning objectives of GSMIT and the schools. The methods of instruction used to achieve the objectives included an instructional model unique to GSMIT. Identified as the cooperative teaching model, this method

of instruction requires classroom teachers to teach alongside the naturalist instructors as well as on their own.

GSMIT has recognized the importance of including teachers in the instruction from the beginning. They see this process as a central component of achieving the objective of connecting people to nature. GSMIT's underlying philosophy is to provide teachers the support they need to successfully teach in an outdoor setting; then that experience will act as positive reinforcement and, thus, they will apply what they have learned not only at GSMIT, but also at their school when they return. In our education system less than 15% of science teachers have taken a formal course in EE and furthermore, the current teaching force lacks professional development opportunities in EE. There is often no provision for preservice training of new teachers, nor is there an ongoing in-service professional development focused on EE (Ramsey & Hungerford 2002). By providing teachers with these opportunities, GSMIT hopes to make their philosophy a reality. GSMIT offers weekend retreats for teachers to meet one another, exchange ideas and get to know staff members. For GSMIT, it is an opportunity to showcase new lessons or provide professional development. However, the professional development up to this point has failed to meet the expectations of the staff. The staff members themselves acknowledge that they need to do more in this area. Teacher perceptions of the escape weekends range from the most enlightening experience of their career to a waste of time they tolerate in order to receive a discounted registration fee for their students.

Grounded theory analysis of the cooperative teaching model resulted in the identification of eight causal conditions that act as barriers to successful implementation of this teaching strategy. These data are presented in Table 4.3 along with the coping strategies for the participants and the observed influences on instruction. Organization of Table 4.3 follows a

grounded theory model presented by Strauss and Corbin (1990). The intervening conditions for difficulties in the cooperative teaching model originate from both the classroom teacher and the teacher naturalist. Four of the eight causal conditions are specific to the classroom teachers and need to be addressed by the professional development offered by GSMIT: 1) lack of experience teaching in the outdoors, 2) lack of understanding of their expected responsibilities, 3) lack of content knowledge, and 4) the teachers' level of interest. In response to these causal conditions classroom teachers would take action or respond in a particular way, as identified on Table 4.4 and this action would result in observed influence on instruction.

Lack of experience teaching in the outdoors, can be addressed by modeling effective instruction techniques, then deconstructing the experience during the professional development. Having the teachers participate as a student during the lesson allows them to gain experience conducting inquiry in the outdoors from the learner's perspective. Deconstructing the experience is a critical component of this PD because the facilitators to draw attention to aspects of instruction that may be over looked by the teachers. Using modeling as an instructional technique for professional development and presevice science teacher education is widely accepted, because it provides teachers an example they can emulate and it allows them to reflect specifically about the nature of inquiry and conceptually linked to ways in which inquiry can be brought into the K-12 classroom (Supovitz & Turner, 2000; Windschitl, 2003). After deconstructing the lesson classroom teachers should have an opportunity to apply these instructional techniques with peer review or feedback.

Lack of understanding of their expected responsibilities can be addressed by explicit instruction explanting the objectives of the cooperative teaching model. By providing direct examples of how GSMIT wants this experience to connect to the communities back home,

teachers will be more aware of their role in achieving GSMIT's objective. This would, in turn, allow teachers to better understand the importance of applying resources and instructional strategies of GSMIT at their school.

Lack of teacher content knowledge can be addressed through the use of effective questioning techniques, and resisting the urge to provide immediate answers. Comstock (1911) explains how the lack of content knowledge should be addressed in nature study. She explains the importance for teachers to have confidence in their knowledge and describes when and why the teacher should say "I do not know".

> No science professor in any university, if he be a man of high attainment, hesitates to say to his pupils, "I do not know" if they ask for information beyond his knowledge. The greater his scientific reputation and erudition, the more readily, simply, and without apology he says this. He, better than others, comprehends how vast is the region that lies beyond man's present knowledge. It is only the teacher in the elementary schools who has never received enough scientific training to reveal to her how little she does know, who feels that she must appear to know everything or her pupils will lose confidence in her. But how useless is this pretense, in nature-study! The pupils, whose younger eyes are much keener for details than hers, will soon discover her limitations and then their distrust of her will be real. In nature-study any teacher can with honor say, "I do not know"; for perhaps the question asked is as yet unanswered by the great scientists. But she should not let lack of knowledge be a wet blanket thrown over her pupils' interest. She should say frankly, "I do not know; let us see if we cannot together find out this mysterious thing. Maybe no one knows it as yet, and I wonder if you will discover it before I do". She thus conveys the right impression, that only a little about the intricate life of plants and animals are yet known; and at the same time she makes her pupils feel the thrill and zest of instigation. Nor will she lose their respect by doing this, if she does it in the right spirit (p3).

In this passage Comstock provides a scenario which illustrates to the student that the teacher is not all-knowing, but really is the exact opposite. In this case the teacher has the opportunity to learn alongside her students. She did not simply provide an answer which would stop student thinking, and in this situation where the teacher has limited background knowledge, possibility the wrong answer, but rather she encouraged student investigation. Comstock continues:

> Moreover, the teacher, in confessing her ignorance and at the same time her interest in a subject, establishes between herself and her pupils a sense of companionship which relieves the strain of discipline, and gives her a new and intimate relation with her pupils which will surely prove a potent element in her success. The best teacher is always one who is the good comrade of her pupils (pp. 3-4).

In the professional development (PD) offered to classroom teachers by GSMIT, this topic should be addressed to alleviate teacher's anxiety derived from the perceived need to be a content expert.

The teachers' level of interest can be addressed when explaining the importance of modeling. Teachers have to follow the example of appropriate environmental behavior put forth by the naturalist instructors. They will need to understand that it is their responsibility that the chaperones that accompany them will also be expected to follow this example. Explicit instruction on this topic will support concepts extracted during the deconstruction of the modeling session. Providing examples of inappropriate behavior would allow teachers an opportunity to identify such behaviors and also act as an authentic assessment for teachers understanding of effective instructional strategies.

