PARTICIPANTS' PERCEPTIONS OF HOW AN EXPEDITIONARY SCIENCE PROGRAM INFLUENCED ENVIRONMENTAL ACTION

Misty Varnell

Montreat College

December, 2016

Work Submitted in partial completion of Master of Science in Environmental Education, Montreat College, Montreat, NC 28757

MONTREAT COLLEGE

School of Adult and Graduate Studies

This is to certify that the following professors have examined this thesis by
Misty Varnell
in final form for submission as partial requirements for a
Master of Science in Environmental Education Degree.

Dorothea K. Shuman, Ph.D.

Dorothea K. Shuman, Ph.D.

November 11, 2016

Richard B. Daniel, Ph.D.

Richard B. Daniel, Ph.D.

November 11, 2016

Montreat College Final Approval and Acceptance:

Susan DeWoody

Vice President & Dean, Adult and Graduate Studies, Susan DeWoody, Ed.D.

November 11, 2016

ABSTRACT

Expeditionary science facilitates hands-on science activities in the context of multi-day wilderness expeditions. Little research has investigated the outcomes of expeditionary science. This study retrospectively surveyed participants of an expeditionary science program, CLIMBE, to identify their perceptions of how the experience may have influenced their current environmental action. The majority of respondents rated CLIMBE as influential on their environmental action. Learning about the environment and being immersed in nature were the most frequently described influential program components. Respondents indicated that CLIMBE influenced environmental actions such as conserving water and pursuing education and volunteer efforts related to the environment. This study contributes to our understanding of how expeditionary science may influence environmental action. The findings may be useful to environmental educators in the ongoing development of educational programming related to influencing environmental action.

Keywords: expeditionary science, environmental education, residential environmental education, wilderness education, wilderness experience program, field science, field ecology, significant life experience, environmental action

ACKNOWLEDGEMENTS

Thank you to Dr. Dottie Shuman and Dr. Brad Daniel for guiding me along this academic journey. You all have sharpened me as a researcher and educator. You have supported me since my youthful undergraduate days, encouraged my desire to make a difference through outdoor and environmental education, and loved me at some of my highest peaks and in my lowest valley.

Thank you to the CLIMBE alumni who participated in this study. The most exciting part of this research process was reading your responses. I also believe that your thoughtful responses are what made this research valuable. To the parents of CLIMBE alumni (including my own) – thank you for taking your kids outside!

I am grateful for two mothers who shared their sons' stories with me. Their sons participated in CLIMBE different years, and were not so unlike all the other intelligent and outdoorsy kids that CLIMBE attracted. I was deeply saddened to learn that they are no longer with us in this life. Both Eric and Greg loved their families, loved nature, and lived life fully. It is my hope that this work honors the families of Eric and Greg, and that their memories will continue to inspire others to love and live likewise.

Thank you to my fellow classmates and dear friends, Erin, Holly, and Lauren, for reading drafts, coding data, and sharing life together. Thank you to all of my friends, family, and colleagues who have cheered me on through grad school and the completion of this thesis.

To my sister, Dana, thank you for supporting me in the countless ways you did that afforded me extra time to write and motivated me to keep going when I was exhausted. Most of all, thank you for being my best friend and adventure buddy! To my Daddy, I wish you were

still here – we never imagined when I started this journey that you would be watching the end from Heaven. You and Mom inspired me to pursue my dreams, encouraged me every step along the way, and loved me through the hardships, successes, and all that was life. To my Mom, thank you for your continued love and support. I especially could not have made it through this last year without you. Lastly, I thank God for blessing me with these gifts in life and the gift of eternal salvation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1.

INTRODUCTION

Background

Environmental education (EE) addresses environmental issues by extending opportunities for people to learn about environmental systems, examine and clarify personal values related to the environment, develop skills for addressing environmental issues, and take actions that help protect the environment for present and future generations (Ardoin & Merrick, 2013; Hungerford & Volk, 1990; NAAEE, 2009; UNESCO-UNEP, 1978). Cumulatively, EE promotes the continual development of environmental literacy, which is expressed through informed environmental action (Ardoin & Merrick, 2013; NAAEE, 2009).

Numerous studies have shown that EE programs can achieve goals related to environmental literacy (Bogner, 1998; Jordan, Hungerford, & Tomera, 1986; Simmons, 1991; Stern, Powell, & Ardoin, 2008), but the outcomes vary by program. Expeditionary science is an educational approach that facilitates hands-on scientific investigation in the context of multi-day wilderness expeditions (Shuman, 2011). Expeditionary science is modeled after the multi-disciplinary technique of scientist-explorers like Alexander von Humboldt and others, whose vast inquiries integrated and advanced numerous scientific disciplines and expanded our knowledge of the natural world (Bowler, 2002; Daniel, 2011; Shuman, 2011). Expeditionary science has received little recognition in the environmental or experiential education literature, so there is little research to support or refute its effectiveness at fulfilling EE goals.

Shuman's (2011) conference proceeding on the Center for Learning and Investigation in Mountain Backcountry Ecosystems (CLIMBE) was the only paper located that specifically

described outcomes of an expeditionary science program. CLIMBE conducted weeklong expeditionary science trips in the backcountry where students learned about environmental concepts and were involved in the collection and reporting of real environmental data (Shuman, 2011). Pre- and posttest data suggested that CLIMBE was meeting its goals of increasing students' knowledge and interest in science (Shuman, 2011), but no research has followed up on the program's outcomes related to environmental literacy.

Time and resource constraints are often limiting factors to conducting longer-term longitudinal research, and as such, there has been a marked deficit in the evaluation of EE outcomes extending beyond six months post-experience (Schneider & Cheslock, 2003). Since it is difficult to follow an individual through continued assessment, some researchers have used a cross-sectional retrospective approach, which relies on particpants' autobiographical memories (Daniel, 2003). Environmental educators have often conducted retrospective research through the theoretical lens of significant life experiences (SLE), seeking to broadly understand the types of childhood experiences that inspire adult environmental action (Chawla, 1998, 1999; Tanner, 1980), and more recently, to investigate participants' memories of specific programs (D'Amato & Krasny, 2011; Daniel, 2003; Farmer, Knapp, & Benton, 2007; Kellert, 1998; Liddicoat & Krasny, 2014). For example, interviews that were conducted up to five years retrospectively revealed that participants felt motivated to protect the environment as a result of multi-day wilderness and EE experiences (D'Amato & Krasny, 2011; Liddicoat & Krasny, 2014). Kellert (1998) documented environmental actions participants reported in the years following wilderness experience program (WEP) courses, but there appears to be little other research exploring the long-term influence educational prorams may have on participants' environmental action.

Purpose

The purpose of this study was to explore participants' retrospective perceptions of how an expeditionary science program, CLIMBE, may have influenced their personal involvement in environmental action. The research was conducted five to ten years after participants' expeditionary science experience, and was guided by three specific questions:

A) Did participants perceive the overall CLIMBE experience as influential on their current level of environmental action? If participants said "yes", then further exploration included:

B) What components of CLIMBE did participants most frequently describe as influential on their current level of environmental action?

C) What environmental actions did participants most frequently describe as having been influenced by CLIMBE?

Key Terms

Environmental education (EE). Environmental education aims to develop environmentally literate citizens – people who are sensitive to the environment, knowledgeable about environmental and human systems, motivated to act responsibly toward the environment, and skilled in taking individual and collective actions for the environment (Ardoin & Merrick, 2013; Hungerford & Volk, 1990; NAAEE, 2009; UNESCO-UNEP, 1978). Therefore, the practical expression of environmental literacy is informed environmental action (NAAEE, 2009).

Residential environmental education. An environmental education program that spans a minimum of three to five days is considered residential (Alkin, Linden, Noel, & Ray, 1992).

Residential EE programs often take place in National Park and camp facilities (Bogner, 1998; Stern et al., 2008).

Wilderness experience program (WEP). Wilderness experience programs are usually characterized by non-motorized activities (i.e. backpacking, canoeing) in the backcountry, and often include adventure elements perceived as high risk (i.e. rock climbing) (Alkin et al., 1992). While wilderness programs often inherently have environmentally educative qualities, the focus is largely on outcomes related to personal growth (D'Amato & Krasny, 2011).

Expeditionary science. Expeditionary science programs facilitate hands-on scientific investigation in the context of a multi-day wilderness expedition (Shuman, 2011). The expeditionary science concept is based on the inquiry-driven scientific expeditions of Alexander von Humboldt, Charles Darwin, Louis Agassiz, Asa Gray, Andrew Michaux, and others, whose integrative approach expanded our scientific knowledge and understanding of the earth (Bowler, 2002; Daniel, 2011; Shuman, 2011). Expeditionary science programs may include EE (Metzger & McEwan, 1999); however, the focus is on developing a scientific understanding of the natural world.

CLIMBE. The Center for Learning and Investigation in Mountain Backcountry Ecosystems was an expeditionary science program that engaged students in hands-on science activities over the course of a multi-day backcountry trip. Participants conducted scientific research to learn about the ecosystems they explored (Shuman, 2011). The overarching goal of CLIMBE was "for students to increase knowledge and understanding of mountain ecosystems" (Shuman, 2011, p. 3). CLIMBE was funded by two consecutive grants through the Burroughs-

Wellcome Fund Student Science Enrichment Program from 2005-2010, then operated independently from 2011-2012.

Environmental action. The term environmental action has been used broadly to refer to any number of behaviors regarding environmental protection (Hollweg et al., 2011). The terminology related to environmental action has been somewhat varied in the literature, as researchers have similarly defined responsible environmental behaviors (Hungerford & Volk, 1990; Marcinkowski, 1998), pro-environmental behaviors (Marcinkowski, 1998), and environmental stewardship (Stern et al., 2008). For the purpose of this study, environmental action refers to a lifestyle or behaviors committed to caring for the environment (Arnold, Cohen, & Warner, 2009).

Significant life experience (SLE). The environmental education profession considers a significant life experience to be any event or influence that shaped a person's environmental attitude and lifestyle regarding environmental action (Chawla, 2006). SLE research related to environmental education is largely characterized by qualitative, retrospective analyses (Chawla, 2006).

CHAPTER 2.

LITERATURE REVIEW

Environmental education (EE) promotes social and environmental sustainability through the process of developing informed, environmentally active citizens (NAAEE, 2009). Researchers have sought to understand the types of life experiences that inspire environmental action through the framework of significant life experiences (SLE). SLE research is typically qualitative, and therefore favorable to studying environmental action development as participants can elaborate on past experiences they think significantly influenced their environmental action (Chawla, 2006). Tanner (1980) conducted the first study of this kind by investigating the backgrounds of members of environmental organizations through an open-ended survey. Tanner's (1980) findings indicated that time spent in natural areas, frequent contact with habitat, parents, and teachers were the most often reported influences on decisions to pursue conservation work. Subsequent SLE research has repeatedly identified time spent in nature, educative experiences, and influential people (often parents) among the top five factors that influence people's environmental attitudes and actions (Arnold et al., 2009; Cachelin, Paisley, & Blanchard, 2009; Chawla, 1998, 1999).

Developing environmental action through EE is a complex process that can take many forms and occur through many programs (Ardoin & Merrick, 2013; NAAEE, 2009). EE can take place in settings such as schools, nature centers, zoos, residential camps, parks, and protected land (Ardoin & Merrick, 2013). Additionally, different EE programs may be driven by different philosophies and serve different purposes (Simmons, 1991). While many EE centers focus on developing environmental knowledge and pro-environmental attitudes (Simmons,

1991), people are often faced with barriers such as lack of skill, lack of incentive, or old behavior patterns, that disconnect their environmental intentions from their actions (Hungerford & Volk, 1990; Kollmuss & Agyeman, 2002). Chawla (2014) suggested that EE programs are most effective at influencing environmental action when they are of extended duration (including three to five days of immersive field experience), connect learning about the environment to the real world, and involve students actively.

Researchers have sought to understand the how various EE and wilderness experience programs (WEP) influence aspects of environmental literacy, including environmental action. However, EE research has rarely extended beyond six months after the conclusion of programs (Schneider & Cheslock, 2003), so there is little evidence to describe the long-term effectiveness of EE programming on influencing environmental action.

Environmental Education Experiences

EE and other ecology-based programs offering direct experiences in nature and opportunities for learning about the environment have often positively influenced participants' environmental knowledge, attitudes, and actions (Bogner, 1998; Farmer et al., 2007; Hanna, 1995; Jordan et al., 1986; Liddicoat & Krasny, 2014; Stern et al., 2008). Research suggests that longer EE experiences (Bogner, 1998; Stern et al., 2008) and recurring participation in EE-type camps (Kruse & Card, 2004) can have greater influence on aspects of environmental literacy, including environmental action, compared programs of shorter duration. Additionally, the emphasis of hands-on learning and mentorship with professionals in a supportive community can positively influence participants' perceptions and pursuit of science (Aschbacher, Li, & Roth, 2010; Bischoff, Castendyk, Gallagher, Schaumloffel, & Labroo, 2008).

Following a six-day residential EE workshop for high school students, Jordan et al. (1986) found a relationship between the instructional time spent on various categories and the amount of knowledge students gained in each category. Additionally, the environmental actions that students engaged in after the residential EE workshops were directly related to the type and amount of knowledge gained in each category (Jordan et al., 1986). The researchers also noted that the students who received instruction in environmental action strategies were more knowledgeable of how to act, and significantly more environmentally active post-program than the students who were only provided issues awareness instruction (Jordan et al., 1986).

