It is an Experience, Not a Lesson:

The Nature of High School Students’ Experiences at a Biological Field Station

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This dissertation titled

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Abstract

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It is an Experience, Not a Lesson: The Nature of High School Students’ Experiences at a Biological Field Station

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The purpose of this case study was to describe the nature of high school students’ experiences in the immersive four-day field experience at Stone Laboratory Biological Field Station including excursions to Kelley’s Island and South Bass Island. Six tenth, eleventh, and twelfth grade students participated through interviews, photovoice, observations, and a survey. Pretrip semi-structured interviews were conducted to understand each participant student’s relationship with science. Participants were given cameras to record their field trip experiences to relate what they found interesting, important, and exciting. Back at school after the field trip, the participants were asked to choose their five most meaningful photographs, and write a short essay to describe the significance of each image. A posttrip semi-structured interview explored each participant’s experiences during the field trip. An unstructured interview was conducted to discuss each participant’s full photograph gallery from the field trip. Interview transcripts were member checked with one minor wording change. Analysis consisted of open coding using apriori codes derived from the ecological framework and emergent codes derived from the data. Coding was duplicated through multiple readers.

Significant findings included: 1) Prior experience, prior knowledge, and funds of knowledge added relevance and value to an experience, facilitating interest development;
2) Experiences appeared to be more meaningful when all the senses were stimulated; 3) Friends and peers were an essential part of a quality experience; 4) Quality experiences included a wow factor, or sudden awareness; 5) Teachers needed to be within the experience, not the focus of the experience, and needed to be available to answer questions, be enthusiastic when a discovery was made, and promote student reflection concerning their perceptions and discoveries; 6) A quality informal learning situation incorporated the cognitive/affective, physical, and social aspects into the experience; 7) Field trips created science interest that students desired to continue when they returned to their classroom; and 8) Biological field stations, in this study specifically Stone Laboratory, and the additional exploratory excursions on the surrounding islands provided high quality experiences that encouraged student interest in the biological and environmental sciences.
Dedication

To Dad

You have always supported and enabled my interests.
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This dissertation exists because I had the support of many wonderful and caring individuals. The opportunity to begin the doctoral program was enabled by Dr. Henning. Thank you for encouraging me to take the first course and for your inspiration to continue until the end.

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Chapter 1: Introduction

Fewer students are interested in science-related careers than ever, at a crucial time of increasing environmental challenges (Osborne, Simon, & Collins, 2003). Baby boomers have begun retiring in force, vacating countless science-related jobs today and beyond the next decade (Osborne et al., 2003). A 2011 nationwide survey for high school students revealed that 49% of the respondents did not plan to enter a science or health related career. Of the remaining 51% of students, the majority indicated they “might” pursue a science career (Burnsed, 2011).

A National Center for Educational Statistics (NCES) study in 1990 found that less than 50% of college freshmen who declared a science or engineering major completed their science or engineering degree within five years (U.S. Department of Education, NCES, 2000). In 2012, 63% of college freshmen who declared a science or engineering major completed their degree within six years. There are not enough college graduates in the Science, Technology, Engineering, and Mathematics (STEM) areas to fill present and projected science related job openings (National Science Foundation, 2012). Without present-day students going into the sciences, the American economy may be at risk (Wall Street Journal Digital Network, 2/16/2012).

In its report entitled “Learning Science in Informal Environments: People, Places, and Pursuits,” the National Research Council (NRC) (2009) declared that “non-school science programs can feed or stimulate the science-specific interests of adults and children, may positively influence academic achievement for students, and may expand participant’s sense of future science career options” (p. 3). Examples of such programs
include after school programs such as science club and science fair, 4H, summer camp, and hobby-related social groups or clubs (NRC, 2009).