The four causal conditions and recommendations for GSMIT classroom teacher professional development have been addressed in this section. The remaining four causal conditions are specific to the naturalist instructors: 5) desire to meet GSMIT curricular objectives, 6) reluctance to overstep teachers' classroom management strategy, 7) desire for all students to have a uniform experience and 8) observations of chaperones and teachers modeling less than ideal behavior. These conditions require a less intensive level of PD. Explicit instruction about the expectations and goals of the cooperative teaching model, should be used to raise the naturalist instructor's awareness of these issues. Participation in modeling activities will help the naturalists evaluate the instructional needs of the teachers and also see that teachers are

making an effort improve their skills as an outdoor educator. Collaboration between teachers and naturalist instructors should establish an open dialog for the sharing of information and advice. By providing quality targeted professional development to both classroom teachers and naturalist instructors, GSMIT could reduce the negative impact these causal conditions have on the cooperative teaching model.

Question Four

How do schools incorporate a residential environmental learning center experience into their school curriculum? To answer this question I have presented case outlines which provide detailed information about each school and its relationship with GSMIT. To better understand how pre-experience preparation influences the delivered objectives I have included a Chi square analysis. This analysis used frequencies of categorical data collected from student questionnaires to identify variations in student preparation. Furthermore, I have included a detailed review of the perceptions of staff and educational leadership on the informal side of the ideal relationship. These data describe the complex nature of the experience and revealed ways to bridge the gap between the formal classroom the GSMIT experience.

Analysis of data collected from teacher interviews and student questionnaires revealed a significant difference in perceived student outcomes between schools that prepare their students for the experience and those that do not. This finding supports that of the internal assessment of GSMIT's influence on student learning conducted by Stern (2008). Furthermore, there was no significant difference in student perception between the different types of preparation. One rationale to account for this result could be the type of instrument used. Questionnaire responses were open-ended and data were coded in to categories. Students were not provided an opportunity to respond to each of the GSMIT objectives. If these data were collected in a way

that each student was assessed on each objective, then the results could identify specific differences between types of preparation. Another possible explanation for this result is that there is some other factor influencing student perceptions of the expected outcomes. Perhaps the additional effort of the lead teacher to provide preparation is an indicator of another. It is likely that there is a difference in teacher buy-in between teachers from schools that provided their students this enrichment than those that do not. Observations of teacher participation in the experience do support this assumption, but data were not collected to measure teacher involvement in this way. This unexpected outcome is an area for future research. It is important to note that even though there was a significant difference between the schools that prepared students and those that did not, all of the students' perceptions aligned with the expected GSMIT objectives. This is an indicator of the success of the program. Regardless of whether the teachers are actively involved in the instruction or are just going through the motions, the residential environmental education experience is positively influencing students' perceptions in alignment with the GSMIT objectives.

Analysis of staff interviews revealed three main topics related to the ideal relationship between schools and GSMIT: 1) A need for more pre- and post-activities, 2) proper gear and physical preparation and 3) multiple visits. Although GSMIT has made steps to incorporate many of these elements into the experience they offer, at this point GSMIT educational leadership team is unsure if these efforts are making it to the classroom, another area for future research. For the most part it is up to the school to prepare their students for the experience.

These findings independently support the need for teacher engagement in the lessons. The more teachers are involved in the instruction at GSMIT, the more they are engaged in the experience and the more likely they are to provide their students pre- and post-activities. This

phenomenon has been referred to by the staff as “teacher buy-in” and there appears to be a link between the level of teacher buy in and the quality of the experience the students have. However, limited research has been done on teacher buy-in related to cooperative teaching and this presents a third area for future research.

Conclusions

This study was concerned with identifying issues related to incorporating a residential environmental learning experience with instruction in the formal classroom. During data analysis a few key themes emerged from the triangulation of these research data.

1. Teacher buy-in is critical to the success of the GSMIT program. The concept of teacher buy-in is not only linked to the quality of the instruction during the experience, but it is also closely related to connecting the GSMIT experience back to formal classroom instruction. This phenomenon is also an essential component to GSMIT’s ability to connect with the communities where the participating schools are located.
2. The cooperative teaching model has the potential for great success, but both classroom teachers and naturalist instructors are faced with difficulties during implementation. By providing high quality professional development, GSMIT could better prepare both parties for the experience.
3. Pre- and post-activities are important components of the experience that help the students connect what they learned at GSMIT to the formal classroom and their everyday lives. These activities help students to overcome the faulty understanding that nature is something that only exists at GSMIT, not something that is everywhere such as in a back yard or at a local park. While this concept is included in the GSMIT curriculum, it is the pre- and post-activities that allow students to make this connection. Ideally, students

could conduct investigations that linked their home environment to the environment they experienced at GSMIT. Not only would this support the idea that nature is all around, but it would also provide students additional opportunities for outdoor scientific inquiries and perpetuate their new found excitement for EE and science learning.

Implications and Recommendations

Teacher escape weekends provide an excellent opportunity to offer PD that could improve the cooperative teaching model. This PD should include several instructional strategies widely utilized in teacher education, including the modeling of effective instruction techniques such as inquiry and Socratic questioning. After modeling, it is important to provide an opportunity for teachers to deconstruct the instructional modeling session. This experience expands the teachers' current understanding of the topic addressing aspects of instruction that are often overlooked. Teachers will need to have an opportunity to apply new information by teaching a sample lesson. There should be some form of authentic assessment to rate the teacher performance with the new methods of instruction. Because many of the undesirable characteristics of instruction, like speech ticks and unengaged body language, take place subconsciously, many teachers are unaware that they are doing them. Additionally, there should be a time to address topics of safety, trail etiquette and effective questioning strategies. These concepts would illuminate the model, defining teacher responsibilities and making the cooperative teaching experience more transparent.

Pre- and post-learning activities are something that could help GSMIT better achieve their objectives. GSMIT staff members are currently developing web-based lessons that could be used by participating schools. These lessons would be taught by GSMIT staff and include content that is aligned with both national science standards and the curricular objectives of

GSMIT. The interdisciplinary nature of these lessons could be used in all subject areas. By including web based assessments, GSMIT staff could be able to monitor which schools use of these resources and collect longitudinal data on the influence of GSMIT experience. Additionally, these lessons could also be used to reduce the novelty effect by introducing the GSMIT staff to students prior to their arrival and provide students a glimpse of the environmental conditions at the GSMIT campus at different times of the year.