Two separate studies found that similar five-day residential national park-based EE and ecology programs for elementary and middle school students were relatively successful in achieving EE goals (Bogner, 1998; Stern et al., 2008). Both programs emphasized direct experiences in the natural world and provided active learning environments (Bogner, 1998; Stern et al., 2008), but only one encouraged environmental actions (Stern et al., 2008). Participants demonstrated increased pro-environmental attitudes immediately following the programs, and both programs led to increases in participants' self-reported environmental actions during the three to six months post program (Bogner, 1998; Stern et al., 2008). Stern et al. (2008) noted that while students' connection to nature and interest in learning increased from pretest to posttest, the significance of these variables diminished in the three months following.

Others have found more promising evidence for the longevity of EE program outcomes. Liddicoat and Krasny (2014) followed up with students five years after a middle school experience in one of two national park-based residential outdoor EE programs that included outdoor recreation, learning about the parks' ecosystems through inquiry-based science, and

practicing environmentally friendly behaviors. The students interviewed said that they remembered learning relevant scientific knowledge, and that the programs inspired environmental stewardship (Liddicoat & Krasny, 2014). The researchers concluded that memories could continue to direct actions in the wake of EE experiences (Liddicoat & Krasny, 2014).

The general success of multi-day programs does not imply that single-day EE experiences are ineffective. In interviews conducted one year after a fourth grade field trip to the Great Smoky Mountains National Park, Farmer et al. (2007) found that students often expressed pro-environmental attitudes related to what they remembered learning about the environment. Furthermore, the students tended to remember the active components of their field trip the best, as evidenced in their descriptions of walking through the park, identifying natural objects, and doing various activities (Farmer et al., 2007). Outcomes regarding environmental knowledge, attitudes, and action have also been shown to increase with higher levels of hands-on learning (Kruse & Card, 2004).

EE can also be implemented in schools in a variety of formats to support the achievement of educational standards (NAAEE, 2009). Hobert (2010) investigated the effects of a yearlong middle school environmental stewardship curricular program, which included a local, student-led environmental stewardship service-learning project. Environmental stewardship projects are a natural expression of hands-on learning and can help develop environmental literacy (Blanchard & Buchanan, 2011). In retrospective interviews, students said that they had developed knowledge of environmental issues and skills for planning their own environmental action projects as a result of the stewardship program (Hobert, 2010). A quantitative assessment,

however, revealed that the students who had participated in the stewardship program were only slightly more environmentally aware and active in community environmental issues than their peers in the control group (Hobert, 2010).

Contrary to many findings regarding the positive outcomes of educational experiences, one study found that youth participating in a ten-week unit, "Watershed to Water Faucets," at an Expeditionary Learning Outward Bound charter school exhibited a decline in self-reported environmental virtue from pretest to posttest (Martin, Bright, Cafaro, Mittelstaedt, & Bruyere, 2008). It was not clear why the students' environmental virtue scores did not improve after the learning experience as expected. The researchers ventured a possible explanation that the students may have become more self-aware through the learning unit and they, therefore, rated their environmental virtue more accurately at the end of the unit (Martin et al., 2008).

Wilderness Experience Programs

WEPs typically emphasize participants' personal growth rather than EE, but given the immersive outdoor experience provided, environmental themes are often inherent to the programs (D'Amato & Krasny, 2011). Research suggests that simply spending time in nature can help develop environmental sensitivity, which is foundational to becoming environmentally active (Chawla, 1998; Hungerford & Volk, 1990). Through reflective (immediately after course) and retrospective (1-5 years after course) interviews with WEP participants, D'Amato and Krasny (2011) found that participants often mentioned connection to nature, awe of nature, and desire to protect nature as outcomes of their wilderness experience. Similarly, Kellert (1998) found that about three-quarters of the WEP participants that responded to a survey

retrospectively (1+ years after course) said that they became more environmentally aware and responsible as a result of program participation.

Qualitative and quantitative studies with various extended WEPs have found instructors often have a positive influence on participants' learning (McKenzie, 2003), environmental sensitivity (Sibthorp, Furman, Paisley, Gookin, & Schumann, 2011), and biophilic expressions (relationship to the natural world) (Meltzer, Faircloth, Bobilya, & Mitten, 2014). WEP participants have frequently credited their instructors as being the most impactful element of a course in terms of their appreciation for nature, for reasons including curriculum delivery, role modeling, and serving as a source of inspiration and support (Sibthorp et al., 2011).

Although not the norm, some WEPs do focus on EE and science. Metzger and McEwan (1999) detected increases in participants' environmental sensitivity following a five-day EE adventure canoe trip that contained both hands-on science activities and interpersonal group development. Hanna (1995) compared and contrasted the effectiveness of two WEPs – one that was adventure-based and one that was ecology-based – in fostering participants' wilderness knowledge, attitudes, intentions, and behaviors. Both WEPs had overall positive outcomes, but with interesting nuance: the ecology-based WEP participants tended to score higher than the adventure-based WEP participants for the wilderness-related variables measured, while the adventure-based WEP participants typically showed the greatest gains in each variable (except environmental behavior) from pretest to posttest (Hanna, 1995). Participants of the ecology-based WEP became more environmentally active post-program than their adventure-based WEP peers; however, it was noted that the ecology participants generally had greater environmental backgrounds and likely enrolled in the course to become more knowledgeable about

environmental issues (Hanna, 1995). The gains measured in environmental behaviors compared to intentions were weak, and while there were inevitably multiple factors contributing to low follow-through on intentions, Hanna (1995) observed that neither WEP actively engaged participants with resources to get involved in achieving their personal environmental goals. In another study, Haluza-Delay (2001) found that few participants of a 12-day WEP course made the connection between environmental care discussed during their trip and their lifestyles at home. Instead, many participants had developed the impression that the environment was a faraway wilderness and that nature did not exist in their suburban and urban communities (Haluza-Delay, 2001). Researchers have concluded that a wilderness experience can heighten participants' concern for the environment, but in order for WEPs to more effectively influence environmental action, participants must understand why action is important, and be aware of ways they can personally get involved in protecting their local environment (Chawla, 2014; Haluza-Delay, 2001; Hanna, 1995; Schneider & Cheslock, 2003).

Expeditionary Science

Expeditionary science combines the immersive, outdoor setting of a WEP experience and the hands-on scientific exploration aspect of an EE experience. This combination may constitute a successful venue for influencing environmental action. Few studies were located that described educational programs like expeditionary science (Hanna, 1995; Liddicoat & Krasny, 2014; Metzger & McEwan, 1999). Shuman's (2011) conference proceeding on the Center for Learning and Investigation in Mountain Backcountry Ecosystems (CLIMBE) was the only paper located that specifically described a program as expeditionary science. CLIMBE conducted six-day expeditionary science trips exploring forest, river, cliff, and cave ecosystems, respectively

(Shuman, 2011). Participants lived in the backcountry and engaged in learning activities such as collecting environmental data following standard scientific procedures and reporting on ecological and environmental concepts discovered through data collection (Shuman, 2011). Pretest and posttest data indicate that CLIMBE increased students' knowledge and interest in science (Shuman, 2011). CLIMBE's influence on environmental action was not assessed, and the long-term effectiveness of the program is unknown.

Statement of Need

The EE field could benefit from more research that explores the influence of EE and related programs long after their conclusion (Liddicoat & Krasny, 2014; Schneider & Cheslock, 2003; Stern et al., 2008). Chawla (2006) has also recommended additional research regarding how environmental action is influenced, and research that measures environmental action. This study responds to the research gap by exploring participants' retrospective perceptions of how an expeditionary science program, CLIMBE, may have influenced their self-described environmental actions.

CHAPTER 3.

METHODOLOGY

This was a retrospective study with participants of an expeditionary science program, CLIMBE, conducted five to ten years after their experience. The purpose of the study was to answer three specific questions: did participants perceive their overall CLIMBE experience as influential on their current level environmental action; if so, what components of CLIMBE did participants most frequently describe as influential on their current level of environmental action, and what environmental actions did participants most frequently describe as having been influenced by CLIMBE. This study used a cross-sectional retrospective design in a mixed-method format. Participants were asked, at one point in time, to reflect on their CLIMBE experience. The overall research design was informed by the significant life experience (SLE) theoretical framework, which explores connections between childhood experiences and adult environmental action (Cachelin et al., 2009; Chawla, 2006; Wells & Lekies, 2006).

Program

The Center for Learning and Investigation in Mountain Backcountry Ecosystems (CLIMBE) at Montreat College conducted six-day expeditionary science trips for middle and high school students during the summers of 2005-2012. CLIMBE was originally developed to meet the objectives of the Burroughs-Wellcome Fund Student Science Enrichment Program, including increasing students' competence in science, nurturing students' enthusiasm for science, and interesting students in pursuing science related careers (Shuman, 2011). As such, the Burroughs-Wellcome Fund provided CLIMBE with two consecutive grants over the six-year period from 2005-2010, supporting CLIMBE's goal to increase participants' knowledge and

understanding of mountain ecosystems (Shuman, 2011). CLIMBE offered a variety of expeditions in western North Carolina: backpacking to explore forest ecosystems; white-water canoeing to explore riparian ecosystems; rock-climbing to explore cliff-face ecosystems; and caving to explore cave ecosystems. Example learning activities included identifying trees, noting species variation at changing elevations, and sampling streams for salamanders and macroinvertebrates as water quality indicators. College faculty, park rangers, and other environmental science professionals often interacted with the students during their expeditions. Each expedition served six to ten participants and was led by two trained field educators, usually Montreat College undergraduate students majoring in Outdoor Education or Environmental Studies.

Participants & Population

Over 400 middle school and high school students in grades 8-12 (12-19 years old) self-selected to participate in CLIMBE from 2005-2010, the years that CLIMBE was grant-funded through the Burroughs Wellcome Fund. The program targeted students who expressed an interest in science. Both male (47%) and female (53%) students participated in the expeditions. The ethnicity was primarily Caucasian (90.6%), with some African-American (3%), Hispanic/Latino (3%), Asian (.4%), and other races (3%) represented. Most participants were from North Carolina, primarily the western region of the state. Some participants attended CLIMBE multiple years. See Shuman (2011) for a summative CLIMBE report.

At the time that participants were surveyed, their grade levels generally ranged from high school students through college graduates. An attempt was made to contact all former CLIMBE participants who attended between 2005-2010 and were 18 years of age or older. Only

participants who completed the retrospective survey were included in the study. As anticipated, a portion of the population were not reached due to a change in addresses within the last five to ten years; therefore, since the participants did not have equal chances of receiving the survey invitation, this study was a descriptive analysis of a nonprobability sample (Dillman, Smyth, & Christian, 2009).

Research Design

The study followed a targeted significant life experience approach (Daniel, 2003) in a cross-sectional retrospective format (Creswell, 2014), meaning that a specific population (participants of CLIMBE) was asked at one point in time to reflect on how a certain experience (CLIMBE) may have influenced their current level of environmental action. The study relied on participants' autobiographical memories of CLIMBE. Qualitative and quantitative data were collected and analyzed concurrently in an embedded mixed-method design (Creswell, 2014). The mixed-method design was selected to obtain participants' rich descriptions of CLIMBE's influence on their environmental action, and to provide supporting quantitative data to better understand their expressed perceptions of that influence on environmental action.

Data Collection

Data were collected via a survey of former CLIMBE participants during the fall of 2015, which was 5-10 years after participants' CLIMBE attendance. Postcards (see Appendix A) were sent through the U.S. Postal Service to the home addresses on file (as of 2005-2010 enrollment dates) for all eligible CLIMBE participants. The postcards informed participants of the study and guided them to respond by completing the survey online in SurveyMonkey® (see Appendix B); parents were asked to forward the survey information to their sons/daughters. Two reminder

postcards followed the initial mailing. The CLIMBE Facebook page was briefly reactivated to open an additional point of contact with the participants who were still connected to CLIMBE via social media: two separate posts informed participants (and parents) of the study and provided a link to the online survey. The survey remained open online for six weeks.

All non-respondents were contacted via the email address on file (as of the 2005-2010 enrollment dates) and asked to complete an abbreviated version of the survey online (see Appendix C-D). Research has shown that participants who respond to surveys often possess some form of motivation to do so; therefore following up with non-respondents and attempting to capture experiences that might have differed from those reported by the initial respondents helped establish data trustworthiness (Dillman et al., 2009).

Survey Instrument

A survey was developed for this study (see Appendix B). Respondents answered open-ended and closed-ended questions about their memories of CLIMBE and perceptions of CLIMBE's influence on their environmental action. An expert panel of six environmental educators, including one who directed an expeditionary science program similar to CLIMBE, reviewed the survey for clarity. Since the purpose of this study was to investigate whether expeditionary science might influence environmental action, and developing environmentally active citizens is a major goal of environmental education (EE), the environmental educators were positioned to provide critical feedback (NAAEE, 2009). Minor revisions to the survey were made per the expert panel's suggestions prior to administering the survey to CLIMBE participants. The survey is described below.

