ENVIRONMENTAL ATTITUDES AND CONNECTIONS TO LANDSCAPES OF UNDERGRADUATE REGIONAL FIELD COURSE STUDENTS

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ABSTRACT

A fundamental goal of geoscience education is to ensure that all people have a basic understanding of the natural processes that shape the earth (Locke, Libarkin, & Chang, 2012). Field studies courses are offered at many colleges and universities in the United States and give students access to hands-on learning and outdoor experiences. In-depth outdoor experiences can influence environmental attitudes (Okada, Okamura, & Zushi, 2013). Other research has indicated that outdoor field experiences enhance student enthusiasm, motivation, and learning (Boyle et al., 2007; Hope, 2009).

This study examined student connections with landscapes, and emotional responses of students to the field course experience. Surveys were completed by students participating in one of four earth science field courses. The data was analyzed to determine whether students developed personal connections to the locations of the field course, and whether this experience influenced their environmental attitudes.

The researcher found that the environmental attitudes of the students surveyed did not change significantly ($p<.05$). Many students reported no change in their environmental attitudes, but a number of students did indicate a deepening of appreciation for the natural world. Additionally, the study found that many students did develop personal connections to the location(s) of their field courses. The personal connections developed by students ranged from spiritual connections, intellectual connections, and personal desires to protect the places where they went on the field course.

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CHAPTER 1.

INTRODUCTION

Relevance of the Study

With increasing global environmental degradation, there is a growing need for a world citizenry that is environmentally literate (Locke, Libarkin, & Chang, 2012). According to Wysession (2012), "Human impacts are no longer an asterisk in Earth science: Our activities are changing the composition of the atmosphere, hydrosphere, biosphere, and cryosphere and altering land surfaces faster than any other natural process" (p. 32). However, in the United States environmental literacy is lacking in the majority of the general public. Coyle (2005) asserted that 80% of Americans are strongly influenced by outdated environmental myths and falsities. For example, 45 million Americans believe the oceans are a source of freshwater. Another 120 million Americans believe that spray cans still contain CFCs (Coyle, 2005). The study compiled by Coyle (2005) on Environmental Literacy also found that only 12% of Americans can pass a basic energy resource quiz.

Locke, Libarkin, and Chang (2012) described the fundamental goal of geosciences education as ensuring that all people understand the natural processes that shape planet earth, and know how the actions of humans have an impact on the earth at all levels. The Earth Science Literacy Initiative (ESLI) driven by the National Science Foundation has asserted that, as a society, we must have earth science literate governments, citizens, and businesses in order to survive as a species (2010). Earth science literacy includes at least a basic understanding of earth's systems, knowledge of how to access credible scientific sources of information, and the ability to make informed and responsible decisions about natural resource use (ESLI, 2010). The most common challenges associated with achieving earth science literacy include the lack of public understanding as to the importance of earth science, religion, and lack of consistent communication from geoscientists to the public (LaDue & Clark, 2012).

A key component of geosciences education at any level is fieldwork. Thompson (1982) defined fieldwork as “practical, experimental study” of natural systems that will ultimately prepare students for life outside of school, as consumers and decision makers (p. 59). Further, Thompson (1982) asserted that studies of natural systems, without an outdoor component, are dull and disconnected from the actual subject being studied. Van der Hoeven Kraft et al. (2011) described a primary goal of geosciences educators as the engagement of students in learning geosciences where they will continue to be motivated to learn about earth’s systems throughout their lives.

D’Allessio (2012) has argued that many students today are cut off from experiences in the natural world and thus lack observational skills and engagement necessary to understand how the earth works. Technology detracts from true observational skills, yet many students today are learning primarily through technology. Curiosity and enthusiasm for learning about earth science is lacking in students who do not have direct experiences in the natural world (d’Allessio, 2012). Thus, a primary priority for the environmental and geosciences education communities is to encourage direct experiences in the natural world, and to build upon those experiences with relevant science content.

Research has indicated that fieldwork benefits student learning on multiple levels. Improved student learning of the subject matter paired with enhanced academic and social integration result from fieldwork experiences (Boyle et al., 2003). Additionally, research has indicated that affective responses of students to fieldwork experiences can lead to deeper learning (Hope, 2009). Boyle et al. (2007) noted an increase in the enjoyment of learning by students who participated in outdoor fieldwork. Fieldwork often requires students to spend significant time in the outdoors, sometimes in remote regions. Research has indicated that repeated visitation to a natural setting can lead to emotional attachment to the land by visitors (Vaske & Kobrin, 2001). This place-attachment has been linked to environmentally responsible behavior (ERB) (Vaske & Kobrin, 2001).

Tuan (1974) defined topophilia as the affective bond between people and place. Tuan asserted that myriad factors influence one's perception of the environment around them. Age, gender, culture, family background, and whether one is a native or visitor to a place, play a role in how an individual perceives a landscape (Tuan, 1974). Landscapes, natural and unnatural, do invoke different feelings in individuals for reasons known and unknown. The concept of topophilia has been explored in different areas of research, including environmental perception, attitudes and values (Tuan, 1974) and studies on the quality of life (Ogunseitan, 2005).

Students who participate in field-based geosciences courses spend significant amounts of time, from days to months, outdoors. Studies have shown that field-based learning enhances student understanding of geosciences concepts and emotional connection to the material (Boyle et. al, 2007; Elkins & Elkins, 2007; Hope, 2010). Additionally, in-depth outdoor experiences have been found to positively influence environmental attitudes (Okada, Okamura, & Zushi, 2013). Van der Hoeven Kraft et al. (2011) have asserted the need for an empirical study to measure students' connections with the earth. Research into student's affective responses to in-depth field-based courses is needed to understand what role emotional connection to the subject plays in geosciences students' learning and attitudes towards the earth.

Purpose

Geosciences education at the undergraduate level exposes students to diverse landscapes through field studies courses. These courses can last from a few days to several weeks and require students to spend ample amounts of time outdoors, often in remote settings. Students learn in-depth about the natural processes that shape the particular region, and often the cultural influences of the place. While increased knowledge of geosciences content may not strengthen students' connection to the earth (Smaglik, 2008, as cited in van der Hoeven Kraft et al., 2011), an affective connection to a particular landscape, coupled with the knowledge of geosciences processes, may enhance students' sense of place, and responsibility towards the environment. This study assessed how students' environmental attitudes are affected, if at all, after participation in a summer field studies course. Additionally, the study gauged the ways in which students connect to the location of the field course.

Research Questions

1. Does participation in a science-based field course influence the environmental attitudes of students?

2. What connections, if any, do students have or develop with the location of the field course?

3. What emotional response to the field experience do students report?

Given the research indicating that environmental attitudes are influenced by experiences in the outdoors (Bogner, 1998; Okada et al., 2013), the researcher hypothesized that students will develop more positive environmental attitudes after completing the field course. Additionally, the researcher believed that students would develop personal connections, such as an appreciation for the natural beauty of the landscapes, with the site of the field course after spending time there.

Definitions

For the purpose of this study, it is important to define the following key terms:

Earth science literacy includes: an understanding of "the fundamental concepts of earth's major systems," knowledge of how to "find and assess scientifically credible information about Earth," the ability to "communicate about Earth science in a meaningful way," and the ability and willingness to make "informed and responsible decisions regarding Earth and its resources" (ESLI, 2010, p. 2).

Geosciences education is, "any discipline that pertains to the studies of Earth, including geology, physical geography, meteorology, and oceanography" (van der Hoeven Kraft et al., 2011, p. 71).

Fieldwork can be defined as, "any component of the curriculum that involves leaving the classroom and learning through firsthand experience" (Boyle et al., 2007).

Topophilia is the "affective bond between people and place or setting" (Tuan, 1990, p. 4).

Environmental attitudes on a positive level represent, "those persons who regard nature for its intrinsic value" (Ewert, Place, & Sibthorp, 2005, p. 227).

CHAPTER 2.
LITERATURE REVIEW

This study encompassed a range of topics in the literature. The topics that will be discussed in the upcoming sections include Earth Science literacy, Geosciences Education, Fieldwork, and Environmental attitudes and behaviors.

Earth Science literacy

Steffen et al. (2011) have described the Anthropocene, or era of humans, as a time of rapidly decreasing natural resources, degradation of ecosystems, and reduced ability for the earth to absorb our waste. More than ever, humans are affecting all components of this planet's natural systems, in many cases to the detriment of the health and well-being of all species, including humans (Steffen et al., 2011). The need for an earth science literate world population is of growing importance to prevent what Steffen et al. (2011) have predicted to be a "one-way trip to an uncertain future in a new, but very different, state of the Earth system" (p. 757).

Wysession (2012) further argued that humans have and continue to significantly alter the earth. Almost 40% of all land on earth is used to grow food. The amount of paved land in the United States is roughly equal to the size of the state of Georgia. Resource consumption is at an all-time high (Wysession, 2012). Lock et al. (2012) suggested that educating the public in earth systems science is critical to ensuring a sustainable future on earth for the human race. Dal (2009) asserted that earth system science education gives students the ability and knowledge to make responsible decisions regarding resource use. Additionally, the teaching of earth science can raise the level of consciousness in students towards the natural environment, which may lead to more environmentally responsible behavior (Dal, 2009).