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Appendices

Appendix A: Case study guide

Overview of Data Collection

The data collection will consist of multiple interviews, one observation of residential environmental learning center and a student questionnaire.

School Interviews (Formal Environmental Education)

- Interview the administrator (school principal or assistant principal)
- Interview classroom teacher (leading the EE program)
- Collect data related to interview responses, this could include student assignments, curriculum guides and professional development materials.

Residential Environmental Learning Center Interviews (In-formal EE)

- Interview the educational leadership team
- Interview naturalist instructors
- Collect data related to interview responses, this could include documents such as curriculum guides, student work books, schedule of activities for the experience, and staff development materials.

Observation at Residential Environmental Learning Center

During the field observations at GSMIT, I followed an established criterion for prioritizing the different daily activities. Using this criterion, I assigned a higher priority to the lessons that provided better observational data as related to my research questions. In event of a schedule overlap, this would ensure I was able to attend the most meaningful aspect of the program.

1. The highest priority lessons taught by teachers providing on their own.
2. The second priority lessons taught by classroom teachers and naturalist instructors engaged in cooperatively teaching.
3. The third priority lessons taught by GSMIT staff on their own.
4. The fourth priority was hired entertainment such as storytellers or musical guests.

The focus of these observations is directed at teacher participation, teacher interaction with the students and the collaboration between the teacher and the naturalist instructor. I also observed the instructional methods of the GSMIT staff.

Just before the students depart the residential program students will fill-out an open

ended questionnaire.

Appendix B: Administrator Interview Protocol

Goal: To conduct a 20 minute interview to reveal information about the schools demographic, a history of their participation with the residential program as well as their perceptions about students experience at the residential environmental learning center.

Documentation: Demographic data, curricula information, and informed consent and permission to collect data.

Introduction Questions:

How long have you served as an administrator at this school?
For how many years has your school attended Tremont?
Have you ever had the opportunity to attend Tremont? Did you?
Does your state have environmental education standards?

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
RQ1 How do schools incorporate a residential environmental learning center experience into their school curriculum?	A#Q1.1 What administrative issues exist around attending a residential program?		
	A#Q1.2 What is the value added to student learning over and above formal classroom learning? Explain		
	A#Q1.3 Describe the academic relationship between the school and the center.		
	A#Q1.4 Is the residential experience used as an extension of classroom instruction?	A#Q1.4.1What are the benefits of the 50/50 requirement for teachers?	
RQ2 What are the outlined objectives of the residential environmental learning center? a. How are these objectives met by the residential learning center?	A#Q2a.1 What are the goals of the GSMIT experience that your students will be attending?		
	A#Q2a.2 Are there aspects of the experience that influence student thinking or actions that extend beyond instructional methods? Explain. (location)	A#Q2a.2.1Is this incorporated through the scheduling of activities, organization of resources and procedures for daily routine?	

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
	A#Q2a.3 What evidence exists of activities or lessons that drive critical thinking, encourage problem-solving, and allow students to gain ownership with the material.	A#Q2a.3.1Does this include guided inquiry, project-based, student centered instruction or citizen science? Explain	A#Q2a.3.2 What types of things do students do at Tremont that support Critical thinking and problem solving?
RQ3 What methods of instruction used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?	A#Q3.1What evidence exists for the use of high quality instruction at both the school and the residential environmental learning center?	A#Q3.1.1 Do you provide your Teachers additional training beyond that at Tremont that would support their use of the center?	Explain.
	A#Q3.2 With respect to content integration is there a direct link between the residential experience and classroom activities?	A#Q3.2.1 Does the residential program specifically address students' prior knowledge that they have acquired in classroom learning?	A#Q3.2.2 How does this influence the selection of program activities and who makes these decisions?
RQ4a What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? a. What are the perceptions held by the educational directors and instructional staff at the educational learning center?	A#Q4a.1What do you think Tremont is teaching your students?	What was the most meaningful thing that students learn at Tremont?	A#Q4a.1.1What is the actual take-home message?
	A#Q4a.2 To what extent do you believe that the objectives are being met?	A#Q4a.2.1Can you provide evidence to illustrate this position? Explain	
	A#Q4a.3How do you think this experience has influenced student development of a positive environmental identity? (Perception of Nature)	A#Q4a.3.1Do you believe that establishing this connection is an essential part of what this experience is about? Explain.	A#Q4a.3.2 If so what aspects of the experience do you think helped establish this connection?
	A#Q4a.4Do you think the students will be able to embrace this connection once they return to their daily lives? Explain.	A#Q4a.4.1What activities did students participate in to help them make this connection?	
Is there any additional information we may have over looked that could help use better understand the connection between the formal classroom and a residential environmental learning center?			

Appendix C: Classroom Teacher Interview Protocol

Goal: To conduct a 20 minute interview to reveal information about the content integration between subjects as well as residential experience and perceptions of student participation in activities at residential learning center.

Documentation: Informed consent and curricula materials

Introduction Questions:

What do you teach and for how long have you been attending Tremont?
Briefly describe your educational background and teaching experience?

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
RQ1 How do schools incorporate a residential environmental learning center experience into their school curriculum?	T#Q1.1 What instructional issues exist around attending a residential program?	Do all students participate?	How do you account for students with special needs?
	How do you prepare for the experience?	How do you prepare your students?	Do you align classroom lessons correspond to scheduling of the experience? Explain
	T#Q1.2 Does attending GSMIT add value to student learning over and above what you can provide in the formal classroom? Explain		
	T#Q1.3 Describe the academic relationship between your school and the GMSIT.	Explain your role as an instructor at the GSMIT. (50/50)	Describe the teacher training session you attended at GSMIT.
	T#Q1.4 In what ways is the residential experience used as an extension of classroom instruction?	After the experience do you connect classroom learning to information acquired during the experience? Explain	Has your participation in this program influenced your classroom instruction in anyway? Explain
RQ2 What are the outlined objectives of the residential environmental learning center? a. How are these objectives met by the residential learning center?	What is the objective of the program your students are attending at the GSMIT?	With respect to content, what do you want your students to get out of the experience?	Other expectations?
	T#Q2a.1 Are there aspects of the experience that influence student thinking or actions that extend beyond instructional methods?	How is this incorporated in to the experience?	How does GSMIT assess their effectiveness?