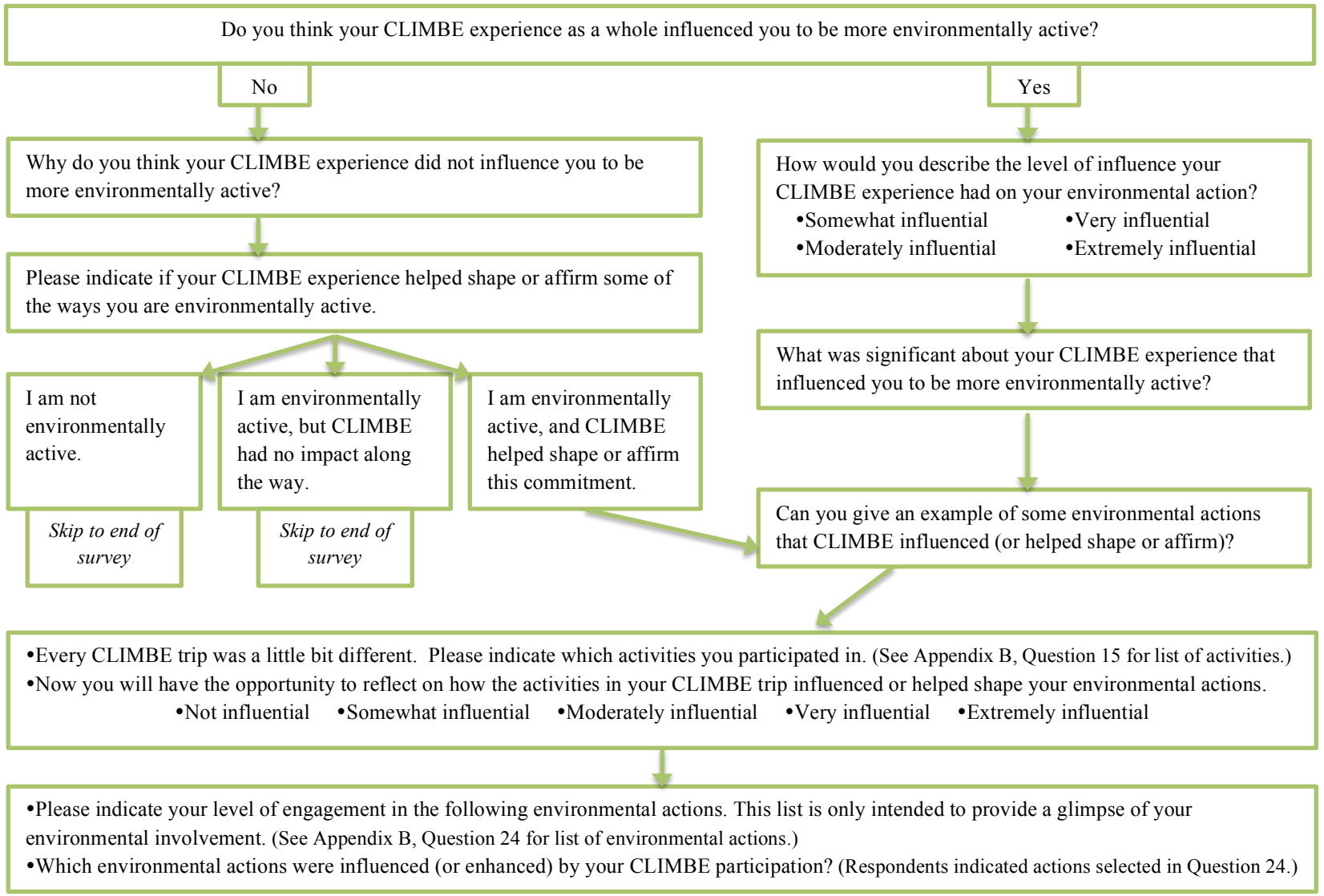
Respondents' background information. Respondents were informed that they would be asked questions related to environmental action. The respondents were instructed to consider environmental action as "any aspect of [their] lifestyle committed to helping the environment," and in order to allow their personal perceptions inform their responses, they were not provided examples of environmental actions. Prior to answering questions about CLIMBE, the respondents were asked if they considered themselves environmentally active, and if *yes*, to describe what they thought influenced them to be environmentally active. Respondents were also asked to provide the hometown where they spent the majority of their teenage years and to list their college majors/minors (intended, pursued or earned).

CLIMBE trip background information. All survey respondents were asked to indicate the number of times they participated in CLIMBE and to list the approximate year(s) of their CLIMBE participation; the approximation of years was intended to reduce respondents' concern if they could not remember the exact years(s) they attended. Respondents indicated which expedition(s) they attended from a closed-ended list.

CLIMBE's influence on environmental action. Prior to the environmental action questions, respondents rated the following items on separate five-point Likert-type scales: enjoyment of the overall CLIMBE experience, environmental knowledge gained through CLIMBE, and environmental awareness influenced by CLIMBE. A closed-ended question prompted respondents to indicate if they thought CLIMBE influenced them to be more environmentally active ("yes" or "no" response). Respondents were directed through the remaining survey differently based on their answers about CLIMBE's influence (see Figure 1).

Figure 1

Survey Questions Related to Environmental Action



Respondents who indicated that CLIMBE did not influence their environmental action were asked to describe why they thought CLIMBE was not influential. These respondents were also asked a closed-ended question about whether they thought CLIMBE helped shape or affirm their environmental action (as opposed to providing an *influence*).

Respondents who indicated that CLIMBE did influence their environmental action were asked to rate CLIMBE's level of influence on a four-point Likert-type scale. These respondents were also asked, in an open-ended question, to describe the CLIMBE components they thought provided significant influences on their environmental action.

Respondents who indicated that CLIMBE influenced or helped shape or affirm their environmental action were asked to select, from a closed-ended list, which activity components were included in their CLIMBE trip. These respondents were also asked to rate the level that each component they participated in influenced their environmental action.

Respondents who indicated that CLIMBE influenced or helped shape or affirm their environmental action were asked, in an open-ended question, to provide examples of their current environmental actions that were influenced, shaped, or affirmed by CLIMBE. Per Chawla's (2006) recommendation, these respondents were also asked closed-ended questions about their current environmental actions at the end of the survey. The closed-ended questions about environmental actions are described with the environmental action scale below.

Environmental action scale. A closed-ended question on environmental action, referred to as the environmental action scale (see Appendix B, Question 24), was developed based on environmental actions measured in previous research (see Hobert, 2010; Kellert, 1998). Only the respondents who indicated that CLIMBE influenced or helped shape or affirm their

environmental action were asked to respond to the environmental action scale. The environmental action scale allowed respondents to indicate how often they engaged in a range of environmental actions, such as recycling and volunteering with environmental organizations, by selecting from a five-point Likert-type scale, from "never" to "always". These respondents also indicated which environmental actions from the environmental action scale were influenced or enhanced by CLIMBE.

Data Analysis

The qualitative data analysis proceeded as follows: The open-ended responses were transcribed by question, read for big ideas, and coded by the primary researcher and an independent coder. The first two coders negotiated codes and established consistent codes for the entire data set. Themes emerged from the coded data. An intercoder reviewed 30% of the data, and intercoder reliability scores were established at 91% for Question 1, 100% for Question 10, 82% for Question 13, 81% for Question 14, and 93% for Question 26 (see Appendix B for questions) (Creswell, 2014). Since memories are often more accurate when people are allowed to construct their own account of the past (Neisser, 1988), the rich, descriptive data were relied on heavily to interpret respondents' descriptions of how they pecieved CLIMBE's influence on their environmental actions.

The closed-ended questions about CLIMBE's influence on environmental knowledge, awareness, and action were analyzed by showing the number of responses for each level on the Likert-type scale from "not influential" to "extremely influential" (see Appendix B, Questions 7, 8, 9, and 12). The closed-ended questions about CLIMBE components (see Appendix B, Questions 15-16) were analyzed by showing: A) the number of respondents that reported

participating in each component, and B) the number of respondents that rated each component as "not influential", "somewhat and moderately influential," and "very and extremely influential" on their environmental action.

The closed-ended questions about environmental actions (see Appendix B, Questions 24-25) were analyzed by showing: A) the number of respondents who reported engaging in each environmental action, and B) the number of respondents who indicated that CLIMBE influenced (or enhanced) their engagement in each environmental action. Respondents' level of environmental action, as measured on the environmental action scale, was quantified based on Hobert's (2010) methodology: respondents' environmental action scores were the sum of their reported level of engagement in each environmental action ("always" = 4, "very often" = 3, "a moderate amount" = 2, "rarely" = 1, or "never" = 0). The environmental action scale ranged from a possible 0-60 points.

Responses about CLIMBE's influence on environmental action were compared between those who attended one CLIMBE trip versus two or more CLIMBE trips. Likewise, the environmental action scores were compared between respondents who reported CLIMBE as "somewhat and moderately influential" versus "very and extremely influential" on their environmental action.

Trustworthiness

It is important to note that the primary researcher was a CLIMBE participant in 2008, and later a field educator for CLIMBE in 2011-2012, following the period included in the study. The second coder and intercoder were selected for having no previous connection to CLIMBE and were included during the analysis phase to reduce the potential bias in interpretation and to help

ensure the integrity of this study. Chawla (2006) noted that only three studies on SLEs in EE had reported checks for inter-coder reliability prior to 2006; therefore this procedure not only strengthens the trustworthiness of this study's results, but also contributes to qualitative data validation in the EE research community.

CHAPTER 4.

RESULTS

Former participants of an expeditionary science program, CLIMBE, were contacted five to ten years after their trip attendance and asked to complete a survey on their perceptions of the program (see Appendix B). The purpose of this study was to explore the questions: did participants perceive CLIMBE as influential on their environmental action; and if so, what specific components of CLIMBE did participants describe as influential, and what environmental actions did participants describe as having been influenced by the program. Open-ended and closed-ended questions provided a more complete analysis of respondents' perspectives on how CLIMBE may have influenced their environmental action.

Respondents provided basic information about their CLIMBE experience, including the year(s) and number of times they participated in CLIMBE, and the ecosystem-focus of their expedition(s). Respondents rated their overall enjoyment CLIMBE, as well as their perceptions of CLIMBE's influence on their environmental knowledge and awareness. Respondents answered "yes" or "no" to the question, "Do you think your CLIMBE experience as a whole influenced you to be more environmentally active?" Respondents who indicated that CLIMBE was influential or affirmative then answered questions about specific components of CLIMBE and their own environmental actions, while respondents who indicated CLIMBE was not influential answered different follow-up questions (see Figure 1).

The results successively describe what respondents reported on: the CLIMBE trips they participated in, CLIMBE's overall influence on environmental knowledge, awareness, and action; the influence of specific CLIMBE components on environmental action; and

environmental actions influenced by CLIMBE. To gain further insight on the influence an expeditionary science program might have, respondents' ratings on CLIMBE's influence on environmental action are compared with: A) attendance on one versus two or more CLIMBE trips, and B) environmental action scores. Additional information about the respondents is provided in the last section.

An attempt was made to contact 405 former CLIMBE participants. Mail was returned for 45 individuals, 3 were reported unavailable to take the survey by their parents, and 2 began the survey but discontinued their participation in the study. Based on these factors and lack of returned mail, 355 eligible participants may have received the postal notice; however, it is possible, and suggested by the follow-up with non-respondents, that an additional number of these potential survey participants did not receive a postcard informing them of the study. Sixty-three ($N = 63$) former CLIMBE participants responded to the online survey in SurveyMonkey® during the six-week period it was open, comprising an 18% response rate.

Basic CLIMBE Trip Data Reported

Respondents participated in CLIMBE as 12-18 year olds during the years 2005-2010; at the time they were surveyed in the fall of 2015, respondents ranged in age from 18-27. Seventy-five percent (75%) of respondents ($n = 47$) attended one CLIMBE trip, while 25% ($n = 16$) attended two or more trips, usually over several summers. The respondents participated in a variety of CLIMBE expeditions as displayed in Table 1. The forest backpacking and river canoeing trips were the longest-running CLIMBE expedition options, and were consequently reported by the majority of respondents in this study.

Table 1

Distribution of CLIMBE Trips

CLIMBE Trip	**No. Trips**	**% Total Trips**
Forests/Water Quality, Climate – backpacking	53	64%
Rivers/Water Quality – canoeing	15	18%
Advanced – backpacking (for returning participants)	7	8%
Rocks – rock climbing	5	6%
Caves – caving	2	2%
MEGA/Appalachian Trail – backpacking (two weeks)	1	1%

Note. $N = 63$. Some participants enrolled in two or more trips, therefore to total number of trips for this sample is 83. Since percentages were rounded to the nearest tenth, the total does not add to 100%.

All of the respondents indicated they enjoyed CLIMBE at least moderately based on selections from a five-point Likert-type scale; most of the responses ranged among the highest values ("I liked it" and "I loved it"). The follow-up with non-respondents yielded similar results regarding trip enjoyment. All of the respondents (100%) indicated that they learned something new about the environment on their CLIMBE trip (see Table 2). Ninety-seven percent of the respondents rated CLIMBE as influential on their environmental awareness (see Table 3).

Table 2

Influence of CLIMBE on Environmental Knowledge

Do you think you learned new things about the environment on your CLIMBE trip?	**No. Responses**	**% Responses**
No	0	0%
Yes, somewhat	5	8%
Yes, a moderate amount	18	29%
Yes, quite a bit	21	33%
Yes, very much	19	30%

Note. $N = 63$

Table 3

Influence of CLIMBE on Environmental Awareness

Do you think your CLIMBE trip influenced you to be more environmentally aware?	**No. Responses**	**% Responses**
Not influential	2	3%
Somewhat influential	11	17%
Moderately influential	23	37%
Very influential	19	30%
Extremely influential	8	13%

Note. $N = 63$

Reported Influence of CLIMBE on Environmental Action

Eighty-six percent (86%) of respondents rated CLIMBE as influential on their environmental action at some level. Respondents rated CLIMBE's influence on their environmental action similarly to how they rated CLIMBE's influence on their environmental awareness. Two respondents who indicated that CLIMBE did not influence their environmental action responded to a closed-ended question indicating that CLIMBE did help shape or affirm some of their environmental actions. The follow-up with non-respondents ($N = 9$) yielded comparable results, with six stating that CLIMBE influenced them to be more environmentally active, two stating that CLIMBE had no impact, and one providing an unclear response. Table 4 summarizes how respondents rated CLIMBE's influence on their environmental action.

Table 4

Influence of CLIMBE on Environmental Action

How would you describe the level of influence your CLIMBE experience had on your environmental action?	**No. Responses**	**% Responses**
Not influential	9[a]	14%
Somewhat influential	13	21%
Moderately influential	22	35%
Very influential	14	22%
Extremely influential	5	8%

Note. $N = 63$

[a]Two respondents indicated in the next question that CLIMBE helped shape or affirm their commitment to environmental action.