The Earth Science Literacy Initiative (2010) defined nine "Big Ideas" that are essential to earth science literacy. These include:

1) Earth scientists use repeatable observations and testable ideas to explain our planet;
2) Earth is 4.6 billion years old;
3) Earth is a complex system of interacting rock, water, air, and life;
4) Earth is continuously changing;
5) Earth is the water planet;
6) Life evolves on a dynamic Earth and continuously modifies Earth;
7) Humans depend on Earth for resources;
8) Natural hazards pose risks to humans;
9) Humans significantly alter the Earth (ESLI, 2010, pp. 4-12).

These concepts represent an overall picture of what humans can and should understand about the planet in which they inhabit. King (2008) supported the notion of earth science literacy through geosciences education. According to King (2008), systems thinking are not typically taught in other subjects, yet much of life on this planet involves complex interactions and feedback systems. Further, comprehension of earth sciences can only benefit human society from local to global scales (King, 2008).

LaDue and Clark (2012) presented the findings of a study about educators' perspectives on the challenges of developing an earth science literate population. Of high importance for educating an earth science literate population is: early exposure to the earth sciences in schools, high school level earth science courses, and hands-on problem-based learning through direct experiences (LaDue & Clark, 2012). The geosciences community has the knowledge and tools to educate an earth science literate population, however, a lack of public understanding of the importance of earth sciences, as well as religious and political agendas, make the transfer of knowledge difficult (LaDue & Clark, 2012). King (2008) has indicated that geosciences educators play an imperative role in educating and inspiring students to study and understand earth's systems. Continued research into best practices for achieving earth science literacy in students is needed (King, 2008).

Geosciences Education

King (2008) has described five distinctive attributes of geosciences education: 1) Large-scale thinking, predicting the past, and interpreting large and incomplete data sets; 2) comprehension of earth systems and complex feedback loops; 3) high level spatial thinking; 4) deep time perspectives; and 5) fieldwork (King, 2008, pp. 188-189). In recent years, emphasis in geosciences education is moving towards earth systems theory, rather than the study of disjointed disciplines related to earth science (King, 2008). Libarkin and Kurdzeil (2006) summarized findings from the American Geophysical Union report as strongly encouraging the development and implementation of earth system science courses by all science education institutions.

Students in the K-12 school system in the United States, under the Next Generation Science Standards (NGSS), will receive foundational knowledge about earth system science (Wysession, 2012). The NGSS are designed to introduce students to basic earth science concepts, and then build upon those concepts as they progress through each grade level. At the elementary level, students learn about *Space Systems*, *Earth's Surface Systems*, and *Weather and Climate*. Starting in middle school and continuing in high school, students will study *Human Impacts* on earth (Wysession, 2012). The students surveyed in this study may or may not have had earth science education prior to attending college. However, determining the effectiveness of geosciences education at the grade school levels and how it affects student learning at the college level may be valuable.

Geosciences education at the college/university undergraduate level provides students with the opportunity to understand earth system science from a more technical standpoint, as well as to truly appreciate the human impacts on earth's systems (Wuebbles, Asplen, & Brewer, 2006). Wuebbles et al. (2006) discussed the increasing prevalence of undergraduate geosciences programs that incorporate the human impacts on the earth with technical geosciences studies. Rather than teaching about earth systems as a separate, unique entity, geosciences education is being taught more and more from a practical standpoint that humans are indeed altering the natural world (Wuebbles et al., 2006). Thus, geosciences educators in higher education are in a prime situation to educate earth science literate students.

One of the major barriers to educating earth science literate students, as described by van der Hoeven Kraft et al. (2011), is the apparent lack of student engagement in introductory geosciences classes at the undergraduate level. Geosciences educators must engage and motivate students to develop skills and knowledge in the geosciences, and continue to do so even after they have graduated from college (van der Hoeven Kraft et al., 2011). Thus, the question arises: how do science educators best engage students in the field of geosciences education?

D'Allessio (2012) described challenges related to connecting urban geosciences students to geologic processes and concepts. "Urban thinkers," or people who spend much of their time indoors and connected to technology, tend to lack the observational and critical thinking skills necessary to truly succeed in the geosciences (d'Allessio, 2012). As technology and built spaces become more prevalent in peoples' lives, urban students in the geosciences often lack the spatial understanding, interest, and motivation to learn about the natural world, which relate directly to the affective domain of students (d'Allessio, 2012). The affective domain in reference to learning relates to a feeling, emotion, or degree of acceptance or rejection within the student, and is fairly complex and unique to each individual (Krathwohl, Bloom & Masia, 1964). Newbill (2009) asserted that students are more likely to be motivated to learn concepts when the assignments and content are relevant to them. Thus, geosciences educators must present geosciences content in a meaningful way that is relevant to the students. What are some ways that geosciences educators can pique student interest and motivation to learn about the planet they inhabit?

Van der Hoeven Kraft et al. (2011) suggested a model of the affective domain for learning in the geosciences. The model includes three overlapping concepts that influence students' affective connection to learning: *motivation, connections with Earth,* and *emotion* (van der Hoeven Kraft et al., 2011). Motivation refers to a student's sustained interest in the content. Connection with the earth is a highly personal component of this model, and refers to a student's personal connection with a landscape or geosciences concept. Emotion relates to how students respond emotionally to learning. Students with positive emotions towards learning (e.g., engaged, eager, comfortable) in an emotionally supportive learning environment, are more likely to maintain interest in and succeed in the area of study (Ainley, Hidi, & Berndorff, 2002; van der Hoeven Kraft et al., 2011). This study sought to determine how students affectively connect with the field course location, which in turns links to the earth component of van der Hoeven Kraft et al.' model (2011). Also, this study asked students to describe their experiences during the field course, which gave insight into the emotion and motivation aspects of the same model.

Additionally, van der Hoeven Kraft et al. (2011) asserted that the most effective measure of student responses to geosciences education is through the affective domain. Three commonly used strategies to enhance undergraduate geosciences education include: 1) peer instruction and formative assessment (McConnell et al., 2006; van der Hoeven Kraft et al., 2011), 2) field-based learning (Elkins & Elkins, 2007; van der Hoeven Kraft et al., 2011), and 3) place-based learning (Semken & Butler Freeman, 2007; van der Hoeven Kraft et al., 2011).

Peer teaching.

McConnell et al. (2006) emphasized peer teaching and formative assessment as effective tools to enhance student learning in the geosciences. Peer teaching enables teachers and students to interact in smaller group sizes, which allows for more open dialogue and a less formal learning environment. Formative assessment following the introduction of key concepts provides teachers with prompt feedback about student learning (McConnell et al., 2006). The practice of peer teaching coupled with formative assessment allows students to be active, rather than passive learners, and has been found to increase student learning in the geosciences (McConnell et al., 2006).

Field-based learning.

Studies have indicated a marked increase in student understanding of geologic concepts, and enhanced student interest in geosciences upon participating in field-based learning (Elkins & Elkins, 2007). Elkins and Elkins (2007) presented findings of a comparison study between students learning in classroom-based introductory level geology courses and two entirely field-based introductory courses. A Geoscience Concept Inventory, developed by Libarkin and

Anderson (2005) was used to assess student learning in these introductory geosciences courses. The researchers found that students who participated in the field-based geosciences courses had significantly higher concept test scores than the students who learned only in the classroom, which indicated that field-based geosciences education significantly improved student learning about geosciences concepts (Elkins & Elkins, 2007).

Place-based education.

A third practice found in geosciences education is place-based education. Place-based education focuses on specific environments, and engages students in experiencing a place on numerous levels, including scientific, cultural, and personal (Semken & Butler Freeman, 2007). Place-based education can enhance student learning by promoting a sense of place-attachment, which may render the science content more relevant and visible to students. In one study, students who participated in a place-based geology course experienced an increased place-attachment to their field study site (Semken & Butler Freeman, 2007).

Kudryavtsev, Stedman, and Krasny (2012) proposed that sense of place develops from direct experiences in nature coupled with relevant instruction. Students in field-based geosciences courses often spend days to weeks in a particular place, and are engaged in learning about natural processes. Thus, a sense of place and/or place-attachment is a viable outcome for students who participate in geosciences field courses.

Fieldwork

Thompson (1982) referred to fieldwork as practical work, with an ultimate aim of attaining student interest in "recognizing and solving field problems," and "having the motivation to do so even outside of the academic setting" (p. 63). Fieldwork can be utilized to develop intellectual skills and abilities, practical techniques, and to develop student interests and attitudes (Thompson, 1982).

King (2008) further asserted that geosciences fieldwork allows students to study the complexity and scales of geologic processes that are not available in the classroom. Additionally, the investigational and problem-solving skills necessary to study earth's systems can only be truly experienced outdoors, where the processes occur (King, 2008; Thompson, 1982). Time spent in the field can foster the development of social skills in students, as well as new interests, attitudes and values that may not otherwise develop in the classroom (Boyle et al., 2007; King, 2008).

Novelty space, or the comprehension of abstract ideas, is an important factor in student experiences of fieldwork (Cotton & Cotton, 2009). Orion (1993) asserted that the primary role of field-based learning is direct experience. Essentially, field-based experience can facilitate the comprehension of abstract concepts, yield meaningful learning and long-term, practical understanding (Orion, 1993).