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
	T#Q2a.2 What evidence exists of activities or lessons that drive critical thinking, encourage problem-solving, and allow students to gain ownership with the material.	Does this include guided inquiry, project-based, student centered instruction or citizen science? Explain	Do any of these activities bridge the gap between the experience and the formal classroom?
RQ3 What methods of instruction used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?	T#Q3. What evidence exists for the use of high quality instruction at both the school and the residential environmental learning center?	When teaching at GSMIT are there instructional methods that you utilize that are different from those that you use in the formal classroom? Explain.	
	T#Q3.2 With respect to content integration is there a direct link between the residential experience and classroom activities?	Does the residential program specifically address students' prior knowledge that they have acquired in classroom learning?	At what point does the experience fit into your instructional unit? Explain your rational.
RQ4 What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? a. What are the perceptions held by the educational directors and instructional staff at the educational learning center?	T#Q4a.1What do you think the Tremont is teaching your students?	What was the most meaningful thing that students learn at Tremont?	T#Q4a.1.1What is the actual take-home message?
	T#Q4a.2 To what extent do you believe that the objectives are being met?	T#Q4a.2.1Can you provide evidence to illustrate this position? Explain	Do you feel that your students will be able apply what they have learned to different environments? Explain.
	T#Q4a.3 How do you think this experience influences student development of a positive environmental identity?	Do you believe that establishing this connection is an essential part of what this experience is about?	If so what aspects of the experience do you think helped establish this connection?
	T#Q4a.4 Do you think the students will be able to embrace this connection once they return to their daily lives? Explain	What activities did students participate in to help them make this connection?	
Is there any additional information we may have over looked that could help use better understand the connection between the formal classroom and a residential environmental learning center?			

Appendix D: Education Leadership Team Interview Protocol

Goal: To conduct a 20 minute interview to reveal information for a history of the center, a description of the goals and objectives, and an explanation for how their educational practices strive to meet those goals. Within the constructs of educational practices I will be looking for specifics about how they develop and train their staff, how decisions are made with reference to curriculum and activities, and what assessment techniques they have implemented to gauge their effectiveness.

Documentation: Informed consent and curricula materials

Introduction Questions:

Briefly describe your role at GSMIT.
Briefly describe the types of programs offered at GSMIT.
Briefly describe Ideal relationship between GSMIT and the schools that attend.

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
RQ1 How do schools incorporate a residential environmental learning center experience into their school curriculum?	ED#Q1.1 What administrative issues exist around schools attending your residential program?	Has participation fluctuated over the years and how can you account for this? Explain.	Can you speculate on the future participation? Are you looking to increase participation? Explain.
	ED#Q1.2 Does attending GSMIT add value to student learning over and above formal classroom learning? Explain		
	ED#Q1.3 Describe the academic relationship between most schools and the center.		
	ED#Q1.4 In an ideal situation, How do you envision the residential experience being used as an extension of classroom instruction?		
	Explain the 50/50 relationship between the Classroom teachers and GMSIT instructors.	Describe the professional development offered to participating teachers.	Is there evidence to show that participation at the GSMIT influences a teacher's classroom instruction? Explain
RQ2 What are the outlined objectives of the residential environmental learning center?	What are the expected learning objectives for students attending GSMIT?	With respect to content, what do you want your students to get out of the experience?	Other expectations?

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
a. How are these objectives met by the residential learning center?	ED#Q2a.1 Are there aspects of the experience that influence student thinking or actions that extend beyond instructional methods?	If so how is this included in to the experience?	How does your program assess its effectiveness?
	ED#Q2a.2 What evidence exists of activities or lessons that drive critical thinking, encourage problem-solving, and allow students to gain ownership with the material.	Does this include guided inquiry, project-based, student centered instruction or citizen science? Explain	Do any of these activities bridge the gap between the experience and the formal classroom?
RQ3 What methods of instruction used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?	ED#Q3.1 What evidence exists for the use of high quality instruction at both the school and the residential environmental learning center?	To what extent do you provide instructional training for your instructors? Explain.	
	ED#Q3.2 With respect to content integration is there a direct link between the residential experience and classroom activities?	Does the residential program specifically address students' prior knowledge that they have acquired in classroom learning?	Is content aligned to school Frameworks?
RQ4 What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? a. What are the perceptions held by the educational directors and instructional staff at the educational learning center?	ED#Q4a.1Discribe the balance between content and experience that you believe has the most significant impact on student learning?	What was the most meaningful thing that students learn at Tremont?	ED#Q4a.1.1What is the actual take-home message?
	ED#Q4a.2 Do you believe that the objectives for the students' residential experience were met? Explain.	If so can they provide evidence to illustrate this growth?	Do you feel that students will be able apply what they have learned to different environments? Explain.
	ED#Q4a.3 How do you think this experience has influenced student development of a positive environmental identity?	In what ways do you believe that establishing this connection is an essential part of what this experience is about?	If so what aspects of the experience do you think helped establish this connection?
	ED#Q4a.4 Do you think the students will be able to embrace this connection once they return to their daily lives? Explain	Can you provide evidence of this? Explain.	What activities did students participate in to help them make this connection?
Is there any additional information we may have over looked that could help use better understand the connection between the formal classroom and a residential environmental learning center?			

Appendix E: Naturalist Instructors Interview Protocol

Goal: To conduct a 20 minute interview to reveal information about background of any educational training, professional development resources available to them, their perceptions of what students are learning, and opinions of students preparedness upon arrival.

Documentation: Informed consent and curricula materials

Introduction Questions:

Briefly describe your role at GSMIT.
Briefly describe your professional or experiential background that you believe contributes to your success at GSMIT.
Briefly describe Ideal relationship between GSMIT and the schools that attend.

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
RQ1 How do schools incorporate a residential environmental learning center experience into their school curriculum?	I#Q1.1 What instructional issues exist around students attending your residential program?	How do you prepare for the arrival of a new school?	
	I#Q1.2 Does attending GSMIT add value to student learning over and above formal classroom learning? Explain		
	I#Q1.3 Describe the academic relationship between most schools and the center.		
	I#Q1.4 How is the residential experience used as an extension of classroom instruction? Explain		
	Explain the 50/50 relationship between the Classroom teachers and GMSIT instructors.	In what ways do you collaborate with the teachers during the program? Explain.	Are there perceived benefits of the 50/50 as opposed to 100% GSMIT instructor lead? Explain.
RQ2 What are the outlined objectives of the residential environmental learning center? a. How are these objectives met by the residential learning center?	What are the expected learning objectives for students attending GSMIT?	With respect to content, what do you want your students to get out of the experience?	Other expectations?
	I#Q2a.1 Are there aspects of the experience that influence student thinking or actions that extend beyond instructional methods?	If so how is this included in to the experience?	How does your program assess its effectiveness?