Reasons Why CLIMBE Did Not Influence Environmental Action

Respondents who indicated that CLIMBE did not influence their environmental action were asked a supporting open-ended question regarding why they thought their CLIMBE trip was not influential (see Appendix B, Question 10). Of the nine respondents who indicated that CLIMBE did not influence them to be more environmentally active, three indicated that they were not environmentally active, and five indicated that CLIMBE was not influential because they were environmentally active prior to CLIMBE. Respondents also provided other explanations for why they thought CLIMBE did not influence their environmental action, including that environmental action was not a focus of their CLIMBE trip. Table 5 summarizes the responses on why CLIMBE did not influence environmental action, in descending order of frequency of themes. The table is supported by representative quotes.

Table 5

Descriptions of Why CLIMBE was Not Influential on Environmental Action

Theme	**No. Responses**	**Representative Respondent Quotes**
Environmentally active prior to CLIMBE	5	"I think I was already environmentally active" *[Forest and river trips ~ 6-7 yrs. ago]*.
Environmental science knowledge prior to CLIMBE	3	"I already had a ton of experience in [environmental] science and activities" *[River trip ~6 yrs. ago]*.
Spent time outdoors prior to CLIMBE	2	"I had already spent a lot of time outdoors…" *[Forest trip ~9 yrs. ago]*.
Environmental action was not a focus of CLIMBE trip	2	"I don't remember [environmental action] being a big focus" *[Forest trip ~9 yrs. ago]*.
Young age	1	"…I was pretty young (13 or so) when I did [CLIMBE]" *[Forest trip ~10 yrs. ago]*.

Note. $n = 9$. Some respondents provided multiple explanations.

Components of CLIMBE that Influenced Environmental Action

After rating CLIMBE's overall influence on their environmental action, respondents who rated CLIMBE as influential (n = 54) or stated that CLIMBE helped shape or affirm (n = 2) their environmental action were asked open-ended and closed-ended questions about the CLIMBE components that they thought influenced their environmental action. The open-ended question preceded the closed-ended questions in order to allow respondents to first construct their own accounts of which CLIMBE components they thought were significant without being potentially influenced by a list of specified CLIMBE components. The qualitative data is described first, followed by the quantitative data.

Descriptions of influential program components. The respondents who rated CLIMBE as influential on their environmental action (n = 54) were asked, "What was significant about your CLIMBE experience that influenced you to be more environmentally active" (see Appendix B, Question 13). The respondents collectively described the following components of CLIMBE as significantly influencing their environmental action: learning about the environment and environmental issues, being immersed in nature, and having influential instructors (see Table 6). Responses are reported in descending order of frequency of themes, with representative quotes to support each component. A description of each item follows the table.

Table 6

CLIMBE Components Described as Influential on Environmental Action

Component	**No. Responses**	**Representative Respondent Quotes**
Learning about the environment and environmental issues (often hands-on)	40	"Having a hands on experience seeing how things have actually impacted our environment" *[Forest and advanced backpacking trips ~9-10 yrs. ago]*.
		"Getting to study numerous streams and water systems and getting the opportunity to observe the different life forms present in clean streams [versus] polluted really opened my eyes to the importance of keeping our beautiful mountain streams clean" *[Forest trip ~10 yrs. ago]*.
Being immersed in nature	10	"The pure immersion in the raw outdoors really forced me to interact with nature… The realizations I had at CLIMBE encouraged me to look more closely at nature in the future because I now knew that you could see some neat things" *[River trip ~5 yrs. ago]*.
Having influential instructors	6	"I remember really admiring my instructors and their environmental activism stood out to me. Because I admired them so much, I wanted to be more like them. Caring about the environment was cool" *[Forest trip ~9 yrs. ago]*.
Other	18	"I also became closely connected to an eclectic group of young leaders - this was responsible for a good bit of my [social] development in high school because I became comfortable with anyone and everyone" *[Forest, advanced backpacking, and river trips ~6-8 yrs. ago]*.
		"Just to know that there was a whole world of backpacking out there that I never had experienced" *[Forest trip ~10 yrs. ago]*.

Note. $n = 54$. Some respondents listed multiple significant components.

Learning about the environment and environmental issues. In response to the open-ended question on which CLIMBE components influenced environmental action, forty respondents described the significance of learning about the environment and environmental issues, and many provided multiple examples of how learning about the environment was influential. Over half of the responses to this question (23) specifically mentioned the hands-on aspect of learning, including some who mentioned the significance of scientific data collection. These responses are representative of how respondents described the influence of hands-on learning:

- "The brief hands-on science that we did allowed me to see practical applications for "classroom" ideas" *[Forest trip ~4 yrs. ago]*.
- "Actually being involved in data collection of climate data, even if it was not in the analysis portion, made me consider my place in terms of the larger environment more" *[Forest trip ~6 yrs. ago]*.

Several respondents described the influence of studying various aspects of stream ecosystems, specifically, as this response demonstrates:

- "The scientific surveying of each river for salamanders, little critters in the water, pH of the water, etc. showed me that it is important we keep our rivers clean" *[Forest trip ~10 yrs. ago]*.

Fifteen respondents described the influence of learning about the negative impact that humans can have on the environment, as this response demonstrates:

- "The information we learned regarding damage done by invasive species to the American [Chestnut], as well as the discussion about industrial pollution affecting

> sensitive water [nymphs] and lichen in what used to be pristine mountain habitats struck a chord when it demonstrated how vulnerable some of the ecosystems could be" *[Forest trip ~7 yrs. ago]*.

Ten responses to the question on which CLIMBE components influenced environmental action suggested that practicing Leave No Trace© (LNT) was significant, as this response demonstrates:

- "Completely leave no trace the entire trip" *[Forest trip ~8 yrs. ago]*.

Being immersed in nature. Ten respondents answered the open-ended question about influential CLIMBE components by describing the influence of being immersed in nature. Some respondents said that CLIMBE was their first multi-day backpacking or wilderness experience, like this response demonstrates:

- "…backpacking for the first time and being totally self sufficient for multiple days in the wilderness" *[Forest trip ~10 yrs. ago]*.

Respondents described the value of spending significant time in the outdoors and becoming more comfortable in their natural surroundings, as these responses demonstrate:

- "It allowed me to believe that I could spend significant amounts of time outside and that I could learn from my surroundings. Being forced to not take a shower for a few days showed me that limiting water usage was not that difficult" *[Forest trip ~8 yrs. ago]*.
- "Anytime I spend time in nature, I become a little more environmentally active" *[Forest trip ~10 yrs. ago]*.

Respondents also described feeling more connected to and appreciative of nature, as these responses demonstrate:

- "CLIMBE was my first multi-day wilderness experience. I learned about my place in the environment in a very real, hands-on way as a result of that. I saw storms happening, learned about native plants, and learned to read the flow of the water. This increased my connection to the natural world, and Appalachian ecosystems in particular, as well as my naturalist knowledge of Appalachian ecosystems" *[Forest and river trips 6-7 yrs. ago]*.
- *"*...it just goes along with appreciating the beauty of nature and having the ability to be away from everything and just spend time hiking, camping, looking at plants, and seeing all of the animals. Obviously with the appreciation, comes a desire to protect" *[Forest trip ~7 yrs. ago]*.

Having influential instructors. When describing influential CLIMBE components, six respondents described their instructors' enthusiasm to share knowledge, as well as their ability to create a trip culture around learning and caring about the environment. These responses are representative of how respondents described the influence of the instructor:

- "Seeing how excited and eager the leaders were to share the knowledge they had accrued with us made me become excited and eager to assimilate that information and ask questions for more" *[Forest and advanced backpacking trips ~6-7 yrs. ago]*.
- "The people that [led] our trips seemed very passionate about the environment, and their excitement was contagious" *[River and rock climbing trips ~6-7 yrs. ago]*.

Other. Instead of describing specific influential components of CLIMBE, six respondents answered the open-ended question by very generally stating that CLIMBE helped affirm an already existing interest in the environment, or that the experience influenced them to pursue science more, as these responses demonstrate:

- "[It's] hard to disentangle the effects of CLIMBE from the general effects of my family and the way I grew up. But CLIMBE definitely helped confirm my love and interest in the natural world *[Forest trip ~9 yrs. ago]*.
- "[CLIMBE] was big for me…[CLIMBE] taught me to be conservation minded, in every aspect of my life, to be self reliant, not to ask for handouts, to help those who are not as self reliant, to use only what I need…" *[Forest and rock climbing trips ~5-7 yrs. ago]*.

Four respondents indicated that seeing the beauty of nature motivated them to be more environmentally active, as this comment demonstrates:

- "To love the beauty of the world" *[Forest trips ~7-8 yrs. ago]*.

Three respondents said they gained confidence in their enthusiasm for the environment as a result of collaborating with peers who shared similar interests and experiences. Three respondents said that CLIMBE introduced them to backpacking. Two respondents said that living in the wilderness taught them to be more self-sufficient, which they transferred to their daily lives to inform decisions such as consuming fewer resources.

CLIMBE components rated as influential. Respondents who indicated that CLIMBE influenced (n = 54) or helped shape or affirm (n = 2) their environmental action were asked to select, from a list, the program components they remembered participating in during their

CLIMBE expedition. These respondents were also asked to rate, on a five-point Likert-type scale, how influential they thought each program component they participated in was on their environmental action (see Appendix B, Questions 15-16).

Respondents most frequently indicated they engaged in the following CLIMBE components: doing hands-on science activities in the outdoors (n = 54), traveling and camping in the backcountry (n = 53), and learning informally about the ecosystems they traveled in (n = 52). The data reveal that over 90% of the respondents who remembered participating in each respective component, as displayed in Table 7 below, also rated the component as influential on their environmental action. Table 7 summarizes how respondents rated the influence of each CLIMBE component on their environmental action, in descending order of frequency for the relative percentage of "very and extremely influential" ratings.

Table 7

Influence of CLIMBE Components on Environmental Action

CLIMBE Program Components	No. Respondents	Relative % Respondents Who Rated The Influence of Program Components On Environmental Action		
		Not Influential	Somewhat & Moderately Influential	Very & Extremely Influential
Traveling and camping in the backcountry	53	0%	30% (16/53)	70% (37/53)
Discussing environmental issues and ways we could take action in our own communities	33	3% (1/33)	36% (12/33)	61% (20/33)
Doing hands-on science activities in the outdoors (including collecting environmental data)	54	2% (1/54)	41% (22/54)	57% (31/54)
Interacting with environmental professionals (i.e. science professors, park rangers, climate scientists)	31	6% (2/31)	42% (13/31)	52% (16/31)
Learning informally about the ecosystems we traveled and lived in	52	0%	50% (26/52)	50% (26/52)
Analyzing and reporting scientific data	42	2% (1/42)	50% (21/42)	48% (20/42)
Having conversations about education and future careers with my instructors	21	5% (1/21)	48% (10/21)	48% (10/21)

Note. $n = 56$. Data on CLIMBE components was collected for respondents who indicated CLIMBE influenced ($n = 54$) or helped shape or affirm ($n = 2$) their environmental action.

Reported Environmental Actions Influenced by CLIMBE

Respondents who indicated that CLIMBE influenced (n = 54) or helped shape or affirm (n = 2) their environmental actions were asked both open-ended (see Appendix B, Question 14) and closed-ended (see Appendix B, Questions 24-25) questions about their current environmental actions, with attention to the actions they thought were influenced by CLIMBE. Since environmental action was largely left open to respondents' interpretation for this survey, the open-ended question was asked first in order to identify the types of environmental actions respondents described as having been influenced by CLIMBE without the prompt of a list. The closed-ended question was asked at the end of the survey in order to better understand and measure respondents' environmental actions. Respondents' open-ended descriptions of the environmental actions they thought were influenced by CLIMBE are reported first, followed by their closed-ended selections.

Environmental actions described by particpants as influenced by CLIMBE. Forty-three (43) respondents described environmental actions they thought were influenced by CLIMBE; the remaining 13 either did not respond to the question or said they could not provide examples. In response to the open-ended question, "Can you give an example of some environmental actions that CLIMBE influenced (or helped shape or affirm)" (see Appendix B, Question 14), respondents most frequently described environmental actions that are relatively easy to engage in, such as recycling, reusing items, picking up trash, and limiting consumption. Respondents also described education, volunteer efforts, environmental awareness, and practicing LNT as environmental actions influenced by CLIMBE. Responses are displayed in Table 8, in descending order of frequency. A description of each item follows after the table.

Table 8

Environmental Actions Influenced by CLIMBE

Theme	No. Respondents	Representative Respondent Quotes
Everyday environmental actions (such as recycling)	17	"I pick up trash when I see it in the woods or on the side of the road if I can. I recycle as much as I can" *[River and rock climbing trips ~6-7 yrs. ago]*.
		"I try to be less wasteful, and conserve water and energy whenever possible" *[Forest trip ~10 yrs. ago]*.
Education and career choices	10	"Participating in the rivers trip for CLIMBE is what inspired [me] to pursue a degree in environmental science (BS), with the intention of a career in river restoration/conservation. While on the trip…we were able to see the direct effects that [a] mining operation had on the river and it's inhabitants. That first-hand experience really struck a chord with me, and is still to this day what I attribute as my career inspiration" *[MEGA-Appalachian Trail, river, and cave trips ~4-6 yrs. ago]*.
Volunteer for environment, citizen science	9	"I am much more interested in participating in citizen science projects and educational outreach activities related to water quality" *[River trip ~5 yrs. ago]*.
Environmental awareness, perspective	8	"I now look for the different (visible) organisms that would indicate pollution or lack [thereof] when I am around streams" *[Forest trip ~10 yrs. ago]*.
Leave No Trace© (LNT)	7	"Did not believe in LNT before this trip" *[River trip ~6 yrs. ago]*.
Other	9	"Because of the stream assessment skills I gained at CLIMBE, I have been able to teach friends and family about macroinvertebrates…" *[River trip ~5 yrs. ago]*.