Several factors influence student learning in the field. Some students may have never spent significant periods of time in the outdoors, thus orientation and preparation for the experience are crucial to ensure effective learning (Cotton & Cotton, 2009). Preparation of students for the field course experience on the cognitive, psychological, geographical (Orion, 1993), and social (Elkins & Elkins, 2007) levels may decrease student discomfort, and thus enhance the learning experience for students (Cotton & Cotton, 2009). Thus, each particular teacher and group may have distinct variables affecting student learning.

Overall, students who participate in geosciences field courses have reported positive and meaningful experiences (Besenyei, Watkin, & Oliver, 2003; Elkins & Elkins, 2007; Hope, 2009). Typically during a field course, days are spent at one or more locations where students are asked to perform observational skills, or complete specific tasks, such as peer teaching or problem solving. Often, too, there is time for reflection, sketching, and journaling. Field-based courses require significant amounts of planning to include travel, lodging, meals, and scheduling, which can be a drawback to teachers planning geosciences courses; however the benefits to student learning are abundant (Elkins & Elkins, 2007).

Fuller, Rawlinson and Bevan (2000) describe the primary goals of fieldwork, these include: 1) strengthening of observational skills; 2) real-life learning experiences; 3) encouragement of self-efficacy in students; 4) development of analytical skills; 5) “kindling a respect for the environment, especially where fieldwork is taken in remote areas” (p. 200); 6) promoting social development; and 7) reducing barriers between teachers and students. Field studies allow students to leave the classroom and observe natural processes in action. Besenyei et al. (2003) report student responses to fieldwork experiences. These students asserted that fieldwork provided them with valuable, real-life knowledge, and gave them memorable lifetime experiences.

In a number of studies, most students enjoyed the experience of fieldwork (Besenyei et al., 2003; Boyle et al., 2007). Fuller et al. (2000) reported that positive attitudes of students who participated in fieldwork likely resulted from enjoyable experiences and relevant information. Specifically related to the learning of geography, earth and environmental sciences, fieldwork has been found to stimulate high levels of interest and motivation in students (Boyle et al., 2007; Fuller et al., 2000; Hope, 2009).

Fieldwork also provides students with enhanced subject-specific learning, independent learning and problem-solving (Hope, 2010). Hope argued that fieldwork enhances and facilitates deep learning because it is active, rather than passive learning, and reaches the affective domain of students, attracting students' attention. This affective response, which awakens student interest, is what leads to true understanding (Hope, 2010).

Elkins and Elkins (2007) have suggested reasons for improved student learning in field-based courses, including: direct experiences with the subject being taught, an emotional response by students, and the number of contact hours. Besenyei et al. (2003) found that fieldwork can greatly facilitate student learning and understanding of environmental processes, systems and patterns, likely due to the direct contact students have with the subject being studied. Manzanal, Barreiro, and Jimenez (1999) provided evidence that fieldwork enhances student learning, as it provides learners with direct experiences from which to draw conclusions and gain deeper understanding of the subject. Thus, research has suggested that the affective response of students to fieldwork enhances student learning and enthusiasm toward the natural world.

Environmental attitudes and behaviors

Ewert et al. (2005) asserted that environmental attitudes are formed in the early stages of one's life. Factors such as outdoor activities and exposure to environment-related media shape a person's environmental attitudes throughout their lives (Ewert et al., 2005). McMillan, Hoban, Clifford and Brant (1997) found in a study focusing on socioeconomic differences affecting environmental attitudes that younger people, women, Caucasians, and people with higher education levels tended to have more positive environmental attitudes. Franzen and Reto (2010) found that various socio-demographic factors, such as income, affect environmental attitudes. Individuals with more wealth tended to have more positive environmental attitudes. Also, an individual's willingness to pay for environmental quality increases with income. Also, factors such as education, knowledge about the environment, and perceptions of environmental quality are directly related to environmental attitudes of individuals (Franzen & Reto, 2010).

Tuan (1974) has asserted that the study of environmental perceptions, attitudes, and values is extremely complex and evasive. Differences in individual human beings, societal and cultural differences, worldviews, and education all influence one's perceptions and attitudes towards the environment (Tuan, 1974). Researchers have examined several different facets that may influence environmental attitudes and behaviors.

Other researchers have asserted that time spent in the outdoors influences environmental attitudes. Vaske and Kobrin (2001) asserted that attachment to a natural area influences environmental attitudes. Repeated visitation to natural areas can lead to an emotional attachment to that place (Vaske & Kobrin, 2011). Additionally, the development of a connection with a particular natural area may help individuals realize that their actions do affect their local communities (Vaske & Kobrin, 2011). Goralnik and Nelson (2011) argued that individuals will not care about nor retain information about natural places to which they are not emotionally connected.

Kudryavtsev et al. (2012) asserted that place attachment is developed through direct experiences with a place, indirect learning of a place, and active engagement with a place. Place attachment is defined as the bond between people and places, and place meaning is the symbolic meaning that people ascribe to places (Kudryavtsev et al., 2012). Place attachment, coupled with place meaning, leads to sense of place, which has been identified as an influencing factor in pro-environmental behavior (Kudryavtsev et al., 2012).

Goralnik and Nelson (2011) summarized the environmental action philosophy of John Muir, a historically significant environmental conservationist. Muir was a strong advocate for the development of emotional attachment to the natural world. In order to develop that emotional attachment to the natural world, individuals must directly experience the natural world (Goralnik & Nelson, 2011). Ultimately, it is the emotional attachment to the natural world that will lead individuals to engage with and protect the natural world (Goralnik & Nelson, 2011).

Bogner (1998) assessed the influence of one- and five-day outdoor science experiences on students' environmental attitudes and behaviors. The study indicated that only the five day experience produced any positive environmental behavior changes in students (Bogner, 1998). Thus, extended outdoor and environmental science experiences, lasting for at least a week, offer better potential for affecting lasting change in positive environmental attitudes and behaviors than short-term experiences.

Okada et al. (2013) assessed the effects of in-depth outdoor experiences on participants' environmental attitudes over an eight-day period. One group participated in a more in-depth outdoor experience (i.e. backpacking, solitude, less human influences on environment) than the other. The group that participated in the more in-depth outdoor experience reported a significant increase in positive environmental attitudes, over the group that had a less-in depth nature experience (Okada et al., 2013). The researchers attributed some of the more positive environmental outcomes developed by the individuals who had a more in-depth experience to the sense of achievement those individuals felt after living very basically and being self-sufficient while backpacking. The sense of fulfillment seemed to lead to more positive attitudes in general, which led to a more positive view of nature (Okada et al., 2013).

Geoscience students are exposed to both earth science and outdoor experiences. These students are in a prime situation to become earth science literate, based on their education in the geosciences. Students who participate in field studies courses during the summer spend significant periods of time (i.e. several weeks) in specific regions of the United States or abroad, and are engaged in field observation and studies related to earth science. The researcher sought to determine if the environmental attitudes of students who participated in field-based courses were influenced by the field course. Additionally, the study examined the emotional connections students experienced with the location of the field course. Thus, this study linked connection to place with environmental attitudes, to determine what, if any, influence participation in a field-based science course has students' affective connection to place.

CHAPTER 3.
METHODOLOGY

Method

This exploratory study investigated the experiences and personal connections of students participating in regional geosciences field courses. Previous research on how students connect emotionally with landscapes during a science-based field course is lacking. The study gauged the environmental attitudes of the students participating in the field courses, and also asked students to provide written reflections on their experiences before and after the field course. The study sought to explore the emotional connections that the students experienced with the location of the field course, and also with the field course experience as a whole.

The researcher hypothesized that students who participate in a field course that takes place in a remote region of the United States, such as a national park or wilderness area will have a more positive emotional connection with the landscape, regardless of their existing environmental attitudes. Also, the researcher hypothesized that students with a more positive environmental attitude at the beginning of the course will have a deeper, richer emotional experience during the field course.

To measure the affective responses of students, and environmental attitudes, a mixed methods exploratory study using pre- and post-surveys, was used. Both qualitative and quantitative data points were collected from students utilizing a survey questionnaire containing Likert scale and open-ended questions. The survey was administered before and after participation in a regional field studies course. The qualitative data were attained via content analysis on written responses to determine emergent themes. The researcher utilized the New

Ecological Paradigm Scale (Dunlap, Van Liere, Mertig, & Jones, 2000) to attain quantitative data that reflected the environmental attitudes of the students surveyed. The combination of qualitative and quantitative data allowed the researcher to better answer the research questions.

Program

Four universities on the East Coast of the United States offering a geosciences field course during May and June of 2014 were chosen. Universities or colleges where the researcher had professional connections, or could personally visit the schools, were chosen so that a direct connection between the field studies course professor could be made to facilitate data collection. There were between five and 11 students in the field courses surveyed. The scope, location, and duration of the courses surveyed were diverse, and are outlined below.

The course run through UNC-Asheville was a 12-day field-intensive geology course focusing on the formation and features of the Great Basin in Nevada, Utah, and California. The course most heavily focused on the geological significance of the region, but also included components of cultural history. The students spent significant time in national parks and other natural areas, and camped the majority of the time.