Research Question	Primary Interview Questions	Secondary Interview Question	Tertiary Interview Question
	I#Q2a.2 What evidence exists of activities or lessons that drive critical thinking, encourage problem-solving, and allow students to gain ownership with the material.	Does this include guided inquiry, project-based, student centered instruction or citizen science? Explain	Do any of these activities bridge the gap between the experience and the formal classroom?
RQ3 What methods of instruction and curricular resources are used by the residential learning center to meet the learning objectives and how is the content aligned with that of the school curricula?	I#Q3.1 What evidence exists for the use of high quality instruction at both the school and the residential environmental learning center?	Do you have any formal teaching experience? Does the program provide any instructional training?	
	I#Q3.2 With respect to content integration is there a direct link between the residential experience and classroom activities?	Does the residential program specifically address students' prior knowledge that they have acquired in classroom learning?	
RQ4 What do stakeholders perceive as the delivered curriculum at the residential environmental learning center during the students' time at the center? a. What are the perceptions held by the educational directors and instructional staff at the educational learning center?	I#Q4a.1What do you teach to the participants during the experience? Explain	What was the most meaningful thing that students learn at Tremont?	I#Q4a.1.1What is the actual take-home message?
	I#Q4a.2 To what extent do you believe that the objectives are being met?	I#Q4a.2.1Can you provide evidence to illustrate this position? Explain	Do you feel that your students will be able apply what they have learned to different environments? Explain.
	I#Q4a.3 How do you think this experience has influenced student development of a positive environmental identity?	In what ways do you believe that establishing this connection is an essential part of what this experience is about?	If so what aspects of the experience do you think helped establish this connection?
	I#Q4a.4 Do you think the students will be able to embrace this connection once they return to their daily lives? Explain	Can you provide evidence of this? Explain.	What activities did students participate in to help them make this connection?
Is there any additional information we may have over looked that could help use better understand the connection between the formal classroom and a residential environmental learning center?			

Appendix F: Student Questionnaire

Hello Friends,

I hope you have enjoyed your time with us. Your opinion is very important to us. Please answer the following questions so that we can do better next time.

1. What was the most meaningful thing that you learned?

2. What was the most confusing aspect of your experience here?

3. What experience would you like to repeat or topic you would like to learn more about?

Appendix G: Case 1 Outline

Case 1 Outline

1. Description of School:

Number of Students/Chaperones:	68/7
Classification of School:	Public, Urban
Grade:	7th and 8th

2. History of Tremont:

This school has been attending Tremont for the past 5 years. They had some extra money budged for an afterschool program. One of the lead teachers had already gown to it for another school district and they moved quickly to set it up. The first year, the teachers went blindly, to the teachers escape weekend to get information and look around. They had an opportunity to talk to other teachers and get a feel for what Tremont had to offer. Students are invited to join. They try to reach students that have the most to gain from the experience. This is determined by a student's predicted T-CAP score. Those students that are at the transitional areas between levels get the first round of invitations, because they have the potential to move up into a higher score with a little boost or enrichment. They then open it up to the rest of the students, by advertising it as educational trip from the beginning. They tell the students "Lots of learning, no books." Over the years the afterschool program has been developed by a tight knit group of teachers.

3. Preparation: (None, Content, Experience, Duty)

The afterschool program includes all three categories of preparation (content, experience and duty) into a required 32 hours that extends beyond regular classroom instruction. We first have an introductory meeting and we actually pretest them based on content in state standards, including science and math. Students complete lessons designed to reinforce concepts they will be exposed to at Tremont. Some of these lessons are used for the Tremont curriculum but others have been developed by the teachers but all of the lessons are aligned with the state standards. In the formal science classroom Tremont acts as a cap stone experience bringing together and unifying the content presented to the students throughout the year.

Experience: The first thing they cover policies and procedures. They introduce students to the idea that when someone raises their hand up they have three seconds to get quiet. No shushing, just get quiet. They talk about supplies they need and those they don't need, this transitions into a game where students to practice packing their gear. This school takes students on hikes to reinforce trail educate and to develop map skills. Another activity they do helps students develop observation skills by having them walk a section of trail, count and try to remember as many things as they can that are not clearly part of nature. In the formal science classroom these students are outside as much as possible. The teachers use an area at the edge of campus to do a biodiversity project where the students in their classes identify all taxa of life in a given area. This experience provides students a background for phonology plots and the ATBI project within the National Park.

To prepare students for their expected responsibilities and duties, this school hosts a mandatory lock-in. During this time students participate in a dress rehearsal of the family style meals. The teachers explain the responsibilities of the table captions, custodial captions and concepts like zero food waist.

4. Funding:

Over the years they have adapted after school program to support their financial needs. The after school program sponsors fundraisers provide additional funds to help cover costs, some people in the community donate or sponsor kids. But for the most part funding the trip has never really been an issue. The group has excellent administrative support.

5. Issues Related to Participation:

They let the students know that their participation is a privilege and that proper behavior is not just expected but required. This is reiterated at all of your meeting because when the students get to Tremont will know what is expected of them. For the most part they have never had any real issues with behavior, and any "small issues seem to get worked out by nature." An example of this would be the student that is messing around falls in the stream. This school has only needed to accommodate students with special needs on a rare occasion. This includes students with physical disabilities taking an alternate hike, but these issues are easily addressed within the flexibility and help of the Tremont staff.

6. Alignment to School Curriculum:

All of the activity's the students do in the afterschool program and while at Tremont are directly aligned to state and national standards, but the main focus for this school is science and math.
For this school students cover all of the major content of Tremont before they attend. This includes rock cycles, geology, cells, and life science. The only thing that they cover after the experience is a section on physics. So in this way students that attend Tremont have the background information they need to be successful at the camp and expend upon the information that they have already been exposed to.