Note. $n = 43$. Not all respondents answered the question; some listed multiple actions in the same theme and/or listed actions in multiple themes; responses were only counted once for each theme.

Everyday environmental actions. In response the open-ended question on environmental actions influenced by CLIMBE, seventeen respondents described actions such as recycling,

conserving resources, reducing consumption, reusing items, picking up trash, and using environmentally friendly products. Since these actions are relatively easy to engage in on a daily basis, they have been categorized as *everyday environmental actions*. These responses demonstrate some of the everyday environmental actions that were described:

- "Picking up trash, reusing and recycling whenever possible and using environmentally friendly products" *[Forest trips ~5-7 yrs. ago]*.
- "Trying to reduce the amount of chemical and plastic waste I generate by using reusable containers. This was probably brought about by the big spiel about leaving trash laying around on the trail" *[Forest trip ~7 yrs. ago]*.
- "I do not litter or dump waste into any bodies of water (or ideally anywhere). I remember doing a lot of water testing for CLIMBE so I think that influenced my motivation for keeping water as clean as possible" *[Forest trip ~8 yrs. ago]*.

Some respondents gave less tangible examples of their environmental action, saying that CLIMBE made them more conscious of how their actions affect the environment, as this response demonstrates:

- "Being more conscious of what I do and how it impacts my surroundings" *[Forest and advanced backpacking trips ~7-8 yrs. ago]*.

Education and career choices. Ten respondents described various education and career choices in response to the question on environmental actions influenced by CLIMBE. Some respondents described multiple examples. Five respondents said that CLIMBE influenced their academic major or career decision, as these responses demonstrate:

- "My major [Environmental Policy]" *[Forest trip ~7 yrs. ago]*.

- "I am employed in the land management field and make decisions that have an impact on the environment regularly. Having an understanding of the environment is crucial in making good decisions" *[Forest trip ~10 yrs. ago]*.

Four respondents said CLIMBE influenced academic research projects, as this response demonstrates:

- "[CLIMBE] certainly spurred me to become more interested in water quality, which became the focus of my research the following summer at SVSM at App State" *[Forest trip ~8 yrs. ago]*.

Two respondents said CLIMBE influenced them to join extracurricular environmental clubs.

Volunteer for the environment, citizen science. Nine respondents answered the open-ended question on environmental actions influenced by CLIMBE by describing involvement in environmental volunteer efforts and citizen science projects. These following comments are representative of this category:

- "I have participated in a [handful] of river cleanup efforts that I may not have if I had not participated in CLIMBE" *[Forest trip ~10 yrs. ago]*.
- "I volunteer with the local Botanical Gardens in Chapel Hill to help monitor soil chemistry" *[Forest trip ~9 yrs. ago]*.
- "Started a recycling program at my local recreation department" *[Forest and river trips ~10 yrs. ago]*.

Environmental awareness, perspective. In response to the open-ended question, eight respondents indicated that CLIMBE influenced their awareness of environmental issues or their perspective on the environment as these comments demonstrate:

- "…awareness around mountaintop removal practices" *[Forest trip ~9 yrs. ago]*.
- "Water quality checks" *[Forest trip ~11 yrs. ago]*.

While not always explicitly connected to environmental actions, their comments were relevant.

Leave No Trace© (LNT). In response to the open-ended question, seven respondents described LNT principles as environmental actions influenced by CLIMBE:

- "Pack in Pack out" *[Forest trip ~10 yrs. ago]*.
- "Did not believe in LNT before this trip" *[River trip ~6 yrs. ago]*.

Other. Four respondents said that CLIMBE influenced them to pursue more outdoor recreation opportunities, noting that they developed a greater love of backpacking, rock climbing, or being outside in general through their CLIMBE trip, as this response demonstrates:

- "Wanting to go out climbing more" *[Rock climbing trip ~7 yrs. ago]*.

Four respondents said they have employed the knowledge and skills gained through their CLIMBE experience to educate friends, family, and students about the environment, as this response demonstrates:

- "I remember sharing the information I learned about water quality and macro-invertebrates with my fellow classmates in high school for a couple science experiments that we did. I know it influenced how I viewed the water life and I think I, in turn, influenced my classmates" *[Forest trip ~9 yrs. ago]*.

Ratings of environmental actions. After describing their environmental actions, respondents were asked to check off environmental actions they currently engaged in from a closed-ended list. Respondents were then asked to indicate which of those environmental actions they thought were influenced by CLIMBE. According to the closed-ended responses, CLIMBE

most frequently influenced respondents to conserve water (n = 36). Respondents also frequently indicated that CLIMBE influenced environmental actions including: educating peers about the environment, basing purchases on environmental considerations, recycling, taking courses about the environment, and volunteering in environmental organizations. Table 9 shows how many respondents reported engaging in each environmental action, and how many respondents indicated that CLIMBE influenced or enhanced their participation in the respective environmental actions. The table is organized by descending frequency of the number of respondents who indicated that CLIMBE influenced the environmental action.

Table 9

Influence of CLIMBE on Specified Environmental Actions

Environmental Actions	No. Respondents Who Reported	
	Engaging in Action	**Action Influenced by CLIMBE**
Conserve water	56	36
Informally educate peers about the environment	52	34
Base some of my purchases on environmental considerations	55	27
Recycle	53	25
Take courses about the environment (school, continuing education, workshops, etc.)	47	24
Volunteer in environmental organizations or improvement efforts	51	21
Conserve electricity by turning lights off or unplugging items when not in use	56	19
Vote for politicians based, at least partly, on their environmental considerations	52	17
Educate others about the environment through my paid profession (teacher, naturalist, etc.)	28	13
Conserve fuel by making fewer trips	55	13
Carpool or take public transportation	53	9
Donate money to organizations concerned with the environment	41	6
Attend/participate in community meetings concerning the environment	42	6
Participate in environmental protests, such as demonstrating or picketing	24	4
Write letters to government officials concerning environmental issues	29	4

Note. $n = 56$. Many respondents reported engaging in multiple environmental actions, as well as indicated multiple environmental actions were influenced or enhanced by CLIMBE.

Reported Number of CLIMBE Trips and Influence on Environmental Action

Forty-seven (47) respondents attended one CLIMBE expedition, while 16 attended two or more CLIMBE expeditions. Based on selections from a five-point Likert-type scale, those who attended two or more CLIMBE expeditions generally rated CLIMBE's influence on their personal environmental actions higher than those who attended only one expedition. Twenty-one percent (21%) of respondents who attended one CLIMBE expedition rated their experience as "very and extremely influential" on their environmental action, while 56% of respondents who attended two or more CLIMBE expeditions rated their experience as "very and extremely influential." Table 10 summarizes these findings.

Table 10

Influence of CLIMBE and Repeated Experiences

	% Respondents		
Rated Influence of CLIMBE on self-described environmental action	**Not Influential**	**Somewhat to Moderately Influential**	**Very to Extremely Influential**
# CLIMBE Trips			
1 Trip (n = 47)	17% (8/47)	62% (29/47)	21% (10/47)
2+ Trips (n = 16)	6% (1/16)	38% (6/16)	56% (9/16)

Note. N = 63.

Rated Influence of CLIMBE on Environmental Action and Environmental Action Scores

Environmental action scores were calculated for respondents who completed the environmental action scale; only the respondents who indicated that CLIMBE influenced or helped shape or affirm their environmental action completed the environmental action scale (n = 56). Respondents' environmental action scores were the sum of their reported engagement level in each environmental action ("always" = 4, "very often" = 3, "a moderate amount" = 2, "rarely" = 1, or "never" = 0). Environmental actions scores ranged from 15-54 out of a possible 60 points, with the average score for this sample equaling 32.5.

Fifty percent (50%) of respondents with above average environmental action scores rated CLIMBE as "very and extremely influential" on their environmental action. In contrast, 18% of respondents with below average environmental action scores rated CLIMBE as "very and extremely influential" on their environmental action. Since environmental action was not measured at the time of the respondents' participation, there is no way to assess how much their environmental action changed as a result of CLIMBE. Table 11 displays respondents' environmental action scores with how they rated CLIMBE's influence on their environmental action.

Table 11

Influence of CLIMBE and Environmental Action

Environmental Action Scale	% Respondents	
	Below Average Environmental Action Score (*n* = 28)	**Above Average Environmental Action Score (*n* = 28)**
Rated influence of CLIMBE on self-described environmental action		
Not Influential	4% (1/28)	4% (1/28)
Somewhat to Moderately Influential	79% (22/28)	46% (13/28)
Very to Extremely Influential	18% (5/28)	50% (14/28)

Note. Since percentages were rounded to the nearest tenth, not all totals add to 100%.

Other Respondent Information

Significant life experiences. At the beginning of the survey, respondents were asked to describe what they thought influenced them to be environmentally active, if applicable, as an opportunity to reflect on all of their influences before focusing on CLIMBE (see Appendix B, Question 1). Sixty respondents (95%) explicitly or implicitly indicated they were environmentally active. Fifty-three respondents described influences on their environmental action, and most respondents shared more than one influence in response to this open-ended question. Family and educational experiences were most frequently mentioned as influential on respondents' environmental action. Fourteen respondents said that CLIMBE influenced their

environmental action. The responses are presented in Table 12 in descending order of frequency. A description of each item follows after the table.

Table 12

Descriptions of Influences on Environmental Action Over The Lifespan

Theme	**No. Respondents**	**Representative Quotes**
Parents, family, upbringing	20	"I was influenced by…parents who spent time with me in the outdoors…" *[Forest and river trips ~6-7 yrs. ago]*.
		"I think it is due to my upbringing where I was told that I need to consider the world and environment around me and not just myself" *[Forest trip ~6 yrs. ago]*.
Education, including classes and extracurricular programs (long-term experiences)	19	"My courses in high school (AP environmental science) and college courses (environmental studies classes) also influenced my orientation towards being environmentally active" *[Forest trip ~8 yrs. ago]*.
		"I was heavily involved in Envirothon from 6th grade through 12th grade" *[River trip ~6 yrs. ago]*.
CLIMBE and other environmental/ outdoor camps (short-term experiences)	17	"I do think that CLIMBE came at a moment in my life that influenced my habits" *[Forest trip ~9 yrs. ago]*.
		"I was a participant on Outward Bound in high school, which I think did a lot to influence my care for the environment" *[Forest trip ~9 yrs. ago]*.
Hometown, farm, surrounding community	14	"Being raised in a hippy-ish community" *[Forest trip ~10 yrs. ago]*.
		"I grew up on a farm..." *[Forest trip ~10 yrs. ago]*.
Outdoor experiences	12	"I think my love for running and hiking…is the reason I adore nature so much" *[Forest trip ~7 yrs. ago]*.
		"Growing up playing in a forest" *[Forest trip ~10 yrs. ago]*.
Love, respect for nature	11	"I have a great love and appreciation for nature" *[Forest trip ~9 yrs. ago]*.

Table 12 Continued

Theme	No. Respondents	Representative Quotes
Environmental concern	9	"…I am greatly concerned with the state of the environment and…I become distressed when I am directly [affected] by mistreatment of the environment" *[Forest trip ~9 yrs. ago]*.
Other	9	"I am environmentally active, because it's practical" *[Forest and rock climbing trips ~5-7 yrs. ago]*. "I am also a Christian, and I think a strong environmental ethic is a biblical principle..." *[River trip ~5 yrs. ago]*.

Note. $n = 53$. Some respondents described multiple influences on their environmental action.

Parents, family, upbringing. The most recurring influence on environmental action was parents, families, and upbringing, with twenty respondents describing familial influences. Respondents mentioned parents who were environmental, outdoor, and science educators, as well as parents who modeled environmental stewardship in their actions and encouraged their children to care for and appreciate nature. Six respondents explicitly described being influenced by parents who spent time with them in the outdoors, including going on hikes and family camping trips.

Education. Closely behind the influence of family, nineteen respondents said that the accrual of environmental knowledge through a variety of educational experiences led them to be more environmentally active, and some respondents described multiple aspects of their educational influences. Within this group, nine respondents specifically mentioned environmental science classes in high school and college, as well as related training in natural resources. Eight of the 19 respondents considered participation in extracurricular programs, including 4-H, Ag-Discovery, Envirothon, Girl Scouts, and others, as influential on their

environmental action. Respondents also described learning about the environment in general and over time as a process of becoming more environmentally active.

CLIMBE and other environmental/outdoor camps. Of the seventeen respondents who mentioned environmental/outdoor camp programs, fourteen specifically described CLIMBE's influence. As a whole, respondents said the aspects of being in the wilderness, experiencing the beauty of nature, and learning about the environment in a hands-on way influenced their environmental action.

Hometown, farm, surrounding community. Fourteen respondents described being influenced by the places where they grew up or lived, including rural and urban areas, and the culture of these places, and some described multiple aspects of this theme. Six respondents said that growing up in the mountains, often with easy access to the outdoors, influenced their environmental actions. Similarly, two respondents credited growing up on a family farm as fostering a sense of connection to the land and influencing environmental actions. Three respondents explicitly mentioned the environmentally-oriented culture of the cities where they grew up or lived, and six others more generally described being surrounded by influential communities of people.

Outdoor experiences. Twelve respondents described spending time outdoors as an influence on their environmental actions. Respondents mentioned outdoor experiences including playing in the woods, running, hiking, camping, and a general love of outdoor activities. Eight respondents specifically mentioned the influence of outdoor experiences that occurred during childhood, often with their families.