The Appalachian State University field course was a 14-day field intensive geology course focusing on vertebrate paleontology in the Triassic period. The course took place primarily in New Mexico, Arizona, and Texas, and taught students about paleontology field and museum methods. The students participated in field excavation and collection of fossils, use of GPS and other technical equipment for surveying, and visiting relevant museums and education centers in the region. Students were camping the majority of the time.

The St. Lawrence University field course was a combined biology and geology course that lasted 11 days, and took place in south-central Alaska. This course linked the physical and biological components of the region to the role of humans on the environment. Students participated in hiking, camping, peer teaching, conducting field surveys, and related activities. The group was camping the majority of the trip.

Last, the course led through Montreat College, was a four-day Wetland Ecosystems course led in Tennessee and North Carolina. Although the course was not entirely geosciences-based, the students did engage in field-based learning related to the geosciences. Students studied the geology of east Tennessee and the Smoky Mountains and its influence on the region's ecology and cultural history. The group camped during most of the course.

Participants

Universities and colleges where the researcher had connections and access to field course leaders were chosen initially. Not all of the program leaders contacted were willing or able to participate in this study. The specific classes surveyed were determined by the course professors' willingness to participate in this study. The individual students surveyed were random but self selected, since they signed up for the field course prior to participation in this study.

Undergraduate students participating in outdoor-based field studies courses were asked to take part in this study. There were 33 respondents, out of a sample size of 33, to the pre- and post-surveys in this study. Of those 33, there were 18 females and 15 males. The average age of respondents was 22 years. The researcher determined that 42% of the students surveyed had previously taken a science field course prior to this study. The college majors of the students included geology, ecology, environmental science/studies, biology, earth science, and teaching.

The average number of geology courses taken by all of the students was three. There were 10 students in a biology/geology field course in south-central Alaska, 10 in a Great Basin geology course, eight in a vertebrate paleontology field course led in New Mexico, Arizona, and Texas, and five in a Tennessee/ South Carolina wetlands course (Table 1).

Table 1

Overview of Field Courses

Course	Topics Covered	Field Site	Details
UNC-Asheville- Regional Field Geology	Geological formation and features of the Great Basin	Great Basin NP, Zion NP, Yosemite NP, Red Rock Canyon	12 days; mostly camping, last night in hotel
Appalachian State- Paleontological Field and Museum Methods	Vertebrate paleontology of the Triassic period; methods for collecting fossils	St. Johns, AZ, Zuni Mountains, NM	14 days; mostly camping, last night in hotel
St. Lawrence University-	Linking physical and biological components	Southcentral Alaska- Matanuska	11 days, mostly camping, last night in hotel

Alaska: Down to Earth	of environment with role of humans	Glacier, Portage, surrounding areas	
Montreat College- Special Topics in Wetland Ecosystems	Ecology and natural history of southeastern US	East Tennessee: Smoky Mtns NP Sites along Tellico River; Chattanooga	Four days; camping and hotel

Research Design

Surveys.

A pre- and post-survey entitled The Student View of Fieldwork developed by Boyle et al. (2007) as a project for the National Subject Centre for Geography, Earth & Environmental Science in Great Britain was modified for this study. The original survey was intended to assess the effects of fieldwork on students' affective domain, and also determine if students' attitudes towards fieldwork influenced their learning. This study examined students' affective responses to a field course, as well as environmental attitudes of students. Thus, the survey created by Boyle et al. (2007) was appropriate for this study, but was modified to include measures of environmental attitudes.

The sections of the pre-survey included:

1. Demographics, including: age, gender, number of geology courses taken, number of field courses taken, location of current field course, and reasons for choosing to participate in the field course.

2. Environmental attitudes: determined using the New Ecological Paradigm model developed by Dunlap, Van Liere, Mertig, & Jones (2000) The NEP scale measures environmental attitudes, beliefs, and values, and includes three dimensions: "balance of nature, limits to growth, and human domination of nature" (Dunlap et al., 2000, p. 430). The NEP scale was included in both the pre- and post-surveys.

3. Qualitative, open-ended questions asking students about their personal experiences with field-based learning and with the location of the field course.

The post-survey included corresponding items to the pre-survey, but asked students to answer after reflecting on their field course experience. The original post-survey created by Boyle et al. (2007) included open-ended questions for students to answer. The researcher edited this section to include questions related to environmental attitudes and emotional connections with the location of and experience of the field course. The questions gauging environmental attitudes included the New Ecological Paradigm Scale (Dunlap et al., 2000), and open-ended questions.

The NEP scale has been utilized for a wide range of studies examining environmental attitudes, beliefs, values, and worldview, mostly in the general public, but also with specific interest groups (Albrecht, Bultena, Hoiberg, & Nowak, 1982; Edgell & Nowell, 1989). The reliability of the fieldwork survey from Boyle et al. (2007) is unknown, but the overall NEP scale has an alpha value of .73 (McMillan et al., 1997), and was utilized for this study.

Data Collection

In April and May 2014, prior to each field studies courses, the researcher engaged with the lead professors in person or via telephone. The researcher either mailed or handed the surveys to the professors, who then administered the surveys to the students in person at the beginning of the field course.

Following the field course, students were asked to complete the paper and pencil post-survey, which were handed out by the professor following the course. The researcher provided each professor with pre-paid envelopes in which to send back the completed surveys.

Data analysis

Several steps were taken to analyze the data collected. First, the researcher entered all of the survey data into Microsoft Excel spreadsheets. Each student who completed the surveys was assigned an identifier number at random, from one to 33. The researcher determined percentages of males versus females responding to the surveys, numbers of students who have taken previous geosciences field courses, and percentages of the students' reasons for taking the field courses highlighted in this study. The researcher then entered the qualitative responses into other spreadsheets. The NEP Scale data were entered into separate spreadsheets for ease of analysis.

To determine the environmental attitudes of the students, the researcher reversed the even scores, which relate to the Dominant Social Paradigm (DSP) in order for all of the values to represent the New Ecological Paradigm (NEP). According to Dunlap et al. (2000), "agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicate pro-NEP responses" (p. 431). Values >3 represent more positive environmental attitudes, whereas values < 3 represent more negative environmental values. Thus, by making all of the values represent pro-NEP values; the researcher was able to determine an average score for each participant. The researcher then ran a paired-sample *t*-test to determine any statistical changes in the students' environmental attitudes from the pre-survey to the post-survey ($p=.05$) for the entire sample and for each course group. Additionally, the researcher ran a *t*-test to determine any statistical significance between male and female environmental attitudes.

Several open-ended questions were included in the questionnaire to better gauge student opinions and experiences surrounding the field course. The student responses to these questions were entered into a database and examined for themes. The researcher then determined a general code list of themes found in the written responses. Then the researcher coded the student responses, as outlined by Creswell (2009). An inter-coder coded 20% of the responses and determined a code list different from that of the researcher.

The researcher and the inter-coder then agreed upon a single list of codes to apply to the student responses. The researcher and inter-coder then independently coded the responses once again. The researcher and coder then discussed the coding to ensure inter-coder agreement. The inter-coder reliability was 98.5%. Once the coding of the responses was established, the researcher determined percentages, using the total number of student responses (33) for each code to determine which codes were most prevalent in the student responses. The emergent themes and representative quotes were integrated into the quantitative data to explain and clarify the findings, as described in Creswell (2009).

CHAPTER 4.

RESULTS

The results to the survey questions are outlined below in separate sections for the pre-surveys and post-surveys. First, in the pre-survey, students were asked to indicate the reason(s) why they chose to participate in the field course. Below are the student responses, including the code developed by the researcher (Table 2).

Table 2

Reasons for Participating in Field Course

OE= Outdoor experience	90%
IS= Interest in Subject	90%
ET= Enjoy traveling	81%
LC= Location of Course	63%
FC= Future Career	57%
PR= Personal recommendation	24%
Other	15%

Thus, the majority of students who enrolled in these science-based field courses were most interested in the outdoor experience aspect of the field course, the subject of the course, and/or the enjoyment of traveling. Over half (63%) chose to participate in the field courses because of the location of the course and because the course was relevant to a future career interest.

Qualitative Responses

Pre-Surveys.

As mentioned, the researcher developed a list of codes for the major themes found in the students' qualitative responses. Responses to specific questions are found in the following sections. The codes developed are outlined in Table 3.

Table 3

Code List for Pre- and Post-Survey Responses

1. Gaining Knowledge (GK) or intellectual connection
2. Social Interaction (SI)
3. Physical Activity (PA) is anything physical, like hiking or camping
4. Connection with Nature (CN) is a deeper connection with nature, enjoyment of nature, etc.
5. New Experience (NE)
6. Past Experiences (PE) means the response was related to previous experiences of respondent
7. Spiritual Connection (SC) is a deeper religious experience
8. Visual Experience (VE)
9. No Connection or Change (NC)
10. Connection with Place (CP) is a sense of connection with a specific location

Post-Survey Additional Codes

1. Humbled/Respect/Awe (H)
2. Free/Peaceful/Happy (F)
3. Rejuvenated/Energized/Inspired (R)

4. Bodily Experience (BE) nothing more than physical sensations

5. Human Impact (HI) includes anything related to human impacts on the natural world

6. No Change (NCh)

Pre-Surveys

The first qualitative question in the pre-survey asked students, "What are you most looking forward to on this field course?" The responses, in percentages, are listed below (Table 4). The representative quote in each table is included to illustrate the types of student responses that correlate with the codes developed for this study. Different students' responses were chosen for each example.