7. Follow-up activities:

As part of the funding requirements of the afterschool program, this school conducts follow-up surveys with students and tracks student performance on the State T-CAP test. Over the past five years they have been able to show that a significant portion of the students that participate in the program have an increase in both science and math scores. After they return from Tremont teachers describe the students as having a hunger to learn and more importantly this phenomena is infectious. Causing students that didn't attend to take classroom learning more seriously.

8. Expected Outcomes - Take Home Message:

1. to get kids outdoors, and get them to love nature
2. Provide them some ideas about what they want to do with their careers.
3. The added benefit of increased test scores,
4. Their attitude to learning when they get back is so much greater.
5. Life skills, we are building the responsibility, mom and dad are not there to take care of them so it is building that independence.
6. Unplug
7. Improved attitude for learning, real learning not book answer finding. For the students to become lifelong learners
8. Personal Challenge

9. Tremont Schedule:

Little Greenbrier School	Salamander Monitoring and Scientific Method
Cooperation Course	Wildlife
Hired Entertainment – Storytelling, Folk Dancing, String Band	Wilderness Navigation
All Day Hike	Astronomy
Night Walk	

Note: this school keeps students going every minute of every day. All time is scheduled; even down time built in to the experience is used for a structured enrichment game or activity. On such activity they do is fort building, this is an open inquiry where students only directions are to build a shelter out of materials found on the forest floor and then when the activity is over they need to break down their forts and return the materials back to the forest.

Appendix H: Case 2 Outline

Case 2 Outline

1. Description of School:

Number of Students/Chaperones: 50/6
Classification of School: Public
Grade: 6th

2. History of Tremont:
This school has been attending Tremont for the past ten years. Science Teachers have taken the lead, taking responsibility for all aspects of the experience. The after some changes to the teaching staff, administrators knew this was something they wanted to continue doing. At that time the current lead teacher reluctantly inherited this responsibility when they became a sixth grade teacher, but over the years has made it their own.

3. Preparation: (None, Content, Experience, Duty)
No preparation beyond the content provided in the regular sixth grade classroom, as dictated by state standards. Reasons for not including components such as content, experience and duty: 1) lack of time because of standards and testing. 2) Class size to large to take students outside. 3) To avoid the negative perception around food waste.

4. Funding:
Students participate on a volunteer bases and receive Tremont financial add as needed. The school also hosts fundraisers to raise money to cover additional costs such as transportation.

5. Issues Related to Participation:
The major concern for this school is the students that cannot attend. The teacher does not want the work that is left behind to appear as punishment for the students because they can't go. So these lessons are just fun activities. This reduces any jealousy for the kids that don't get to go.
"There's that fine line of getting them excited and giving them the background knowledge without making the other kids feel like they're missing out of something that is really cool."
The main reason students don't attend is because of costs, and being away from home. Less frequent issues would include physical disabilities. In this teachers perspective students with learning disabilities, they tend to blossom at Tremont. Furthermore they rarely have any behavioral problems; in fact some of the largest behavior problems at school become star students at Tremont

6. Alignment to School Curriculum:
Tremont has aligned curricular resources to the state standards. The timing of the is in the spring to facilitate fundraising and chaperone schedules. The teacher perceives that the curriculum is more aligned to the material that is presented in the fall semester but for these reasons they have to wait until spring. More specifically the ideal timing of the trip would co inside with the presentation of the material in order to provide an immediate example of the content while it was fresh on the student's brain.
"The timing is pretty bad, because here we typically cover life science and bio diversity and interdependencies in the first semester, but for many reasons we can not go in the fall."
Typically this school comes home from Tremont and goes on spring break. So students have a week off before they return to school. This was done deliberately to reduce the discrepancy between those who went and those who didn't.

7. Follow-up activities: NONE

8. Expected Outcomes - Take Home Message:

1) Teacher wants to kids to make the connection from lessons taught at Tremont to the greater community.
2) To give the students an opportunity to leave the county and stay the night away from their parents.
3) There is so much more learning besides just the content that goes on, kids have changed because of the this trip. (Social Skills, Learning to live with other people, respecting other people, cooperation)

4) I want them to take away an appreciation for nature and for their backyard.
5) But just a learning experience of observation and being able to, you know, to observe around them, instead of just blindly following the person in front of you.
6) To share the experience their family and the community.

9. Tremont Schedule:

Native American Culture and History	Salamander Monitoring
Hired Entertainment	Geology Hike to the falls
Little Creatures	Astronomy
Wilderness Navigation	All Day Hike

Appendix I: Case 3 Outline

Case 3 Outline

1. Description of School:

Number of Students/Chaperones:	24/3
Classification of School:	Public/ Urban
Grade:	6^{th}

2. History of Tremont:
This school incorporates Tremont in to the school as part of a wellness program of getting kids unplug, getting them out and moving to help their health , to help their body and just to appreciate nature for what it is. The lead teacher is the head of the physical education department and established the Tremont relationship at this school six years ago. In the past couple years the program has expended to include involvement of the science club but this aspect of the relationship is relatively new.

3. Preparation: (None, Content, Experience, Duty)
Experience: This school has their students practice hiking. This includes instruction on topics including Leave No Trace and trail educate. As far as science content preparation they have not done much in this area up to this point but there are plans to incorporate aspects of the program in to the science club. Beyond the discussion of the daily schedule this school does not prepare their students with respect to duties or facility responsibilities but they do express the importance of compliance and participation.

"What I want them to get out of it, you can't really teach anyway."

"They get a lot out of it that's not in a book."

4. Funding:
Students participate on a volunteer bases and receive Tremont financial add as needed. The school also hosts fundraisers to raise money to cover additional costs such as transportation.

5. Issues Related to Participation:
In order to be eligible for the trip Students must provide two letters of reference and are required to right a paper explaining why they would be a good candidate to go to Tremont. This school has not experienced any behavior issues or had to accommodate students with special needs.

6. Alignment to School Curriculum:
Tremont provides curricular resources aligned to state and national standards, but for the most part there is weak alignment in science. But the experience has more of an enrichment expectation.