Love, respect for nature. Eleven respondents described an affective connection to nature as motivation for their environmental actions. Respondents described sentiments including their love of nature, respect or awe of natures' beauty, and a general appreciation as influences on how they care for nature.

Environmental concern. Nine respondents expressed concern for the environment as influential on their actions, usually in the context of a desire to address environmental issues. Pollution, litter, and endangered species were specifically mentioned. Respondents also discussed being bothered by mistreatment of the environment and concern about the general state of our environment today.

Other. Three respondents said that making environmentally responsible choices, such as limiting consumption, is practical, convenient, and cost-effective for their lifestyle. Three respondents said that friends and peers influenced their environmental action. Two respondents described their environmental action as creation stewardship, rooted in a Christian belief that it is their duty to care for and protect God's earth. One respondent connected learning LNT principles with trying to be responsible and create little impact.

Additional Perspectives. Respondents were given an opportunity at the end of the survey to express any thoughts that came to mind during the reflection process that were not accounted for in the preceding survey questions (see Appendix B, Question 26). One new theme surfaced in the responses to this open-ended question: 13% of respondents expressed a belief in the importance of youth experiencing nature, informally or through programs like CLIMBE. Representative quotes included:

- "I think it is a great program to begin getting young students to get outside and see the importance of their environment" *[Forest trip ~10 yrs. ago]*.
- "Was lucky to have experience and having lived now in India, Armenia, and NYC wish more youth were exposed to being outdoors/appreciating nature" *[Forest trip ~9 yrs. ago]*.

CHAPTER 5.

DISCUSSION

The purpose of this study was to explore participants' perceptions of how an expeditionary science program, CLIMBE, may have influenced their current environmental action, as described five to ten years after the experience. The findings suggest that an expeditionary science experience can be influential, particularly through components like learning about the environment and being immersed in nature.

This study adds a unique perspective to environmental education (EE) research by exploring the long-term outcomes of an expeditionary science program, related to environmental action, through the lens of participants' perceptions within the significant life experience (SLE) theoretical framework. By reporting perceptions on how a program influenced environmental action five to ten years after the experience, this study markedly extended the timeframe of follow-up within EE research, which typically occurred up to six months post-program (Schneider & Cheslock, 2003).

Respondents' Significant Life Experiences

Most respondents in this study identified themselves as environmentally active. The SLEs that respondents described in this study were consistent with those described in previous SLE research in EE (Arnold et al., 2009; Chawla, 1998, 1999; Tanner, 1980; Wells & Lekies, 2006). When asked about their environmental action influences as a whole, respondents described factors including: their parents (Arnold et al., 2009; Chawla, 1999; Tanner, 1980) long-term educational experiences (Arnold et al., 2009; Chawla, 1999), outdoor camp experiences (Arnold et al., 2009) (including CLIMBE), places where they grew up, outdoor

recreational and play experiences (Arnold et al., 2009; Chawla, 1999; Wells & Lekies, 2006), love of nature, and concern for the environment (Chawla, 1999; Tanner, 1980) (see Table 12).

Respondents' Descriptions of CLIMBE's Influence on Environmental Action

The majority of respondents in this study (86%, see Table 4) rated their CLIMBE experience, which occurred five to ten years earlier, as influential on their environmental action. This finding supports other research where respondents described similar influence in the five years following a multi-day EE experience that, like CLIMBE, included hands-on science and direct experiences in nature (Liddicoat & Krasny, 2014). The data suggest that CLIMBE was one of several SLEs for most respondents, and had varying levels of influence or affirmation regarding environmental action. The CLIMBE components that respondents described as significantly influential were also in agreement with previous EE research related to influences on environmental action (Bogner, 1998; Hanna, 1995; Jordan et al., 1986; Kellert, 1998; Kruse & Card, 2004; Liddicoat & Krasny, 2011; Stern et al., 2008). When asked specifically about CLIMBE components, over 90% of the respondents who remembered each component also rated the respective component as influential on their environmental action (see Table 7). Significant components, as they connect with the literature, are discussed below:

1. Learning about the environment and environmental issues, often through hands-on activities,
2. Being immersed in nature,
3. Having influential instructors, and
4. Discussing environmental issues and ways to take action in their home communities.

Learning about the environment and environmental issues. Respondents frequently reported that learning about the environment and environmental issues influenced their environmental action (see Tables 6-7). While researchers have noted that environmental knowledge alone does not necessarily lead to environmental action (Kollmuss & Agyeman, 2002), these responses underline the importance of environmental knowledge being prerequisite to informed environmental action (Hungerford & Volk, 1990). Similar to what Farmer et al. (2007) found, respondents often described active engagement in learning as significant, for example: doing hands-on science, collecting legitimate data, seeing the water quality change, and practicing Leave No Trace© (LNT) principles.

Respondents also expressed the significance of directly witnessing the negative effects humans can have on the environment: "Seeing the fragility of ecosystems, and how humans have huge influence and impact, instilled a sense of responsibility and stewardship" *[Forest trip participant ~9 yrs. ago]*. This finding is consistent with SLE research, which has noted that negative experiences like witnessing habitat destruction can influence people's environmental action (Chawla, 1999). Some respondents described their environmental actions related to what they learned about the environment through CLIMBE, such as:

> "Getting to study numerous streams and water systems and getting the opportunity to observe the different life forms present in clean streams [versus] polluted really opened my eyes to the importance of keeping our beautiful mountain streams clean. I now look for the different (visible) organisms that would indicate pollution or lack [thereof] when I am around streams. I do my best to clean them as well if there is litter [etc.] around the location" *[Forest trip participant ~10 yrs. ago]*.

Previous research suggest that active, hands-on learning activities are memorable, and therefore, may continue to exert influence long after the experience has concluded (Farmer et al., 2007; Liddicoat & Krasny, 2014), and this study supports these ideas. Indeed, Liddicoat and Krasny (2014) found, through five-year retrospective interviews, that students had continued to apply the scientific knowledge gained through EE experiences that could be compared to CLIMBE in the years following. In this research, comments indicated that knowledge gained through the CLIMBE experience continued to be influential for some participants as long as ten years later.

Being immersed in nature. Consistent with earlier research (Chawla, 1999; D'Amato & Krasny, 2011; Kellert, 1998), respondents in this study indicated that being immersed in nature for an extended period of time influenced their environmental action (see Tables 6-7). For example, when describing the components of CLIMBE that influenced environmental action, one respondent shared: "The beauty of nature around us constantly. The view of the forest from on top of a mountain. I'll never forget that experience for as long as I live" *[Rock climbing trip participant ~5 yrs. ago]*. Another respondent stated:

> "…appreciating the beauty of nature and having the ability to be away from everything and just spend time hiking, camping, looking at plants, and seeing all of the animals… with the appreciation, comes a desire to protect" *[Forest trip participant ~7 yrs. ago]*.

Responses like these support other evidence that participants felt awe, connection to, and a desire to protect nature as a result of living in nature during a wilderness experience program (WEP) course (D'Amato & Krasny, 2011). Similarly, Kellert (1998) found that participants often retrospectively reported the immersive wilderness experience as influential on their environmental attitudes and actions.

Having influential instructors. Some respondents described their CLIMBE instructors as a significant component influencing their environmental action (see Table 6). This finding appears to support Arnold et al.'s (2009) conclusion that teachers can have a significant impact. In agreement with previous research (Arnold et al., 2009), some respondents described their instructors' influence in terms of the example they set, as this comment illustrates "…the most influential thing was a part of the trip that was not overt: my trip leaders were role models of Christians who cared for the natural world as a part of their faith" *[Forest and river trip participant ~6-7 yrs. ago]*. Responses like "Seeing how excited and eager the leaders were to share the knowledge they had accrued with us made me become excited and eager to assimilate that information and ask questions for more" *[Forest and advanced backpacking trip participant ~6-7 yrs. ago]* are consistent with WEP research that identified instructors as one of the main course components to influence participant learning (McKenzie, 2003; Sibthorp et al., 2011). Other descriptions like "…I think our leaders did a great job of instilling a love of the outdoors with a sense of humor and grace" *[Forest trip participant ~11 yrs. ago]* support Meltzer et al.'s (2014) conclusion that instructors may positively affect participants' relationships to nature. This study adds to ongoing research on the role of the instructor by recognizing that instructors may influence participants' environmental action.

Discussing environmental issues and ways to take action in home communities. CLIMBE did not have an explicit goal of influencing environmental action, but responses suggested that instructors may have incorporated environmental issues and action discussions into some trips. Most respondents indicated that discussing environmental issues and ways to take action in their home communities was an influential component of CLIMBE (see Table 7).

This component was reported overtly in the closed-ended question, but it also appeared in open-ended responses like the following: "…all the side lessons from the group leaders about invasive species, habitat loss, history of the area was influential" *[Forest, advanced backpacking, and river trips participant ~6-8 yrs. ago]*. The finding that many respondents considered discussing environmental issues and actions strategies influential supports earlier research conclusions on the importance of participants understanding why environmental action is needed and being aware of how to personally get involved (Chawla, 2014; Haluza-Delay, 2001; Jordan et al., 1986; Schneider & Cheslock, 2003).

Respondents' Descriptions of Environmental Actions Influenced by CLIMBE

A number of studies have inquired about changes in participants' environmental actions following EE and WEP programs (Bogner, 1998; D'Amato & Kransy, 2011; Hanna, 1995; Hobet, 2010; Jordan et al., 1986; Kellert, 1998; Liddicoat & Kransy, 2014; Stern et al., 2008), but the studies have not often focused on the types of environmental actions pursued. For this study, environmental action was defined broadly as a lifestyle or behaviors committed to caring for the environment (Arnold et al., 2009); therefore, respondents were instructed to consider "any aspect of [their] lifestyle committed to helping the environment" when describing their environmental actions. The following themes emerged regarding the environmental actions respondents described as having been influenced by CLIMBE (see Tables 8-9):

1. Everyday environmental actions,
2. Education (Kellert, 1998) and career choices, and
3. Environmental volunteer efforts.

These types of environmental actions are similar to outcomes that have been described of other educational programs that emphasized hands-on learning (Hobert, 2010; Jordan et al., 1986) or wilderness experiences (Kellert, 1998). These environmental action themes, as they relate to the literature, are discussed below.

Everyday environmental actions. In agreement with EE and WEP research (Hobert, 2010; Jordan et al., 1986; Kellert, 1998), respondents most frequently indicated that CLIMBE influenced environmental actions that were relatively convenient to engage in on a daily basis, such as recycling, reusing items, reducing consumption of resources, not littering, and picking up trash. CLIMBE had a substantial curricular focus on water quality in both the forest and river expeditions, and not surprisingly, respondents frequently indicated that CLIMBE influenced them to conserve water and protect water resources, as suggested in the following comment:

> "I do not litter or dump waste into any bodies of water (or ideally anywhere). I remember doing a lot of water testing for CLIMBE so I think that influenced my motivation for keeping water as clean as possible" *[Forest trip participant, ~8 yrs. ago]*.

Respondents also frequently indicated that CLIMBE influenced them to educate peers about the environment, for example:

> "I remember sharing the information I learned about water quality and macro-invertebrates with my fellow classmates in high school for a couple science experiments that we did. I know it influenced how I viewed the water life and I think I, in turn, influenced my classmates" *[Forest trip ~9 yrs. ago]*.

These findings support the link that Jordan et al. (1986) inferred between instructional time, knowledge, and environmental action.

Education and career choices. Some respondents described their education choices as environmental actions, which is consistent with Kellert's (1998) suggestion that "taking courses about the environment" (p. 226) is an environmental action. There has been little research on just how significantly programs like CLIMBE may influence education and career choices, however, studies suggest that participants' intentions at the conclusion of courses are typically not well followed through in the subsequent months and years (Hanna, 1995; Kellert, 1998). As could be expected, the respondents in this study who said CLIMBE had influenced their education and career choices in the five to ten post-experience were proportionately fewer than those who reported a desire to take more science classes immediately following CLIMBE (Shuman, 2011). It is also prudent to note that CLIMBE recruited students who expressed an interest in science (Shuman, 2011). Regardless of other variables, this study revealed that some respondents did consider CLIMBE influential on education and career choices, and the following comment exemplifies the types of educationally-related environmental actions respondents described as a result of CLIMBE: "…conducting my undergraduate thesis in the field of environmental sustainability...participating in an alternative spring break trip that was focused on environmental justice…applying to study environmental governance in the UK" *[Forest, advanced backpacking, and river trips participant ~6-8 yrs. ago]*. Likewise, another respondent said, "Participating in the rivers trip for CLIMBE is what inspired [me] to pursue a degree in environmental science (BS), with the intention of a career in river restoration/conservation" *[MEGA-Appalachian Trail, river, and cave trips participant ~4-6 yrs. ago]*, and went on to describe how directly experiencing river pollution influenced personal education and career decisions. Such comments support previous research findings that WEPs (Kellert, 1998) and

camps emphasizing hands-on science (Aschbacher et al.; 2010; Bischoff et al., 2008) may pique participants' interest in learning about the environment/science and encourage their pursuit of further scientific study and career.

Environmental volunteer efforts. Some respondents indicated that CLIMBE influenced them to participate in volunteer and citizen science efforts for the environment, as this response demonstrates: "I became more aware of what was happening to the trout populations in [nearby] rivers and streams and helped in a project to help restore balance within the creek near my house" *[Forest trip participant ~9 yrs. ago]*. Such comments support earlier research that revealed a hands-on learning stewardship program (Hobert, 2010) and various WEPs (Hanna, 1995; Kellert, 1998) generally led to participants becoming more involved in community environmental issues after the programs.