Table 4

Student anticipation

Code	Response Rates	Quote
Gaining Knowledge (Intellectual connection)	63%	"Learning about nature and its ecosystems"
Physical Activity	27%	"Finding fossils"
New Experience	24%	"Being outdoors and seeing the sights you can only see in Alaska"
Visual Experience	12%	"Seeing the wildlife"

Social Interaction	12%	"Getting closer with the students on the trip"

What students most looked forward to on the field course.

The majority of students most looked forward to the intellectual components of the field course, which correlates directly with the 90% of students who chose the field course due to an interest in the subject. Only 27% of students indicated that they most looked forward to the physical outdoor experiences, such as hiking and camping, although 90% indicated that as a reason for enrolling in the course to begin with.

The second qualitative question asked students, "Do you feel any type of connection to the location of your field course (*e.g.*, spiritual, physical, intellectual, etc.)? Please explain." Below are the student responses, as coded by the researcher (Table 5).

Table 5

PC connection with field site

Code	Response Rates	Quote
New Experience	45%	"Yes and no. I have a connection to water in general, but I have never really been to the area we are going."
No Connection	36%	"I haven't ever been there before, so no. I hope that will change as the course runs."
Gaining Knowledge (Intellectual Connection)	27%	"I feel an intellectual connection to the national

		forests out west. I am most interested in the ecological phenomena in the region, because I have never been there before."
Connection to Nature	21%	"Yes, natural world in general."
Spiritual Connection	15%	"I have a spiritual connection to nature and the outdoors. I love learning about the Earth and am obsessed with mountains! (glaciers are interesting too)"
Visual Experience	12%	"No, other than it looks beautiful and I can't wait to see it in person"

PC refers to Pre-Course

Note: representative quote is included to illustrate the types of student responses that correlate with the codes developed for this study. Different students' responses were chosen for each example.

For many of the students (45%), the location of the field course is a place they had not yet spent time, and so they had not developed a connection with the place. Pre-course meetings had been held for the students as an orientation for the trip, which likely exposed students to knowledge about where they were going, hence the intellectual connection to the place. There were 21% of students who indicated a connection with nature in general, which may not be influenced by the exact location but rather be a universal connection to the outdoors.

The third question asked students, “What factors, if any, led to this connection (*e.g.*, studying books, influence of professor, personal experiences, etc.)?” Below are the percentages of the coded student responses (Table 6).

Table 6

Reason for PC Connection

Code	Response Rates	Quote
Past Experience	30%	“Connection to water- I grew up on Lake Michigan”
Social Interaction	27%	“Parents’ influence”
No Connection	27%	“None”
New Experience	15%	“I have never seen a glacier and I chose the Matanuska glacier because I get to get up close and examine something I have never seen before in person”
Connection to Nature	15%	“Interest in all living things since childhood”

What factors led to student connections to site of field course, prior to the course

Note: representative quote is included to illustrate the types of student responses that correlate with the codes developed for this study. Different students’ responses were chosen for each example.

Considering that many students indicated no specific connection to the site of the field course, 30% of students indicated that past experiences influenced their feelings of connection with the site of the field course. Several students wrote of childhood experiences camping with their families, or spending time outdoors. Others mentioned people who encouraged or inspired their connections to nature and the site of the field course.

Post-Surveys

Following the field course, students were asked to complete the post-course surveys. Some students wrote detailed, thoughtful responses, while others wrote only a few words. The depth of responses for specific students did not vary greatly from pre- to post-survey.

The first question asked of student respondents in the post-course survey was, “What was the most memorable experience from the field course?” Student responses are categorized below (Table 7).

Table 7

Most memorable experience

Code	Response Rate	Quote
Physical Activity	60%	"Finding fossils, camping, and hiking all over the southwest."
Connection to Place	36%	"Zion Canyon and Bryce Canyon"
Visual Experience	30%	"Watching the full moon rise in Valley of Fire"
Gaining Knowledge (Intellectual connection)	24%	"Realizing that hands on field learning is so much better than being in a classroom."
Social Interaction	21%	"Making friends with the people that I was in the van with during our travels"

Post-course responses on the most memorable experiences from the field courses.

There were 60% of the students who indicated that physical activity, such as hiking, or collecting fossils, was their most memorable experience from the field course. Thirty six percent of students indicated a connection with the field site as the most memorable experience. Another 30% said that the visual experiences (*i.e..,* the views) were most memorable. Less than 25% of students mentioned that the intellectual and social components of the course were most memorable to them.

The next question asked students, "How did you feel when you were outside in a remote place during your field course?" Below are the categorized responses (Table 8).

Table 8

How Students Felt in Remote Place

Code	Response Rates	Quote
Rejuvenated/Energized/Inspired	45%	"Rejuvenated, at peace"
Free/Happy/Peaceful	42%	"I felt peaceful and happy"
Humbled/Awe/Respect	18%	"I enjoyed it a lot. It often made me feel small and insignificant as well as more connected with nature"
Connection to Nature	15%	"I felt at peace and more connected to the world around me."
Bodily Experience	9%	"Cold then sometimes hot…mostly dry and dirty."

Students were asked to describe how they felt when away from "civilization" and from the comforts of the modern world. Almost half of students indicated they felt rejuvenated, inspired, energized, as well as happy and peaceful. No students indicated a negative experience.

Next, students were asked, "Do you have any personal connections with the site of your field course now that you have spent time there (e.g. emotional, physical, intellectual, etc.)? Please describe." The responses are categorized below (Table 9).

Table 9

Connections with Field Site

Code	Response Rate	Quote
Gaining Knowledge (Intellectual Connection)	42%	"Yes, I know the ecology, conservation issues of the area. I feel I know the place therefore I want to see it protected."
Connection to Place	42%	"A strong connection, appreciation, a desire to go back. A new found love for the desert and understanding of the Basin and Range."
Human Impacts	18%	"I found myself with a desire to learn and explore more and a reluctance to leave. I also felt a sense of sadness and conviction seeing negative human impacts caused for frivolous reasons and several species that have gone extinct."
No Connection	18%	"I can't say that I have any further connection with those sites; we spent minimal time at each location."
Connection to Nature	15%	"I feel connected b/c I have been to remote places and felt and seen the power of nature and seen how big it is compared to us."
Spiritual Connection	15%	"I feel a spiritual connection to the Great Basin after spending time out there."
Humbled/Awe/Respect	12%	"I am in awe of the mountains and I felt humbled to be in their presence."
Physical Activity	12%	"Physical- Kennicott Mine 15 mile hike=memorable experience"

There were 42% of students who indicated that they felt an intellectual connection to the location of the field course, meaning they had learned about the place and thus felt connected to the place. Another 42% of students felt a personal connection to place, indicating that after spending time there, the site(s) of the field course have greater meaning to the students who indicated this connection. Only 18% of student felt no connection to the place after the field course, while another 18% wrote about seeing negative impacts of humans on the environment.

Last, students were asked, "Has your view towards the natural world changed upon completion of this field course? Please explain." Below are the categorized responses (Table 10).

Table 10

Change in View of Nature

Code	Response Rate	Quote
No Change	69%	"Has not changed, my views are the same as before."
Human Impacts	24%	"I didn't have any major view changes. The only thing that changed was my feelings towards man modifying the environment. After this trip, I think that man needs to be more careful and considerate when dealing with the environment."
Gaining Knowledge (Intellectual connection)	18%	"I don't think my view has changed dramatically, but I recognize more and appreciate the complexity and diversity of nature. The natural world has taught me to appreciate the here and now and to love and protect the beautiful scenery around us. Nature will always be a stronger force than humans."

Humbled/Awe/Respect	12%	"I have even more respect for the natural world, more than I did before. I also understand the "wildness" of nature and how you cannot predict or control things. I have a healthy respect for the creatures that I came in contact with and I even more so for bears, which I was phobic about before the trip but now I am curious about them and want to learn more while respecting them and giving them their space"

The majority of students (69%) indicated that their view of the natural world had not changed as a result of the field course experience. The students who indicated they had no change in their views of the natural world wrote responses such as: "It's about the same," or, "It has not changed." Some (24%) students wrote that their view had not changed, but their awareness of negative human impacts on the environment had increased after the field course. Other students indicated that the field course experience enhanced their knowledge, respect, and appreciation of the natural world.

NEP Scale

The New Ecological Paradigm scale is a five-point Likert-type scale that determines the worldview and general environmental attitudes of respondents. Scores > 3 represent a more positive environmental attitude, whereas scores < 3 represent more negative environmental attitudes. Overall, the average environmental attitude (NEP) score for students in this study was 3.8 in the pre-survey and 3.7 in the post-survey. This indicates that most of the students in this sample have more positive environmental attitudes to begin with, and it did not change much after the field course.

The overall sample NEP scores decreased very slightly, but not significantly, from the pre- to post-survey (Table 11).