7. Follow-up activities:
Students not attending are writing a grant to secure funding to establish the schools own phonology plot. This will be used to not only monitor seasonal changes at the school but also allow the students an opportunity to analyze how geographical differences and other environmental factors influence plant growth at their campus and determine differences while at Tremont. It is perceived that for students participating in the Tremont experience will have increased understanding of the phonology plots in the national park and in turn get more out of that part of the experience. For the students that cannot attend they will still benefit from the experience of weekly observations and participation in scientific processes.

8. Expected Outcomes - Take Home Message:
1. Slowdown and appreciate nature.
2. UNPLUG
3. Teamwork

9. Tremont Schedule:

Cooperation course	Trees are Tremendous
Hired Entertainment – Story Telling	Geology Hike to the Falls
Night Hike	Explorations

Appendix J: Case 4 Outline

Case 4 Outline

1. Description of School:

Number of Students/Chaperones:	19/6
Classification of School:	Private/Rural
Grade:	4th thru 7th

2. History of Tremont:
When this school first started attending Tremont they only took 1st and 2nd graders, and the experience consisted of a day trip. They would spend the whole day in the water, catching Salamanders. This continued for two or three years until the lead teacher moved up teaching 4th thru 5th grades, at that point the students would stay for 3 days. For the past 5 years they have taken students in 5th through 7th grades. Many of the students have had multiple experiences at Tremont.

3. Preparation: (None, Content, Experience, Duty)
Content: "Tremont is a topic of discussion from day one in my classroom." This year the students have been studying bio-diversity. They drew pictures of animals and flowers that might not be recognized being part of the Smokey's and they all wrote a paper on bio-diversity. Also they do experiments that connect students with the outside, and discuss topics like the invasive species.
Experience: This school spends a lot of time outside of the classroom. In fact students participate on multiple hikes prior to attending Tremont. During these hikes students are encouraged to observe and take in the beauty of nature, but they are also asked to point out different things that they see. This way they can share their findings with the larger group.

4. Funding:
This school accepts Tremont financial aid when applicable but for the most part the school is able to cover the expense. Some family's chip in to assist with students that can't afford gear. But for the most part they make it work.

5. Issues Related to Participation:
The students that don't attend Tremont do activities from the Tremont lesson pack. It is for this reason the lead teacher does not use these lessons as pre-experience activities. Behavior has never been an issue and up until this point this school has not had to accommodate any students with special needs on the Tremont trip.

6. Alignment to School Curriculum:
Tremont activities are aligned with the state standards, but the message that is delivered at Tremont goes much further than that. They link the experience directly into history, science, and even math, but this school integrates the Tremont experience at a much deeper level than content standards. As a christen school they want students to see the beauty of god's creation and understand the importance of being good stewards of the environment.

7. Follow-up activities:
After the experience, teachers brake down the experience asking students consider what they did while they were there and to think about why they did those activities. This reflection helps the students connect the experience back to the school. If fact the students' wanted to do a conservation project in their cafeteria, so the students did a benefit analysis for switching to cloth napkins like at Tremont. Also the school is in the process of establishing a phonology plot so that they can collect their own long-term weather and climate data, but also share these data with Tremont. Students are required to write follow up letters to the staff and or thank those who helped provide this opportunity.

8. Expected Outcomes - Take Home Message:
1) to gain a real appreciation for gods creations (Nature) and enjoy it
2) to develop habits of stewardship that will go beyond Tremont to home and the community
3) to develop sense of teamwork

9. Tremont Schedule:

All Day Hike	Little Creatures
Freddie the Fungus	Hired Entertainment – Band
Walker Valley Living History	Night Walk

Appendix K: Case 5 Outline

Case 5 Outline

1. Description of School:

Number of Students/Chaperones:	22/6
Classification of School:	Public/Rural
Grade:	7th

2. History of Tremont:
The first time the lead teacher went Tremont was on a teacher escape weekend. Their reason for going was to earn continuing education credits and to have fun. They had no intention of returning with the students. The school 6th grade goes to Nashville, the 8th grade goes to Washington DC, and the 7th grade goes to Tremont. It is part of the school culture.

3. Preparation: (None, Content, Experience, Duty)
No preparation beyond the content provided in the regular sixth grade classroom, as dictated by state standards. Reasons for not including components such as content, experience and duty: 1) So much content to be covered in the State standards there is no time. 2) Not all students attend so they won't understand the duties expected by Tremont.

4. Funding: NONE

5. Issues Related to Participation:
This school has identified behavior as an issue they have had to overcome. "I think they are so excited there in a new environment, they have this problem of not listening." They attempt to manage this issue by being highly structured, but for the most part students settle down after the novelty wears off.

6. Alignment to School Curriculum:
Activities and lessons the students do at Tremont are aligned with the state standards, but there is no additional alignment. The only consideration is make sure that the trip does not conflict with schools spring testing schedule.

7. Follow-up activities: NONE

8. Expected Outcomes - Take Home Message:

1) They want the students to gain an application for outdoor activities in their community
2) Unplug and connect with nature.
3) Learn that they are part of a community, and you should clean up after themselves.

9. Tremont Schedule:

Astronomy	Cooperative Course
All Day Trip – Cades Cove	Insect Search
Geology Hike to the Falls	Hired Entertainment – Story Telling

Note: The school schedules down time for students, because the kids that are not use to going all day, they need that down time, and most of them take advantage of it.

Appendix L: Case 6 Outline

Case 6 Outline

1. Description of School:

Number of Students/Chaperones:	44/6
Classification of School:	Private, Urban
Grade:	6th

2. History of Tremont:
This school has been attending Tremont for the past 17 years. This experience is part of a large informal science program which includes a 7th grade trip to the Florida Keys and an 8th grade trip to Washington DC. This is the third for the lead teacher, but the teacher was hired knowing this was part of their responsibility as the science teacher. Having experience as an informal science instructor the lead teacher accepted the responsibility knowing the power these experiences on student learning. The 6th grade trip includes other experiences beyond those provided by Tremont; in fact the whole trip provides an opportunity to discuss the difference in ecosystems, and geology of the southeast. As they drive from the gulf coast to the smoky mountains students experience with these geographic region.