Other Variables Related to the Overall CLIMBE Experience

Response differences were not detected based on the year(s) respondents attended CLIMBE (i.e. 5 years ago versus 10 years ago). However, respondents who attended two or more CLIMBE trips tended to report CLIMBE's influence on their environmental action higher than respondents who attended only one trip (see Table 10). Similar to Kruse and Card's (2004) findings, it appears that repeated exposure to CLIMBE may have influenced respondents' environmental action more greatly, but a correlation was not tested in this study.

The findings that CLIMBE influenced respondents' self-reported environmental knowledge and awareness are consistent with research on other programs that emphasized hands-on science and experiences in nature (Bogner, 1998; Farmer et al., 2007; Hanna, 1995; Kellert, 1998; Kruse & Card, 2004; Liddicoat & Krasny, 2014; Stern et al., 2008). Respondents' ratings

on CLIMBE's environmental knowledge and awareness influence appear to be positively correlated with their ratings on CLIMBE's environmental action influence (see Tables 2-4); however, a correlation was not tested. Research states that environmental knowledge and awareness are antecedents to environmental action (Hungerford & Volk, 1990; UNESCO-UNEP, 1978); therefore, it is possible that further analysis would support this observation.

As a whole, respondents who rated CLIMBE as "very to extremely influential" on their environmental action also had above average environmental action scores based on their self-reported data. Without longitudinal data from pre-CLIMBE to the time of this study, it is difficult to unpack the implications of respondents' current ratings, as other variables could have also affected their environmental action within the five to ten year timeframe. It is possible that some respondents were more environmentally-inclined, and as Kollmuss & Agyeman (2002) suggested, some respondents may have faced greater barriers to becoming more environmentally active. While the likelihood is that other variables contributed to respondents' environmental action during the recent years, the majority of respondents still rated CLIMBE as influential on their environmental action at some level and provided examples of ways they became more environmentally active as a result.

Limitations

This study provided valuable insight on how an expeditionary science program may influence participants to become more environmentally active. However, it is not without certain limitations that warrant consideration when interpreting the results.

The results represent a relatively small sample size ($N = 63$) from one program. While the data provide valuable insight on participant-reported outcomes of expeditionary science, the findings cannot be generalized to larger populations.

The targeted SLE design of this study presents a certain limitation in that respondents were asked to recall a specific event, their CLIMBE experience, which may have confounded their overall sense of CLIMBE's significance among other experiences in their life story (Neisser, 1988). This limitation was addressed by allowing respondents to A) indicate the level of influence they thought CLIMBE had on their environmental action, B) describe the components of CLIMBE that they thought significantly influenced their environmental action, and C) describe the environmental actions they thought CLIMBE influenced them to engage in.

The environmental action scale had not been previously tested as a measure of environmental action, so internal reliability is unknown. This limitation was addressed by adapting similar measures used in preceding research (see Hobert, 2010; Kellert, 1998).

The potential for researcher bias existed in this study, as the researcher was a CLIMBE participant in 2008, and later a field educator for CLIMBE in 2011-2012. This limitation was addressed by including an additional coder and intercoder in the analysis of the qualitative data, neither of whom had previous connection to CLIMBE or expeditionary science. Intercoder reliability scores were established at 91% for Question 1, 100% for Question 10, 82% for Question 13, 81% for Question 14, and 93% for Question 26 (see Appendix B for questions).

Recommendations for Future Research

This study could be replicated with similar expeditionary science programs in order to strengthen understanding of A) the overall effectiveness of expeditionary science influencing

environmental action, and B) the program components that participants most often remember as influential on their environmental action. Longitudinal studies with expeditionary science programs could shed light on their influence over time, and may measure variables such as knowledge retention, environmental actions, and participants' perceptions of the program's influence on their environmental action. SLE studies with expeditionary science and similar programs could explore how these educational experiences in adolescence influence adult environmental actions.

Recommendations for Practice

Environmental educators may consider offering expeditionary science experiences when feasible, as a method for influencing participants' environmental action. Where expeditionary science is not feasible, environmental educators may consider facilitating experiences based on the influential program components described in this study:

- Hands-on activities and direct experiences to learn about the environment and issues,
- Time to be immersed in nature, and
- Conversations about local environmental issues and action strategies.

Offering incentives for participants to return for multiple experiences may also increase the influence that expeditionary science and similar EE programming can have on environmental action.

Environmental educators should also stay mindful of the influence they can have as individuals. Influential CLIMBE leaders were described as being passionate about the environment, eager to share knowledge, and role models for being environmentally active. The potential influence an environmental educator can have is summed up in this participant

comment: “I remember really admiring my instructors and their environmental activism stood out to me. Because I admired them so much, I wanted to be more like them. Caring about the environment was cool” *[Forest trip participant ~9 yrs. ago]*.

Conclusion

The majority of respondents (86%) thought the CLIMBE expeditionary science program provided a direct influence on their environmental action. Learning about the environment and environmental issues through hands-on activities and being immersed in nature were the most frequently described CLIMBE components that influenced respondents’ environmental action. CLIMBE did not have an explicit goal of influencing participants’ environmental action, but rather sought to increase participants’ knowledge and understanding of mountain ecosystems (Shuman, 2011). These findings reiterate the importance of developing environmental sensitivity through time spent in nature (Chawla, 1998; Hungerford & Volk, 1990) and knowledge of the environment and environmental issues through hands-on learning (Bogner, 1998; Hungerford & Volk, 1998; Stern et al., 2008) as essential components in influencing environmentally active individuals. Ultimately, this study suggests that expeditionary science may be a mechanism through which environmental educators can positively influence participants’ environmental action.

REFERENCES

Alkin, M. C., Linden, M., Noel, J., & Ray, K. (Eds.). (1992). *Encyclopedia of educational research* (6th ed., Vol. 3). New York: Macmillan Library Reference USA.

Ardoin, N., & Merrick, C. (2013). Environmental education: A brief for US grant makers. *The North American Association for Environmental Education.* Retrieved from https://naaee.org/sites/default/files/eepro/resource/files/ee_brief_blue_sky_0.pdf

Arnold, H. E., Cohen, F. G., & Warner, A. (2009). Youth and environmental action: Perspectives of young environmental leaders on their formative influences. *The Journal of Environmental Education, 40*(3), 27-36.

Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine. *Journal of Research in Science Teaching, 47*(5), 564-582.

Bischoff, P. J., Castendyk, D., Gallagher, H., Schaumloffel, J., & Labroo, S. (2008). A science summer camp as an effective way to recruit high school students to major in the physical sciences and science education. *International Journal of Environmental and Science Education, 3*(3), 131-141. Retrieved from http://files.eric.ed.gov/fulltext/EJ894856.pdf

Blanchard, P. B., & Buchanan, T. K. (2011). Environmental stewardship in early childhood. *Childhood Education, 87(4), 232-238.* Retrieved from http://0-search.proquest.com.library.acaweb.org/docview/866565396?accountid=12544

Bogner, F. X. (1998). The influence of short-term outdoor ecology education on long-term variables of environmental perspective. *The Journal of Environmental Education, 29*(4), 17-29.

Bowler, P. J. (2002). Climb Chimborazo and see the world. *Science*, *298*(5591), 63-63. doi: 10.1126/science.1071988

Cachelin, A., Paisley, K., & Blanchard, A. (2009). Using significant life experience framework to inform program evaluation: The Nature Conservancy's Wings & Water Wetlands Education program. *The Journal of Environmental Education, 40*(2), 2-14.

Chawla, L. (1998). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *The Journal of Environmental Education, 29*(3), 11-21.

Chawla, L. (1999). Life paths into effective environmental action. *The Journal of Environmental Education, 31*(1), 15-26.

Chawla, L. (2006). Research methods to investigate significant life experiences: Review and recommendations. *Environmental Education Research, 12*(3-4), 359-374. doi: 10.1080/13504620600942840

Chawla, L. (2014). *Teaching in the field and on natural school grounds: Gains for people and places.* [Southeast Environmental Education Alliance Annual Conference keynote address]. Retrieved from http://eenc.org/index.php/conference/seea-conference-proceedings/34-conference/conference-archive/98-seea-keynote-addresses

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles: Sage.

D'Amato, L., & Krasny, M. E. (2011). Outdoor adventure education: Applying transformative theory to understanding instrumental learning and personal growth in environmental education. *The Journal of Environmental Education, 42*(4), 237-254.

Daniel, B. (2003). *The life significance of a spiritually oriented, outward-bound type wilderness expedition* (Doctoral dissertation). Montreat College, Montreat, North Carolina.

Daniel, B. (2011). Alexander von Humboldt: Expeditionary scientist. In T. E. Smith & C. E. Knapp (Eds.), *Sourcebook of experiential education: Key thinkers and their contributions* (pp. 93-99). New York: Routledge.

Dillman, D., Smyth, J., & Christian, L. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method.* Hoboken: John Wiley & Sons, Inc.

Farmer, J., Knapp, D., & Benton, G. (2007). An elementary school environmental education field trip: Long-term effects on ecological and environmental knowledge and attitude development. *The Journal of Environmental Education, 38*(3), 33-42.

Haluza-Delay, R. (2001). Nothing here to care about. Participant constructions of nature following a 12-day wilderness program. *The Journal of Environmental Education, 32*(4), 43-48.

Hanna, G. (1995). Wilderness-related environmental outcomes of adventure and ecology education programming. *The Journal of Environmental Education, 27*(1), 21-32.

Hobert, T. M. (2010). *A follow-up study of Eco Education's environmental service learning program* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3434268)

Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy: Executive summary.* Washington, DC: North American Association for Environmental Education. Retrieved from http://www.naaee.net/sites/default/files/framework/EnvLiteracyExeSummary.pdf

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education, 21*(3), 8-21. Retrieved from http://www.cbtrust.org/atf/cf/%7BEB2A714E-8219-45E8-8C3D-50EBE1847CB8%7D/Changing%20learner%20behavior%20-%20H%20and%20V.pdf

Jordan, J. R., Hungerford, H. R., & Tomera, A. N. (1986). Effects of two residential environmental workshops on high school students. *The Journal of Environmental Education, 18*(1), 15-22.

Kellert, S. (1998). *A national study of outdoor wilderness experience.* School of Forestry and Environmental Studies, New Haven: Yale University Press.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239-260. doi: 10.1080/1350462022014540 1

Kruse, C. K., & Card, J. A. (2004). Effects of a conservation education camp program on campers' self-reported knowledge, attitude, and behavior. *The Journal of Environmental Education, 35*(4), 33-45.

Liddicoat, K. R., & Krasny, M. E. (2014). Memories as useful outcomes of residential outdoor environmental education**.** *The Journal of Environmental Education, 45*(3), 178-193. doi: 10.1080/00958964.2014.905431

Marcinkowski, T. (1998). Predictors of responsible environmental behavior: A review of three dissertation studies. In H. Hungerford, W. Bluhm, T. Volk, & J. Ramsey (Eds.), Essential readings in environmental education. (2001 ed.) Champaign, IL: Stipes Pub. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=33D76440839D0BF890225134B2E766A3?doi=10.1.1.561.8302&rep=rep1&type=pdf

Martin, B., Bright, A., Cafaro, P., Mittelstaedt, R., & Bruyere, B. (2008). Cultivating environmental virtue among 7th and 8th graders in an expeditionary learning outward bound school. *Journal of Experiential Education, 30*(3), 294-298.

McKenzie, M. (2003). Beyond "The Outward Bound Process:" Rethinking student learning. *Journal of Experiential Education, 26*(1), 8-23.

Meltzer, N.W., Faircloth, W. B., Bobilya, A. J., & Mitten, D. (October 22-25, 2014, 2014). An investigation of the influence of the instructor on participants' biophilic expressions. *2014 Symposium on Experiential Education Research, 42nd Annual International Association For Experiential Education Conference.* Chattanooga, TN.

Metzger, T., & McEwan, D. (1999). Measurement of environmental sensitivity. *The Journal of Environmental Education, 30*(4), 38-39.

North American Association for Environmental Education. (2009). Excellence in environmental education: Guidelines for learning (K-12). Washington, DC: NAAEE.

Neisser, U. (1988). Time present and time past. In M. M. Gruneberg & P. E. Morris & R. N. Sykes (Eds.), *Practical aspects of memory* (Vol. 2, pp. 545-560). New York: John Wiley.

Schneider, B., & Cheslock, N. (2003). *Measuring results: Gaining insight on behavior change strategies and evaluation methods from environmental education, museum, health, and social marketing programs*. San Francisco: Coevolution Institute Understanding Metrics Project. Retrieved from http://pollinator.org/PDFs/websitemaster_pdf_final.pdf

Shuman, D. K. (2011, October). *A tool for conservation education: Expeditionary science*. Paper presented at the meeting of the North American Association of Environmental Education, Raleigh, NC.

Sibthorp, J., Furman, N., Paisley, K., Gookin, J., & Schumann, S. (2011). Mechanisms of learning transfer in adventure education: Qualitative results from the NOLS transfer survey. *Journal of Experiential Education*, *34*(2), 109-126. doi:10.5193/JEE34.2.109

Simmons, D. (1991). Are we meeting the goal of responsible environmental behavior? An examination of nature and environmental education center goals. *The Journal of Environmental Education, 22*(3), 16-21. Retrieved from http://online.montreat.edu/2013-01/course/view.php?id=3600

Stern, M. J., Powell, R. B., & Ardoin, N. M. (2008). What difference does it make? Assessing outcomes from participation in a residential environmental education program. *The Journal of Environmental Education, 39*(4), 31-43.

Tanner, T. (1980). Significant life experiences: A new research area in environmental education. *The Journal of Environmental Education, 11*(4), 20-24.

UNESCO-UNEP. (1978, January). The Tbilisi declaration. *Connect, UNESCO-UNEP Environmental Education Newsletter, 111*(1), 1-8.

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children, Youth, and Environments, 16*(1), 1-24.