Table 11

NEP Scores for Course Groups

Course Location	Pre-Course NEP Score	Post-Course NEP Score	Is the difference significant? (p value)
East Tennessee	3.66	3.67	0.8
Great Basin	4.04	4.03	0.6
Southwest	3.63	3.59	0.6
Alaska	3.81	3.57	0.06

None of the groups experienced significant ($p<.05$) changes in NEP scores. The group that traveled to Alaska was close to having a significant change, but was still within the confidence interval of 95%.

Males tended to have lower NEP scores, with an average of 3.59 in the pre-course survey, and 3.42 in the post-course survey. There was no significant change in the NEP scores for males. The females tended to have higher NEP scores, and had no significant changes in NEP score from the pre to post surveys (Table 12).

Table 12

Male vs. Female NEP

	Pre-Course NEP Score	Post-Course NEP Score	Is the difference significant? (p value)
Male	3.59	3.42	0.18
Female	4.03	4.00	0.66

Note: Neither males nor females experienced a significant ($p<.05$) change in NEP scores from before the course to after the course.

The researcher determined the NEP scores of the students surveyed before and after the field course. Next, the researcher determined if there were significant differences in environmental attitudes between separate field course groups, as well as between males and females. The findings reported in this section will be discussed in Chapter 5.

CHAPTER 5.

DISCUSSION AND RECOMMENDATIONS

Discussion

Student responses to the field course surveys, which were administered before and after the field courses, provided some insight into the student perception and experience of science-based field courses. The purpose of this study was to determine if the environmental attitudes of the students were influenced by participation in a field-based science course. Also, the study was designed to better understand the emotional connections students experience with the location of the field course. Several layers of information were attained from the pre- and post-course surveys: demographic data, the NEP Scale data, which indicated the general environmental attitudes of students, and the qualitative written responses of the students. This data allowed the researcher to see a broader picture of the student experience of the field course, specifically connections students had or developed with the location of the course.

Although the goals and focuses of the field courses surveyed varied, all of the courses included a number of elements related to the concept of earth science literacy. The National Science Foundation developed the Earth Science Literacy Initiative in order to encourage an understanding of how the earth works, and how humans impact the earth (2010). All of the field courses surveyed included or focused entirely on geological elements. Thus, the students were introduced through firsthand experience to earth processes, including the interaction between “rock, water, air, and life” (ESLI, 2010, pp. 4-12). Additionally, two of the field courses covered human interactions with the earth, through cultural history and modern human impacts on the environment. Despite the variance in topics covered in these science-based field courses, students were exposed to several of the key topics found in the Earth Science Literacy Initiative.

Environmental Attitudes.

Environmental attitudes represent a complex set of interacting influences in a person. Ewert et al. (2005) asserted that environmental attitudes begin to form at an early age, and are likely directly influenced by physical experiences in the natural world, as well as exposure to the natural world through media. Several students surveyed in this study indicated that childhood experiences, such as camping with their families, shaped their view of the natural world today.

The environmental attitudes of the students participating in this study were overall more positive (NEP 3.0), with only four of the 33 students having a more negative environmental attitude (<3.0). All four students with more negative environmental attitudes were males. Females tended to have more positive environmental attitudes. According to other research, females in general tend to have more positive environmental attitudes than males (McMillan et al., 1997).

A number of students indicated a deepening of appreciation for the natural world. Research has indicated that students who participate in fieldwork tend to develop interests and attitudes towards the natural world and to learning that may not otherwise develop in the classroom (Boyle et al., 2007; King, 2008; Thompson, 1982). One student wrote, “My view has not changed, but being re-exposed to a natural environment renewed my enthusiasm and reminded me to be more aware of my actions.” Another student wrote, “I think every field experience I have deepens my appreciation for God's creation." Still another response indicated a deepening of appreciation for nature because of the field course:

> "I don't think my view has changed dramatically, but I recognize more and appreciate the complexity and diversity of nature. The natural world has taught me to appreciate the here and now and to love and protect the beautiful scenery around us."

All of these examples, and others not shared, convey that a number of students experienced a deepening of their appreciation for nature, regardless of their NEP scores.

Some other examples of students who indicated a deeper appreciation or respect for the natural world following the field course were: "No, I have always had an ecocentric view of the earth but I think this trip has helped strengthen it;" and "I have even more respect for the natural world, more than I did before." Student responses from this study support the research indicating that field experiences can help students develop interests and attitudes about the natural world (Boyle et al., 2007; King, 2008; Thompson, 1982), as a number of students indicated a deeper appreciation for the natural world and more meaningful understandings of the concepts learned out in the field.

Human Impacts.

Several students (24%) cited seeing how humans have impacted and degraded the environment at the site of their course. For example, one student wrote about the field course experience, "I see more of how humans have altered [nature] that has produced negative outcomes." Another student reported, "I didn't have any major view changed. The only thing that changed was my feelings towards man modifying the environment. After this trip, I think that man needs to be more careful and considerate when dealing with the environment." Thus, some students indicated no change in their personal environmental attitudes, but rather a greater awareness of human impacts on the environment.

Students in every course surveyed, except the American Southwest paleontology course, indicated that they were impacted in some way by seeing the negative human impacts on the environment. Perhaps focusing on fossils and historical geological features and not modern processes during that particular field course led to this lack of focus on human impacts on the environment. Those particular students did not have significantly different NEP scores than students in other field course groups, nor did they indicate a negative experience during the field course. For some reason, however, the one field course group did not indicate any negativity about human impacts on the environment. This may be due to the remoteness of the place, where negative human impacts are not obvious or present.

NEP Scale.

There were no significant changes in the NEP scores of the students surveyed. In their written responses, many students asserted that, although their overall attitude towards the natural world had not changed, their views towards nature had been positively enhanced by the field course experience. In fact, 69% of students indicated in their written responses that they had no changes in their environmental attitudes. Thus, the NEP data did correlate well with the written responses of the students. What was missing in the NEP values, however, was the deepening of connection with the natural world that a number of students indicated in their written responses. Of all the students, 54% indicated a change in awareness of human impacts, knowledge of place, and/or a greater respect and appreciation for the natural world. It appears that the environmental attitudes of most students did not really change, but were reinforced and deepened by the field course experience.

One student wrote in response to the question, “Has your view towards the natural world changed upon completion of this field course? Please explain”: “My view has not changed, but being re-exposed to a natural environment renewed my enthusiasm and reminded me to be more aware of my actions.” Another student wrote, “Not really. If anything, more appreciation [for nature]” came from the field course experience. Still another student indicated, “Not really, I’ve learned more but my view towards the world hasn’t really changed.” A number of students, then, indicated in their written responses that their views towards the environment did not change due to the field course experience.

From the pre survey to the post survey, several students’ NEP scores decreased, some more slightly than others. Yet, not one student indicated a decrease in his/her environmental attitude in the written responses. For example, a student who’s NEP score decreased from 3.13 to 2.8 wrote in response to “Has your view towards the natural world changed upon completion of this field course?”: “I didn't have any major view changes. The only thing that changed was my feelings towards man modifying the environment. After this trip, I think that man needs to be more careful and considerate when dealing with the environment.”

Another student, whose score went from 3.06 to 2.6 wrote, “No, I know/knew a lot about the world prior to this.” The NEP score of another student decreased from 3.4 (more positive) to 2.6 (more negative). That student wrote, “Nope, still beautiful.” One more example is a student whose score went from 4.46 to 3.6, yet wrote, “People are still miniscule in the grand scheme of things.” Rather than describing a decrease in environmental attitude, many of these students are indicating that their environmental attitudes did not change following the field course. In fact, one student, whose NEP score decreased from 4.6 to 4.2 (still more positive, yet a slight decrease), wrote, “I have even more respect for the natural world, more than I did before. I also understand the "wildness" of nature and how you cannot predict or control things.” Thus, there is a disconnection between the NEP values and the student responses. The reason for this is unclear, but may lie in the NEP measure itself.

The NEP scale was created to measure environmental attitudes, beliefs and values, and quantifies “balance of nature, limits to growth, and human domination of nature” (Dunlap et al., 2000, p. 430). The original NEP scale was scrutinized as having poor validity, and a revised scale was developed to improve the reliability of the measure (Cordano, Welcomer & Scherer, 2003). Researchers assert that the NEP scale is a valuable tool to measure environmental attitudes, but it is important to first determine whether it is the most appropriate measure for specific studies (Cordano et al., 2003).

Although there were no statistically significant changes in the NEP score of the students surveyed in this study, several students’ NEP scores decreased slightly. The post-course survey, including the post-course NEP measure, was administered to the students on the last day of the field course. It is possible that the students were tired from the course, and did not put as much thought into the surveys. The students who indicated this deeper emotional connection did not all have NEP scores greater than four. Again, this may reflect the inappropriateness of using the NEP scale to measure short-term changes in students’ environmental attitudes in this study.

The NEP scale has been used in many studies to determine the general environmental worldview of individuals. It was not necessarily designed to measure short-term changes in environmental attitude. The NEP scale was beneficial to this study, because it provided the researcher with a snapshot of the general environmental attitudes of the students surveyed, but it did not account for more subtle shifts in the environmental attitudes of the students. The researcher utilized the open ended questions in the surveys to develop a better picture of the student experience of the science-based field courses.