3. Preparation: (None, Content, Experience, Duty)
Content: Everything the students do in the science classroom prepare the students for the Tremont experience. "It takes the entire year of your science and it brings it full circle." Students start in the fall studying rocks and minerals then earthquakes and plate tectonics, then they move into the force of water, weather and erosions and just before the trip the students learn about habitats. Then the trip is used to bring all that information together and show the students that no one part can stand alone. In the classroom students can get the impression that these concepts are separate and unrelated but at Tremont the students see that everything is interconnected. It really takes everything the students have done and puts it into one week. "I would want to go to Tremont, because it has all of that earth sciences right there. It's the perfect classroom for that."
Experience: In these students science class they spend a significant amount of time in the outdoors. They have a wooded area behind their school where they go on hikes practice appropriate trail educate. Prior to the trip students do several days of nature journaling, and also some Tremont activities that help the students observe. Not just see, but really pay attention to all the things around them.

4. Funding:
This school accepts Tremont financial aid when applicable but for the most part the school is able to cover the expense. To cut costs for some kids they are able to slip them into other rooms with other students. This helps cover their additional hotel costs, and they just pay their Tremont part.

5. Issues Related to Participation:
The students that don't attend Tremont are given their own journal and are expected to do a series of activities in the outdoors. Unfortunately the entire 6th grade goes on the trip so there is no one at school for these students so they stay at home and this can cause problems at home. But usually it is only one or two children. Behavior has never been an issue and up until this point this school has not had to accommodate any students with special needs on the Tremont trip.

6. Alignment to School Curriculum:
This school schedules the experience toward the end of the year so they have time to prepare the students content knowledge and also because the teachers get to know the kids better.

7. Follow-up activities:
When students return they go to wooded area behind the school and discuss the different soil horizons. This helps to tie the experience back to their home and show them it is connected. Students also continue to journal when they get back.

8. Expected Outcomes - Take Home Message:

1) I want them to know how to act in nature and it's not a scary place.
2) I want them to see that nature is a neat place that you can discover all kinds of things.
3) I want them to know how to respect nature and come back with a greater appreciation for nature.

4) It is OK and it is fun to be out there to touch things and to get dirty. That's part of science, and that's what makes it cool, all of those things.

5) Them to learn how to live with each other.

9. Tremont Schedule:

Wilderness navigation

Life in the forest

Eco-Jeopardy

Hired entertainment (ST)

Night Walk

Geology Hike to the Falls

Stream life

Appendix M: IRB Approval

January 23, 2012

MEMORANDUM

TO:	Ryan Walker Cathy Wissehr
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	12-01-414
Protocol Title:	*A Multiple Case Study of the Relationships Between Middle Level School Science Programs and a Model Residential Environmental Learning Center*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 01/23/2012 Expiration Date: 01/22/2013

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 530 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

Appendix N: National Park Service Research Permit

SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Great Smoky Mountains NP	Study#: GRSM-01092 Permit#: GRSM-2012-SCI-1092 Start Date: Jan 01, 2012 Expiration Date: Dec 31, 2012 Coop Agreement#: n/a Optional Park Code: n/a

Name of principal investigator:

Name: Ryan Walker **Phone:** [redacted] **Email:** n/a

Name of institution represented:

University of Arkansas

Co-Investigators:

No co-investigators

Project title:

Relationships Between Middle Level Science Programs and a Residential Environmental Learning Center: Multiple Case Study Approach to Reveal Best Practices.

Purpose of study:

The purpose of this study is to identify the best practices for schools implementing a EE in conjunction with a residential component. By understanding the relationship between well-established formal EE programs and a large well-established informal residential environmental center we can learn how to best integrate these two essential components to foster student learning. Residential programs are extremely diverse with respect to methods of instruction and focus of materials, and the schools are equally diverse in nature. This project will closely examine the relationships between these groups to identify effective use of curriculum and instruction, Reveal best practices,Identify areas of improvement,

Outline Ideal strategies for content integration,

Explore the stake holders perceptions of both the motivations for participation and also presumed effects on student learning.

Subject/Discipline:

Social Science

Locations authorized:

The Great Smokey Mountain Institute at Tremont

Transportation method to research site(s):

vehicle

Collection of the following specimens or materials, quantities, and any limitations on collecting:

NA

Name of repository for specimens or sample materials if applicable:

n/a

Specific conditions or restrictions (also see attached conditions):

READ AND ABIDE BY NPS GENERAL CONDITIONS #1-18 (enclosed).

YOUR WORK PLAN AND ALL RESEARCH INSTRUMENTS AND INTERVIEW QUESTIONS MUST BE APPROVED BY GREAT SMOKY MOUNTAINS INSTITUTE DIRECTOR KEN VOORHIS OR HIS DESIGNATE PRIOR TO USE. YOU MUST NOT DISTRUPT THE VISITOR EXPERIENCES OF THE STUDENTS YOU ARE

STUDYING. If Mr. Voorhis or his designate requests that you stop an action, please follow stop immediately.

THE PRINCIPAL INVESTIGATOR AND ALL CO-INVESTIGATORS MUST CARRY A COPY OF THE SIGNED RESEARCH PERMIT WITH THEM AT ALL TIMES WHILE WORKING IN THE PARK. IF you need to add any co-investigators who will work apart from the PI, MAKE COPIES FOR EACH "SATELLITE" GROUP and inform Resource Coordinator of additional names (paul_super@nps.gov; 828-926-6251).

Please contact park Research Coordinator (paul_super@nps.gov, 828-926-6251) about depositing copies (or originals) of completed surveys in the park achieves, once names and other confidential information has been redacted.

YOU ARE REQUIRED TO SUBMIT AN ONLINE REPORT OF YOUR RESEARCH ACTIVITIES EACH YEAR, and you must mail two copies of your final research report to our office upon completion of your project. Even if you did no work in the Park during a calendar year, you must go online and say so. The URL and password needed to input your Investigator's Annual Report are distributed electronically to permit holders at the end of the calendar year by Washington. We also request two copies (or one electronic copy) for our library of any publications, dissertations, etc. that use data collected in Great Smoky Mountains National Park.

Breach of any of the terms of this permit or for violation of park regulations will be grounds for revocation of this permit and denial of future permits.

Recommended by park staff(name and title): Biologist

Reviewed by Collections Manager:

Yes ___ No ___

Approved by park official:

Date Approved: 12/5/2011

Title:

Supervisory Bio./I&M Coordinator

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

(Principal investigator's signature)

12/22/2011
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)