In the same report, the NRC (2009) called for research on how students learn and gain interest in informal settings, with special attention to understanding experiences from a student’s viewpoint, as well as what students consider to be important and effective learning and teaching. Many researchers have investigated knowledge gain and learning that occurred during field trips (Hudak, 2003; Kisiel, 2006a; Mawdsley, 1999; Michie, 1998; Nadelson & Jordan, 2012; Scarce, 1997; Scribner-MacLean & Kennedy, 2007). Researchers have also investigated attitude, motivation, and interest gained during a field trip (Ebenezer & Zoller, 1993; Malinowski & Fortner, 2011; Nadelson, & Jordan, 2012; Zandstra, 2012). However, there is scant research examining student interactions with experiences and activities at field stations (DeMarie, 2001; Falk, 2001; Falk & Dierking, 2000).

**Background**

Early interest in science is emerging as a key predictor of students’ decisions to pursue science-related careers. Sixty-five percent of scientists and science graduate students surveyed by Stainburn (2011) said their interest in science began before middle school. Similarly, eighth graders with an interest in science were significantly more likely to acquire science-related careers than students with no interest in science (Cwikla, Lasalle, & Wilner, 2009; Tai, Lui, Maltese, & Fan, 2006). The less science the students experience by the time they reach middle school, the less likely they will develop an interest in science (Burnsed, 2011).
Yet, science is often not included in elementary school curricula despite the recognized importance of early development of science concepts and skills (Fries-Gaither & Lightle, 2011; NRC, 2009). In order to improve mandated test scores, some elementary schools replaced science time with extra reading and math prep, and some schools pushed science to after school programs (Dorph, Goldstein, Lee, Lepori, Schneider, & Venkatesan, 2007; Stainburn, 2011). The added focus on literacy and mathematics offers middle school students little to excite them about science (Burnsed, 2011).

When students take science in elementary and secondary schools, their motivation to participate in and learn science is dependent on their interest in the topic (Jolly, Campbell, & Perlman, 2004; NRC, 2009). Unfortunately, many students find the topics irrelevant, boring, and too hard to learn (Prokop, Prokop, & Tunnicliffe, 2007). Ebenezer and Zoller (1993) found that tenth grade students disliked science because they felt all they did was copy the teacher’s notes. Delpech (2002) described the spiral-type of curriculum, which sequentially revisits topics in greater depth, but is viewed as repetition by students, who become bored with the topic. Delpech (2002) also identified diminished teacher enthusiasm as a source of decreasing student interest in science.

Informal science programs promote learning by affording meaningful experiences to students, allowing students to socially interact, offering authentic, hands-on experiences, and promoting interests in specific knowledge, skills or activities through student free-choice (Cox-Petersen, Marsh, Kisiel, & Melber, 2003; NRC, 2009; Zandstra, 2012). Venues designed for informal science programs offer a place where students are able to discover the natural world, explore their interests, engage in scientific inquiry, and reflect on how the experience affected them (NRC, 2009). The venue is defined by its
setting and purpose. Visitors at a zoo, by definition, will observe the animal exhibits. Visitors at a science center will have structured, hands-on activities at many different stations (Falk & Dierking, 2000). A biological field station will be highly experiential, primarily using experiential, informal fieldwork and with less formal, classroom learning methods in place (Malinowski & Fortner, 2011; Woodhouse & Knapp, 2000).

Biological field stations create a learning environment for students, where each student engages in fieldwork and is able to explore, discover, and reflect over the things that they personally find interesting (Klug, Hodder, & Swain, 2002; Lei, 2010; Malinowski & Fortner, 2011; NRC, 2009; Woodhouse & Knapp, 2000). School trips to field stations, even in poor weather conditions, can result in slightly more positive student feelings and attitude about science as a career option (Malinowski & Fortner, 2011). The realistic and interactive nature of fieldwork is meant to foster students’ enthusiasm and creates a more positive attitude about the subject (Hudak, 2003). Enthusiasm and positive attitudes should lead to increased awareness, care, and passion for the subject matter, no matter whether it is the environment, animals, or a social situation (Janovy & Major, 2009; Tal 2004; Tal & Morag 2009; Variano & Taylor, 2006). According to Fail (1995):

Students come to feel connections between themselves and their natural and urban environments, and they make progress towards feeling like investigative scientists. They also become informed voters within their urban society, which may lead to more ecologically sound urban environments in the future (p. 524).