According to a study by Ewert et al. (2005), regardless of the type or intensity of environmental or outdoor program in which individuals participate, those individuals often bring with them a set of pre-existing environmental attitudes that were formed earlier in life (p. 234). A single field course, lasting a few days to weeks, may not greatly impact the environmental attitudes of students. The usefulness of the NEP for this study was in gaining a snapshot of the students' environmental attitudes as they are, but not necessarily to measure short-term change. The researcher did not encounter a measure to study short-term change in environmental attitude specifically.

Student Connections to Place.

Prior to embarking on the field course, 45% of students indicated that going to the specific locations was a new experience for them, and 36% indicated they had no connection to the site(s) of the field course in which they were participating. After the field course, 42% of students indicated a connection to place and another 42% indicated an intellectual connection to the location of the field course, meaning 84% of students noted some type of connection to the location of the field course upon completion of the trip. An increase from 36% of students reporting no connection to the site of the field course, to 84% of students indicating some type of connection, is a marked increase that requires a deeper analysis. This change is also found in the written qualitative responses of students.

In the pre-course survey, students were asked to describe their connection(s) to the location of the field course to which they were to travel: “What factors, if any, led to this connection (e.g. studying in books, influence of professor, personal experiences, etc.)?” One respondent wrote, “Well, family and personal experience.” Another student wrote, “I have always been a lover of animals/being outside/professors in the environmental studies department; appreciation of nature's beauty- being able to travel the world and have seen many amazing things/landscapes created by nature.” Another response indicated that, “My parents did a lot of camping and hiking when I was a child.” And one final example said that, “Spending time outdoors, and I’ve had some pretty inspiring professors.” Thus, many students indicated past experiences as factors that led to their connection to the site of their field course, as well as social connections such as family and college professors who were inspirational to the students.

The connections referred to by several students seem to be more of a connection to nature in general than to the actual location of the field course. However, in reference to the actual location where the student was going, one student wrote, “Alaska is a place with so many resources and experiences that I wanted to see for myself.” Another wrote, “Yosemite has a long and colorful climbing history, and is a world-famous destination. Its history, and my previous experiences there, have both influenced my connection.” In these instances, the students indicated more of an intellectual connection to the site of the field course based on what they have heard or read.

Kudryavtsev et al. (2012) have asserted that place attachment is developed through direct experiences with a place, indirect learning of a place, and active engagement with a place. The student responses above represent this indirect learning of place. The students surveyed were allowed each of the developmental components of place attachment: indirect learning of place in the classroom or through reading prior to the course, as well as direct experience and active engagement with a place when they actually went to the locations of the field courses. Thus, they were in a prime situation to develop place attachment, which will be discussed in further detail.

In the post-course survey, students were asked, "Do you have any personal connections with the site of your field course now that you have spent time there (*e.g.*, emotional, physical, intellectual, etc.)? Please describe." Of the respondents, 42% of students indicated an intellectual connection to the location(s) of the field course. One student wrote:

> "Yes, I found myself with a desire to learn and explore more and a reluctance to leave. I also felt a sense of sadness and conviction seeing negative human impacts caused for frivolous reasons and several species that have gone extinct."

Another student who developed a more intellectual personal connection to the site of the course wrote, "Yes, I know the ecology, conservation issues of the area. I feel I know the place therefore I want to see it protected." One final example was:

> "I think that now, since I know more about the area, that I really like the area. A personal connection was kind of developed because of the trip and the people I

> was with on the trip. Intellectually, I learned about the ecosystem there and how it has been impacted by man and that, I think was helpful in forming connections."

The nature of personal connections to place is fairly evasive. A number of students reported more focused connections with the places they spent time during their field course. Students whose responses are reported above were developed because of the intellectual components of the field course. Knowing about the local geology and/or ecology of the locations of the field courses led some students to feel more deeply connected to those places.

A total of 42% of students indicated a spiritual connection, and/or a deeper emotional connection to the place. One student wrote:

> "I feel a spiritual connection to the Great Basin after spending time out there. Also, I feel as though my understanding of the Western US has been significantly enhanced. It's still a wild, very natural place (far less developed than the East), and I see no need for us to develop it further."

Another student's deeper emotional connection was described as, "I feel connected b/c I have been to remote places and felt and seen the power of nature and seen how big it is compared to us." One more example is:

> "I am in awe of the mountains and I felt humbled to be in their presence. I want to go back to Utah and CA because it felt like a religious experience to be able to see and explore these natural wonders."

Thus, some students experienced a much deeper than surface level connection with the location of the field course. Again, this deeper emotional connection to place is what research has indicated will lead to retention of information and personal concern for the environmental health of that place (Goralnik & Nelson, 2011). Without a follow up study, it is unclear if the students who developed a personal connection with the site(s) of their field course will have long-term concern for the environmental health of those places.

In some cases, it was because of the intellectual experience that students developed a deeper emotional or spiritual connection to the place. One student wrote, “I understand the ecology/geology behind the sites we visited, and therefore feel more of a spiritual/emotional connection to them.” Another example is, “Yes, learning about an environment is spiritual and it helps you connect to a place.” Thus, it was not purely just being there that led student to experience a deeper connection to the place, but rather the combination of learning about the ecology, geology, cultural history of the place and actually being there and experiencing those concepts firsthand.

One student summed up how physically spending time in a place influenced feelings of connectedness with that place: “Of course I've made memories and experienced things that have made me feel good, bad, small, happy and sad. As such I've made apparent connections.” Thus, for some students, the intellectual experience, learning about the place, led to deeper connections, whereas for others, just spending time there led to deeper connections.

There were 18% of students who indicated no connection to place. One student, who participated in the Southwest field course, and whose NEP score was consistently below 3.0, had consistent responses throughout the study, wrote, “Since [the natural world is] inanimate, I do not connect with it." This same student, in response to, "Has your view towards the natural world changed upon completion of this field course? Please explain," wrote, "Negative. I still seek to make the most money from it." Most of the students, however, indicated some connection to the location(s) of the field course.

Emotional Responses to Field Course.

A more evasive concept, topophilia, the affective bond between people and place (Tuan, 1974), manifests the student responses to this study. Students wrote of how they saw the landscapes during the field course with descriptions like, "The magnificence of Yosemite National Park, the quaint town of Tonapali, NV, and the bright, orange rocks in Valley of Fire." Another example of the affective bond between people and place is, "I feel at ease when I am away from city life and I feel humbled when I look up to high mountain peaks." Students described intellectual, emotional, and spiritual connections to place, which is what Tuan (1974) referred to when noting that landscapes invoke different feelings in people, some that are tangible and some that are more evasive in understanding. The relationship with topophilia and deeper learning in the geosciences is not well understood, but deserves more attention; especially since one of the key desired outcomes of the Earth Science Literacy Initiative is the ability and willingness to make responsible and informed decisions about how humans treat the earth (ESLI, 2010).

No students indicated that being out in a remote or secluded area was a negative experience. In fact, 45% of student indicated feeling rejuvenated, energized, or inspired by the experience, while another 42% indicated feeling free, happy, and peaceful. Thus, 87% of students reported very positive feelings and emotions from being outside in the natural world.

This finding matches other studies that found, overall, students who participate in science-based field courses have reported positive and meaningful experiences (Besenyei et al., 2003; Elkins & Elkins, 2007; Hope, 2009).

Students wrote responses such as, "I felt at peace and more connected to the world around me." Another student wrote, "I enjoyed it a lot. It often made me feel small and insignificant as well as more connected with nature." Words like, grounded, capable, energetic, healthy, creative, comfortable, calm, and whole were used to describe how the students felt in remote and secluded places. Other research has indicated that students who had enjoyable experiences and were taught information that was relevant to them had more positive encounters with field-based learning (Fuller et al., 2000). Students in this study ultimately had positive experiences with the field courses in which they participated.

A purely intellectual understanding of the earth may not invoke a desire to protect the natural world, but an emotional attachment, whether a specific place in nature, or to the environment in general, inspire people to want to protect the planet from degradation (Goralnik & Nelson, 2011; Vaske & Kobrin, 2001). As previously mentioned, students who participate in field-based geosciences courses are exposed to the intellectual concepts as well as the direct experience with a location that may lead to place-attachment. Place-attachment, according to Vaske and Kobrin (2011) may make the science content more relevant and visible to students as well as allow students to recognize their locus of control when it comes to impacting the natural world.

Conclusion

The findings from this study, overall, indicated that most of the students who participated in these field-based science courses that traveled to Alaska, Tennessee, the American Southwest, and the Great Basin, did develop personal connections to the location of the course after spending time there. Additionally, the environmental attitudes of students did not change significantly as a result of the field course experience, but some students did experience a deepening of their views of the natural world, or in some cases developed a greater respect for nature. Since the NEP scores of the students did not change significantly, it may indicate that these students had already formed their environmental attitudes based on past experiences in their lives. The field course experience did not determine their environmental attitudes, yet it seemed to reinforce student perceptions of the natural world.

Students who participate in field-based earth science courses are in a prime situation to become literate in earth science concepts. These students are in a position to not only intellectually understand the concepts, but also to connect personally with those concepts because they have firsthand, direct experience. Research indicates that this type of hands-on experiential learning can lead to a deeper understanding, which allows students to apply the concepts to other aspects of their lives (King, 2008; Manzanal et al., 1999; Orion, 1993). The field component of geosciences learning appears to facilitate student comprehension of earth science concepts, as well as promote student connections to outdoor places, which may ultimately allow those students to make informed and responsible decisions regarding earth and its resources.