APPENDIX A

SURVEY NOTICE POSTCARDS

Initial Notice:

Dear Former CLIMBE Participant or Parent,

Hello! I am a graduate student at Montreat College, pursuing a Master's degree in Environmental Education. I am writing to you because our CLIMBE files indicate that you participated in an expedition as a student. As part of my thesis research, I am interested in learning about your CLIMBE trip memories and if you think the trip influenced anything about how you live your life today. If you are willing to reflect on your experience and share your thoughts, I will be greatly appreciative, as it will help me complete my degree and see the impact that a program like CLIMBE may have on students. In fact, by completing the short survey, your name will be entered into a drawing to win a $50 REI gift card! Your name will not be associated with your answers or disclosed to anyone outside this research project. More information about this study, as well as the survey, is provided online at: www.surveymonkey.com/r/climbe I welcome your questions and may be reached directly at *[email address]*.

If you are a parent, I ask that you please forward this information to your son or daughter.

Thank you in advance,

Misty Varnell

Misty Varnell

CLIMBE
Montreat College

Reminder:

Dear Former CLIMBE Participant or Parent,

Hello! You may have received a postcard within the last week about taking a survey to reflect on your CLIMBE experience. If you have not, I would like to invite you to participate in my master's thesis research. If you are familiar with the project, this is a friendly reminder that there is still time to take the survey. By sharing your CLIMBE trip memories through a short online survey, you can enter into a drawing to win a **$50 REI gift card!** By completing the survey, you will help me complete my Master of Science degree in Environmental Education and contribute to a better understanding of the impact that a program like CLIMBE may have on students. Your name will not be associated with your answers or disclosed to anyone outside this research project. More information about this study, as well as the survey, is provided online at: **www.surveymonkey.com/r/climbe** The survey will be open through October 24. I welcome your questions and may be reached directly at *[email address]*.

If you are a parent, I ask that you please forward this information to your son or daughter.

Thank you in advance,

Misty Varnell

Misty Varnell

CLIMBE
Montreat College

Final Reminder:

Dear Former CLIMBE Participant or Parent,

I hope this note finds you well. Hopefully you received an invitation earlier this month to reflect on your CLIMBE experience through a survey. I am writing to let you know that the deadline to complete the survey has been *extended to November 7*, so there is still time for you to participate and enter to win **$50 to spend at REI**! By sharing your CLIMBE trip memories and a little bit about yourself, you will help me complete my master's thesis research and earn a degree in environmental education. The purpose of this study is to see the impact that a program like CLIMBE may have on students and to contribute these insights to the greater field of environmental education. Please know that your name will not be associated with your answers or disclosed to anyone outside this research project. More information about this study, as well as the survey, is provided online at: **www.surveymonkey.com/r/climbe** I welcome your questions and may be reached directly at *[email address]*. Finally, if you are choosing to opt out of the survey for any particular reason, if you don't mind letting me know via email, I would appreciate that and will remove your name from the list.

Parents, thank you for forwarding this information to your son or daughter.

Gratefully,

Misty Varnell

Misty Varnell

CLIMBE
Montreat College

APPENDIX B

RETROSPECTIVE SURVEY

Dear Former CLIMBE Participant,

Welcome! I am excited that you are reflecting on your CLIMBE experience and contributing your thoughts for the continual betterment of environmental education programs. I want to take a moment to introduce myself and share with you a little bit more about my research.

I am a graduate student at Montreat College pursuing a Master of Science in Environmental Education. But years before that, I also participated in CLIMBE. I am curious to learn about your CLIMBE experience in retrospect, and how you think participating in a scientific expedition may have affected some of your behaviors today. I realize there were probably many factors shaping where you are now and what you do today, but for the next few minutes, please try to isolate your thoughts to reflections about your CLIMBE experience. This was your experience, so there are no right or wrong answers and all will be treated with respect.

The purpose of the study is to learn what activities are particularly meaningful to participants and to use this information to inform future environmental education programs.

The survey will take about 15 minutes to complete. Your name will not be associated with your answers, and no personally identifying information will be published or shared with anyone outside this research project. By completing the survey, you are consenting to have your responses included in the results and future publication of this study. Completing the survey is voluntary and you may choose to back out at any point by declining to complete the survey. By completing the survey, you can enter into a drawing for a $50 REI gift card!

Please note that as you progress through the survey, you will not be able to go back and change your answers. This is because I am interested in learning your first impressions. At the end of the survey, you will have the opportunity to share any additional thoughts that came to mind during the process of reflection.

If you have questions about any part of the study, please contact me and I will be happy to speak with you. Finally, if you are interested in the conclusions of this investigation, let me know and I will be happy to share my finished thesis once it is published on ProQuest. I can be reached at *[email address]*.

Lastly, if you have friends who participated in CLIMBE and you think they might be willing to share their experience through this survey, please send them the link!

I hope you find this opportunity for reflection enjoyable!

Thank you,
Misty Varnell

Note: question numbers were not visible to respondents.

Questions 1-9 were asked of all respondents.

1. Do you think you are environmentally active? If you said yes, please describe what you think influenced you to be environmentally active. Note: this question is an opportunity for you to reflect on all of your influences before focusing your memories on your CLIMBE experience.

2. In what city/town and state did you spend the majority of your teenage years?

3. How many times did you participate in CLIMBE?

4. Approximately what year(s) did you participate in CLIMBE?

5. Which expeditions did you do? Check all that apply.
    - Forests/Climate – backpacking*
    - Advanced – backpacking (for second year participants)
    - MEGA/Appalachian Trail – backpacking (two weeks)
    - Rivers/Water Quality – canoeing
    - Caves – caving
    - Rocks – rock climbing

    **Note: the forests trip also had a water quality focus*

6. How did you enjoy your CLIMBE trip overall?
    - Not at all
    - Somewhat
    - Moderately okay
    - I liked it
    - I loved it

7. Do you think you learned new things about the environment on your CLIMBE expedition?
    - No
    - Yes, somewhat
    - Yes, a moderate amount
    - Yes, quite a bit
    - Yes, very much

8. Do you think your CLIMBE experience influenced you to be more environmentally aware?
    - Not influential
    - Somewhat influential
    - Moderately influential
    - Very influential
    - Extremely influential

9. Do you think your CLIMBE experience as a whole influenced you to be more environmentally active?
    - Yes
    - No

Questions 10-11 were asked only of respondents who indicated CLIMBE did not influence their environmental action (Question 9).

10. Why do you think your CLIMBE experience did not influence you to be more environmentally active?

11. Please indicate if your CLIMBE experience helped shape or affirm some of the ways you are environmentally active.
    - I am not environmentally active.
    - I am environmentally active, but CLIMBE had not impact along the way.
    - I am environmentally active, and CLIMBE helped shape or affirm this commitment.

Questions 12-13 were asked only of respondents who indicated CLIMBE influenced their environmental action (Question 9).

12. How would you describe the level of influence your CLIMBE experience had on your environmental action?
    - Somewhat influential
    - Moderately influential
    - Very influential
    - Extremely influential

13. What was significant about your CLIMBE experience that influenced you to be more environmentally active?

Questions 14-16 were asked only of respondents who indicated CLIMBE influenced their environmental action (Question 9) or who indicated CLIMBE helped shape or affirm their commitment to environmental action (Question 11).

14. Can you give an example of some environmental actions that CLIMBE influenced (helped shape or affirm)?

15. Every CLIMBE trip was a little bit different. Please indicate which activities you participated in.
    - Traveling and camping in the backcountry
    - Learning informally about the ecosystems we traveled and lived in
    - Doing hands-on science activities in the outdoors (including collecting environmental data)
    - Interacting with environmental professionals (i.e. science professors, park rangers, climate scientists)
    - Discussing environmental issues and ways we could take action in our own communities
    - Having conversations about education and future careers with my instructors
    - Participating in a stewardship project (such as weeding out invasive plants)
    - Analyzing and reporting scientific data
    - Other (please specify)

16. Now you will have the opportunity to reflect on how the activities in your CLIMBE trip influenced or helped shape your environmental actions. *Note: respondents rated each activity selected from Question 15 on the following scale:*
    - Not influential
    - Somewhat influential
    - Moderately influential
    - Very influential
    - Extremely influential

Questions 17-22 were asked of all respondents. *Note: Questions 17-20 were used for demographic data; Questions 21-22 were discarded during analysis.*

17. What is the highest level of education you have completed?

18. Are you currently enrolled as a student?

19. What was/is/will be your undergraduate college major?

20. What was/is/will be your undergraduate college minor, if applicable?

21. If you have completed graduate school or are currently enrolled, what was/is your degree and area of specialization?

22. What were some factors that influenced you to pursue the above-mentioned college major(s) and minor(s), if applicable?

Question 23 was asked only of respondents who indicated CLIMBE influenced (Question 9) or helped shape or affirm (Question 11) their environmental action. This question was discarded during analysis.

23. Did CLIMBE influence you to pursue any of the above-mentioned college major(s) and/or minor(s), if applicable? If yes, please explain.
    - Yes
    - No

Questions 24-25 were asked only of respondents who indicated CLIMBE influenced (Question 9) or helped shape or affirm (Question 11) their environmental action.

24. Please indicate your level of engagement in the following environmental actions. This list is only intended to provide a glimpse of your environmental involvement.
    - Recycle
    - Conserve electricity by turning lights off or unplugging items when not in use
    - Conserve water
    - Conserve fuel by making fewer trips
    - Base some of my purchases on environmental considerations
    - Volunteer in environmental organizations or improvement efforts
    - Attend/participate in community meetings concerning the environment
    - Donate money to organizations concerned with the environment
    - Write letters to government officials concerning environmental issues
    - Vote for politicians based, at least partly, on their environmental considerations
    - Participate in environmental protests, such as demonstrating or picketing
    - Take courses about the environment (school, continuing education, workshops, etc.)
    - Educate others about the environment through my paid profession (teacher, naturalist, etc.)
    - Informally educate peers about the environment
    - Other (please specify)*

    **Note: the "other" selection was not used in calculating respondents' environmental action scores.*

25. Which environmental actions were influenced (or enhanced) by your CLIMBE participation? *Note: respondents indicated actions selected in Question 24.*

Question 26 was asked of all respondents.

26. Having reflected on your CLIMBE experience more, is there anything else you would like to add?

Thank you for completing this survey! Your responses will contribute to the greater field of environmental education research and practice, and help me earn my master's degree in environmental education! If you have any further questions, I can be reached at *[email address]*.

APPENDIX C

CONTACT WITH NON-RESPONDENTS

Initial E-mail:

Dear Former CLIMBE Participant or Parent,

Greetings! My name is Misty Varnell and I am a graduate student at Montreat College, pursuing a Master's degree in Environmental Education. Hopefully you have received a few postcards in the last month about participating in a survey on your CLIMBE experience and memories. Since I have not heard from you, I wanted to find out if you are aware of the survey, and if you would be willing to answer just a few short questions about your experience. **Your response will make an important contribution to this research and help me complete my thesis!**

If you are willing to take a couple minutes to share, you can answer the questions at this link: www.surveymonkey.com/r/climbe2

Thank you in advance for reflecting on CLIMBE and helping me get a step closer towards graduation!

If you a parent, I ask that you please forward this email to your son or daughter.

If you have any questions about the study, please do not hesitate to contact me at *[email address]*.

Sincerely,
Misty Varnell

Reminder:

Dear Former CLIMBE Participant or Parent,

Hi! I recently sent you an email about participating in a short survey on your CLIMBE experience, and since I haven't heard from you, I wanted to remind you that your perspective would be appreciated if you were willing to share. You can answer the questions at the following link or by clicking the button below: www.surveymonkey.com/r/climbe2 (Parents, please forward this to your son or daughter!).

If you have already completed the survey, **Thank you!**

In case this is the first time you are hearing about the survey, my name is Misty Varnell and I am pursuing a Master's degree in Environmental Education at Montreat College. This is part of my thesis research focusing on students' memories and perceptions of their CLIMBE trip.

Sincerely,
Misty Varnell

Final Reminder:

Dear Former CLIMBE Participant or Parent,

Good evening! I want to extend a "**Thank You**" to those of you who have taken the CLIMBE survey, and remind those of you who have yet to answer the survey that there is still time! **Your input will make an important contribution to environmental education research, and will help me complete my thesis.**

It will take about 5 minutes to answer the questions at the following link or by clicking the button below: **www.surveymonkey.com/r/climbe2**

If you are a parent, I ask that you please forward this link to your son or daughter.

In case this is the first time you are hearing about the survey, my name is Misty Varnell and I am pursuing a Master's degree in Environmental Education at Montreat College. This survey is part of my thesis research focusing on students' memories and perceptions of their CLIMBE trip.

Gratefully,
Misty Varnell

APPENDIX D

FOLLOW-UP SURVEY FOR NON-RESPONDENTS

Note: Respondents linked to the survey from the e-mail contact in Appendix C.

1. Is there a reason why you did not take the initial CLIMBE survey? (i.e. didn't hear about it, forgot, don't remember CLIMBE trip)

2. How many times did you participate in CLIMBE

3. What CLIMBE trip(s) did you go on?

4. Approximately what year(s) did you participate in CLIMBE?

5. How did you enjoy your CLIMBE trip(s) overall?
    - Not at all
    - Somewhat
    - Moderately okay
    - I liked it
    - I loved it
6. Do you think you are environmentally active? Please explain.

7. Do you think your CLIMBE experience influenced your level of environmental action?
    - CLIMBE had no impact
    - CLIMBE influenced me to be *more* active
    - CLIMBE influenced be to be *less* active

8. Please explain why you think CLIMBE did or did not impact your personal environmental actions.

9. Is there anything else you would like to add?

Thank you for taking your time to answer these questions! I appreciate your input!