With increased interest or passion, learning is promoted as students construct more abstract connections, make deeper observations, give in to curiosity to conduct simple investigations, and discuss the subject matter with peers and teachers (Falk & Dierking, 2000). “When people like something, they attribute positive feelings and values
to it; the result is a high probability that they will choose to follow up on that interest with action” (Falk & Dierking, 2000, p. 23). Thus a successful field trip may inspire the learners to pursue a career in the sciences (Cwikla et al., 2009).

In summary, informal science venues have been recognized as important sources of science learning (Falk, 2001). Informal venues have also been credited with improving attitude toward and interest in science (Falk & Adelman, 2003; Falk & Dierking, 2000). Much remains to be learned about student experiences in informal learning environments. Falk (2001) suggested little is understood concerning how informal learning activities influence a person’s cognition and how the experiences are internalized.

**Theoretical Framework**

The NRC broadly defined the outcomes of learning that occur in informal settings to include “awareness, interest, motivation, social competencies, and practices…incremental knowledge, habits of mind, and identities that set [learners] on a trajectory to learn more” (p. 27). Interest, the learning outcome that is the focus of this study, is a motivational state of an individual who desires to engage or reengage with an activity, person, or object (Hidi & Renninger, 2006). Hidi and Renninger proposed a four-phase model of interest development, which describes the sequential phases of interest (Figure 1). The first phase, called triggered situational interest, is first sparked by an experience, either situational or textual. In the second phase, maintained situational interest, the spark persists, supported externally through others or through continued engagement of the situation. If the interest persists, it steps into the third phase, emerging
individual interest, where the interest becomes intrinsically motivational, begins accumulating a store of knowledge, and the interest has developed some value. The fourth phase, well-developed individual interest, is a continuation of phase three, however the knowledge base is high and the individual is passionate about the topic and considered an expert in that interest. The process is multidirectional, thus interest can be lost if not nurtured.

Experience emerges as an integral component of the first two phases of Hidi and Renninger’s model of interest development. According to Kolb (1983), learning consists of grasping an experience and then transforming it into an application or result (Kolb, 1983). Experiential learning is most effective when all five senses become involved and when the student sees relevance or has something at stake (Crosby, 1995; Montessori, 2004). Kolb uses a spiral model to describe experiential learning. The model starts with a
concrete experience, followed by observation and reflection, at which time abstract concepts form, and then concludes by testing the cognition in a new setting, which initiates another concrete experience, and the pattern continues to spiral.

The NRC (2009) recommends using the model, “ecological framework for learning in places and pursuits” to examine experiences in informal contexts and explain how people learn from these experiences. Drawing from cognitive and sociocultural theories of learning, the ecological framework uses the lenses of people, places, and culture to emphasize:

…the cognitive, social, and cultural learning processes and outcomes that are shaped by distinctive features of particular settings, learner motivations and backgrounds, and associated learning expectations. The term ‘ecological’ [in this framework] refers to the relations between individuals and their physical and social environments with particular attention to relations that support learning. (p. 31)

Using the ecological framework to examine the informal learning environments and experiences will allow researchers to tease out factors that result in improved learning, and more specifically in this study, interest.

In summary, interest is triggered or maintained as learners experience and form relations with the physical and social environments of informal settings. This study will use the ecological framework (people, places, and culture) to explore high school students’ experiences at Stone Laboratory in an effort to identify factors and leverage points that result in increased interest in science.
**Purpose and Significance**

The purpose of this case study will be to describe how high school students experience an immersive four-day field experience at Stone Laboratory, leading to the development of interest in science. Specific research questions include:

What is the nature of high school students’ experiences in an immersive four-day experience at Stone Laboratory?