Instructors of geosciences field courses are in a prime situation to encourage broader thinking in their students. For example, considering how we affect the environment through long-term human impacts on a region and short-term impacts to the environment. Two of the four courses surveyed in this study included elements of human-nature interactions, which required students to consider how humans alter the natural world. Not all courses may directly relate to human interactions with the environment; however, even a paleontology course or other strictly geosciences courses could intersect with concepts related to human-earth interactions. For example, students may consider the impact of quarrying or excavating on the local hydrology of the region. Field course leaders have the opportunity to take the student learning to a deeper level that encourages students to consider the human impacts on the environment in a larger context, as well as to develop personal connections with the natural world.

Limitations

This particular study was exploratory in nature, and limited in scope. The researcher had limited time and funds to complete this research, so only four course groups were studied. Also, the NEP Scale utilized for this study did not give the researcher a completely accurate read on the changes in environmental attitudes of students. The written responses did give a clearer picture of the student experience. Many students indicated a deepening of their positive environmental attitudes, yet for many students, their actual NEP Score decreased slightly. The NEP Scale may not be the best measure for determining short-term changes in environmental attitudes.

Recommendations for Future Research

The researcher suggests several approaches that could be taken in future research on this topic. For one, a larger sample population would have allowed for more substantial claims to be made. Surveying students at 10 or more colleges and universities would give a much broader student base to study. Also, deliberately choosing field courses based on the scope, such as a certain number of paleontology courses, a certain number of geomorphology courses, and a certain number of more ecology or culturally focused courses, would give a more intentional focus on how course themes influence the findings of how students respond emotionally to field-based learning.

Another recommendation of the researcher is to survey the course leaders to determine their environmental attitudes. A number of students surveyed indicated that their college professors had a big impact on their environmental attitudes and connections to the course location. Again, due to time constraints, the researcher for this study did not survey the course professors.

Most of the students surveyed in this study had previously engaged in outdoor activities, such as camping, hiking, or previous field course experience. A study that samples students with and without prior outdoor experience may be interesting to determine what role, if any, previous outdoor experience played in the students' experiences on the field course.

Last, the researcher wonders what role technology (or lack thereof) played in the students' experience of the field course. Typically, the use of technology such as cell phones and computers is discouraged during an academic field course. Oftentimes, there is little to no cell reception where the field courses are conducted. A study examining how students responded to not having the same technology access as when they are back on campus may be interesting. Do students have a deeper, more meaningful experience when they do not have access to technology?

Research on geosciences field courses and how students learn and connect emotionally with the place and the content is relatively unexplored. Purely recreational outdoor experiences have had positive and negative impacts on peoples' environmental attitudes (Okada et al., 2013). Field courses often offer the same depth of recreational experience but also include a strong focus on science concepts relevant to that area. Therefore, students who participate in natural science field-courses gain an in-depth outdoor experience, and hands-on learning in earth science concepts. Field-based science education may be a potent vehicle for developing an earth science literate citizenry.

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Appendix A

Consent Form

MONTREAT COLLEGE

Outdoor Education Department

310 Gaither Circle
Montreat, NC 28757
(828) 669-8012

CONSENT FORM

"An exploratory study of the connections between students and the site of a field course"

You are among a group of undergraduate geoscience students being asked to participate in an exploratory study for a Master's thesis. This study will examine your experiences surrounding your upcoming field studies course. Please read this form and ask any questions you may have before agreeing to participate in this study.

This study is being conducted by Emilee Mroz in the Outdoor Education Department at Montreat College, and is advised by Dr. Jim Shores and Dr. Brad Daniel of Montreat College.

Background Information
The purpose of this study is to investigate the connections students have with the site of a multi-day field course.

Procedures
If you agree to be in this study, you will be asked to do the following things:
1. Complete the pre-course survey, which will take approximately 10-15 minutes.
2. Complete the post-course survey after your course, which will take approximately 15 minutes.

Risks and Benefits of this Study
The risk in completing the surveys is that it will take some time and thought to complete. The benefit you will have as a result of your participation is that you will be offered the opportunity to reflect on your experiences participating in a field studies course.

Confidentiality
The records of this study will be kept private. The researcher will not include any information that will make it possible to identify participants in any resulting publication. Research records will be kept in a locked file; only Emilee Mroz will have access to the records, which will be destroyed one year after completion of the study.

Voluntary Nature of the Study
Your decision whether or not to participate will not affect your current or future relations with your college or university.

Please sign the next page indicating your consent to participate.

Contacts and Questions
The researcher conducting this study is Emilee Mroz. You may ask any questions you have now. If you have questions later, you may contact Emilee Mroz; Phone: (252)622-5125, E-mail: emilee.mroz@montreat.edu, her advisor, Dr. Jim Shores; Phone: (828)669-8012 x3314, or Dr. Brad Daniel; Phone: (828)669-8013 x3307.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, contact the Internal Review Board (IRB) of your institution.

You will be given a copy of this form to keep for your records.

Statement of Consent

I have read the above information. I have asked questions and have received answers. I consent to participate in this study.

________________________________ ________________

Signature of Participant Date

________________________________ ________________

Signature of Investigator Date

Appendix B

Pre-Course Survey

The Student View of a Geoscience Field Course

A Master's Thesis Study

Montreat College

Pre-field work

Thank you for your assistance with this study. I am researching the connections students have with the location of geoscience field courses. Please answer the questions to the best of your ability.

Demographics

1. Name 2. Your age at May 1, 2014 __________ years

3. Gender Male ☐ Female ☐

4. Have you been on an overnight field course before?

Yes ☐ ________ times No ☐

5. What is your Major? If you have a Minor, please list.

6. How many Geology/Geoscience classes have you taken thus far?

7. Where will you be going for your field course in May 2014?

Substantive

1. Why did you choose this program? Please check the boxes that apply to you.

Outdoor Experience	☐	Interested in subject	☐
Future career	☐	Location of course	☐
Enjoy traveling	☐	Personal recommendation	☐
Other	☐	Specify	

2. If you have been on a field course before, what was your most memorable field course experience?

For each of the following statements please indicate the extent to which you agree or disagree.

1	2	3	4	5
Strongly Disagree	Mildly Disagree	Neutral	Mildly Agree	Strongly Agree

1. ________ We are approaching the limit of the number of people the earth can support.
2. ________ Humans have the right to modify the natural environment to suit their needs.
3. ________ When humans interfere with nature, it often produces disastrous consequences.
4. ________ Human ingenuity will insure that we do NOT make the earth unlivable.
5. ________ Humans are severely abusing the environment.
6. ________ The earth has plenty of natural resources if we just learn how to develop them.
7. ________ Plants and animals have as much right as humans to exist.

8. ________ The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. ________ Despite our special abilities humans are still subject to the laws of nature.
10. ________ Human destruction of the natural environment has been greatly exaggerated.
11. ________ The earth has only limited room and resources.
12. ________ Humans were meant to rule over the rest of nature.
13. ________ The balance of nature is very delicate and easily upset.
14. ________ Humans will eventually learn enough about how nature works to be able to control it.
15. ________ If things continue on their present course, we will soon experience a major ecological disaster.

Reflection

1. What are you most looking forward to on this field course?

2. Do you feel any type of connection to the location of your field course (e.g. spiritual, physical, intellectual)? Please explain.

3. What factors, if any, led to this connection (e.g. studying in books, influence of professor, personal experiences, etc.)?

Thank you for your help! If you need more space, please write on a separate sheet.

Appendix C

Post-Course Survey

The Student View of a Geoscience Field Course

A Master's Thesis Study

Montreat College

Post-Field Course

Demographics

1. Name

2. Where did you go on your field course?

3. How long was your field course?

4. What was your lodging situation? (i.e. camping, hotel, etc.)

Substantive

1. What was your most memorable experience from the field course?

Please rank each item to the extent to which you agree or disagree.

1	2	3	4	5
Strongly Disagree	Mildly Disagree	Neutral	Mildly Agree	Strongly Agree

16. We are approaching the limit of the number of people the earth can support.
17. Humans have the right to modify the natural environment to suit their needs.
18. When humans interfere with nature, it often produces disastrous consequences.
19. Human ingenuity will insure that we do NOT make the earth unlivable.
20. Humans are severely abusing the environment.
21. The earth has plenty of natural resources if we just learn how to develop them.
22. Plants and animals have as much right as humans to exist.
23. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
24. Despite our special abilities humans are still subject to the laws of nature.
25. Human destruction of the natural environment has been greatly exaggerated.
26. The earth has only limited room and resources.
27. Humans were meant to rule over the rest of nature.
28. The balance of nature is very delicate and easily upset.
29. Humans will eventually learn enough about how nature works to be able to control it.
30. If things continue on their present course, we will soon experience a major ecological disaster.

Reflection

1. How did you feel when you were outside in a remote place during your field course?

2. Do you have any personal connections with the site of your field course now that you have spent time there (e.g. emotional, physical, intellectual, etc.)? Please describe.

3. Has your view towards the natural world changed upon completion of this field course? Please explain.

Please use a separate sheet if you need more space to write. Thank you for your help!