How do high school students experience the various activities at Stone Laboratory?

How do high school students experience the physical and social resources at Stone Laboratory?

What aspects of students’ experiences at the Stone Laboratory lead to the development of interest in science?

Biological field stations have been recognized as informal learning venues that lead to the development of student interest and learning in science. Therefore an understanding of how students experience these venues can lead to critical insights regarding how interest in science develops, as well as the particular contributions of informal experiences to science learning. Findings of this study can lead to a description of the types of outcomes that are most desirable (and should be expected) from informal science learning experiences. Findings will also have implications for the kinds of experiences that might be included in formal science programs.

**Definition of Key Terms**

*Experiential Learning.* An instrument or learning method to allow students to utilize all five senses, to directly encounter the topic being studied, instead of learning
abstractly through written and spoken words. Experiential learning may be experienced through every day lived experiences. The student may see relevance or have something at stake with the lesson or objective (Smith, Knapp, Seaman, & Pace, 2011).

*Formal Science Learning.* Science learning that takes place in a school classroom, constrained by a pre-determined curriculum and standards, and that is assessed to determine a student’s grade (Falk, 2001).

*Funds of Knowledge.* Knowledge and skills gained through and accumulated from one’s family and culture, often developed and utilized to survive as a family, home and community (Moll, Amanti, Neff & Gonzalez, 1992).

*Informal Science Learning.* Science learning taking place outside of a school classroom, which may occur at home, in woods, and at institutions such as museum, science center, or biological field stations. The learning is student directed and is not assessed (Falk, 2001).

*Interest.* A motivational state of an individual who desires to engage or reengage with an activity, person, or object (Hidi & Renninger, 2006).

*Stone Laboratory.* A biological field station located on Gibraltar Island in Lake Erie, administered by Sea Grant and The Ohio State University, which has a focus on research and education. Educational programming includes the spring and autumn workshops that are devoted to hands-on experiences for students in grades four through twelve (Ohio State University, 2013).
Chapter 2: Literature Review

Concerns with Science Literacy

Science defines the quality of life for individuals and countries through material goods, living conditions, knowledge, and ultimately economic contributions (National Research Council (NRC), 2009). Citizens rely on new technologies throughout their daily lives. The quality of water, food, air, and medical services define the health of a nation. Innovations and a solid knowledge base solve perceived needs and science-related problems. The importance of science in a nation suggests that science education and the nurturing of students who are destined for science-related careers is an important mission. Understanding science will influence each person’s purchases, behaviors, and political decisions. The American Association for the Advancement of Science (AAAS)(2006) called this understanding “scientific literacy”, and defined it as an awareness that:

Science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes. (p. xvii)

Balgopal and Wallace (2009) defined scientific literacy as “the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity” (p. 13).

A science literate population is necessary if the society is to remain medically, technologically, and environmentally strong. The Hechinger Institute on Education and the Media (Stainburn, 2011) explained that science education today is in distress, because people are making poor decisions due to their lack of scientific literacy. For example, energy utilization and whether to vaccinate children require a working knowledge of
science. Trefil (2008) explained that scientific illiteracy can have only two results, decision making will be done by a few elite individuals, or decisions will be made by mystical powers or a “demagogue”. A problem exists because the science illiterate, superficial, subjective learners, have difficulty understanding their connection to the environment and have difficulty comprehending their personal ecological impact (Balgopal & Wallace, 2009; Saylan & Blumstein, 2011).

The strength of scientific literacy among a nation’s students can be examined through international assessments. The Program for International Student Assessment (PISA) 2009 test results revealed that the United States science literacy score of 502 was also the PISA average score compared with other 33 Organisation for Economic Cooperation and Development (OECD) countries (OECD, 2006). The 2009 score of 502 is slightly better than from the 2006 score of 489. PISA separates individual student scores into six science literacy proficiency levels ranging from level 1 to level 6. Only twenty-nine percent of students from the U.S. scored at or above level 4 on the scale, suggesting “At level 4 students select and integrate explanations from different disciplines of science or technology and link those explanations directly to...life situations” (Fleischman, Hopstock, Pelczar, & Brooke, 2010, p. 25). Eighteen percent of students from the U.S. scored below level 2, which suggests that “students may not be able to consistently provide... explanations in familiar contexts or draw conclusions based on simple investigations or consistently make literal interpretations” (Fleischman et al., 2010, p. 25). The scores indicate that one fifth of U.S. students are functionally scientifically illiterate, and only one third of U.S. students can be considered scientifically literate.
The California Academy of Sciences in 2009 performed a survey resulting with data such as 53% of adults know how long it takes for the Earth to revolve around the Sun, 59% of adults know that the earliest humans and dinosaurs did not live at the same time, 47% of adults are able to roughly approximate the percent of the Earth's surface that is covered with water, and 21% of adults answered all three questions correctly. Access to fresh water is a major issue facing much of America and especially the western U.S., yet less than 1% of those surveyed knew what percent of the planet’s water is fresh, and half did not even try to guess. Forty percent of those surveyed stated that they had no knowledge concerning sustainability (Stone & Ng, 2009).

In another study, The National Assessment of Educational Progress (NAEP) in Science (U.S. Department of Education, National Center for Educational Statistics, 2010) released the 2009 assessment of science education, which indicated American students were not improving at desired levels:

Thirty-four percent of fourth-graders, 30% of eighth-graders, and 21% of twelfth-graders performed at or above the Proficient level in science in 2009. The Basic level denotes partial mastery of the knowledge and skills fundamental for proficient work at each grade. Seventy-two percent of fourth-graders, 63% of eighth-graders, and 60% of twelfth-graders performed at or above the Basic level in science in 2009 (p.1).

The longer students were in school, the less scientifically literate they seemed to be.

A common belief in American society is that scientific knowledge is acquired from school. In reality, schools provide an important quantity and quality of science for students through formal learning, however, whether unnoticed or discounted, informal learning provides a significant source of science knowledge. Students spend as little as
nine percent of their lives in school amidst formal learning, the remaining 91% of their lives are open to informal learning opportunities (NRC, 2009).

Ohio Sea Grant (2011) identified three primary areas of understanding that scientifically literate individuals in northern Ohio should possess:

A Lake Erie Literate Person

Understands the characteristics, functioning and value of Lake Erie;

Communicates accurately about Lake Erie’s influence on systems and people in and beyond its watershed; and

Makes informed and responsible decisions regarding Lake Erie and the resources of its watershed. (Ohio Sea Grant, 2011).

The purpose of scientific literacy is to guide people’s knowledge of how natural systems interrelate with local and regional communities, and how decisions by the local and regional communities affect the natural systems.

Examining the literature, Chapter Two will consist of definitions of formal and informal science education, followed by examination of experiential learning, the four-phase model of interest development, field trips, and informal venues.

**Formal and Informal Learning**

Informal learning, also known as free-choice learning, is voluntary, loosely organized, not assessed, student or learner-centered, has an open-ended curriculum, and allows social interaction (Falk & Dierking, 2000; Hofstein & Rosenfeld, 1996; Rennie, 2007; Wellington, 1990). Falk and Dierking (2000) proposed changing the term informal learning to free-choice learning because the term “informal” sounds as if it is secondary or not important. This study will utilize the term informal learning on the basis of the
majority of research that continues to use the term “informal learning”. Informal learning is not confined to school-aged children. A person of any age, culture, cognitive level, or sociocultural background may find enjoyment or fulfill a sense of inquiry that is personally rewarding and personally relevant. Informal venues such as museums and science centers promote informal learning by affording meaningful experiences to students, allowing students to socially interact, offering authentic, hands-on experiences, and promoting interests in specific knowledge, skills or activities through student free-choice (Cox-Petersen et al., 2003; NRC, 2009; Zandstra, 2012).

Informal learning may be defined contextually through knowledge, in association with the personal, sociocultural, and physical contexts of the experience (Falk & Dierking, 2000). Informal learning will be personal, adapted to the person’s reality, motivations, and expectations, past knowledge, interests, and beliefs. Friends, coworkers, or whatever social group is involved, will influence the learning, as well as bystanders, teachers, docents, and guides, but learning is controlled by the learner. The physical context is determined by the venue or setting. Programs and activities may be organized and orchestrated, but the informal learner determines what he or she will learn, and often what is learned is something tangential and not intended by the program directors (Falk & Dierking, 2000).

In contrast to informal learning, formal learning is obligatory, organized, assessed, teacher centered, has a predetermined curriculum, and allows minimal social interaction (Saylan & Blumstein, 2011; Wellington, 1990). State and federal agencies have mandated a structured school curriculum that defines subject priorities. For example, writing, reading, literacy, and mathematics are high priority subjects during the
primary grades (NRC, 2009). Formal learning environments are often empirical, where students simply receive the information and are assessed by recall, without applying the information or seeing it in action (NRC, 2009). “Formal education is the interaction between a teacher and a student within a systematic framework of standards, tests, and a fixed curriculum” (LZ-L-Landstra, 2012, p. 25.) Grenier (2009) related that formal learning in the classroom was necessary to become competent in a subject. Knowledge and skills develop, creating a foundation onto which potential interest may expand.

There is debate whether or not there is a clean dichotomy between formal and informal science learning (Hofstein & Rosenfeld, 1996). Hofstein & Rosenfeld (1996) supported a hybrid definition that informal learning may occur both in informal learning environments, such as museums, and in formal learning environments, such as school classrooms. However, the reverse is not true. Formal learning methods are not effective in an informal learning setting. Olson, Cox-Petersen, and McComas (2001) illustrated how teachers tried to lead an entire class on a field trip just as if they were in a classroom, but only the students nearest the teacher were able to hear. Teachers often view a field trip as an event, not an educational experience, initiating an ineffective formal pedagogy because those teachers may not attempt to connect concepts on the field trip to previous classroom lessons or prepare the students in advance (Griffin & Symington, 1997; Olson et al., 2001). Illustrating the variability of informal learning that can occur in a formal learning setting, Hofstein and Rosenfeld (1996) revealed that a field trip to a museum might be required or optional, structured or unstructured, learner led or teacher led.

Additional examples are listed in Figure 2, including level of assessment, ability to
pursue tangential interests that lead to unintended or unexpected outcomes and the amount of allowable social discourse during the learning activity.

<table>
<thead>
<tr>
<th>Informal learning – field trips</th>
<th>Formal learning – school</th>
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<tbody>
<tr>
<td>Voluntary</td>
<td>Compulsory</td>
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<td>Unstructured</td>
<td>Structured</td>
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<td>Unsequenced</td>
<td>Sequenced</td>
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<td>Nonassessed</td>
<td>Assessed</td>
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<td>Unevaluated</td>
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<td>Open-ended</td>
<td>Close-ended</td>
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<td>Learner-led</td>
<td>Teacher-led</td>
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<tr>
<td>Learner centered</td>
<td>Teacher-centered</td>
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<tr>
<td>Out-of-school context</td>
<td>Classroom context</td>
</tr>
<tr>
<td>Non-curriculum-based</td>
<td>Curriculum-based</td>
</tr>
<tr>
<td>Many unintended outcomes</td>
<td>Fewer unintended outcomes</td>
</tr>
<tr>
<td>Less directly measureable outcomes</td>
<td>Empirically measured outcomes</td>
</tr>
<tr>
<td>Social intercourse</td>
<td>Solitary work</td>
</tr>
<tr>
<td>Nondirected or learner directed</td>
<td>Teacher directed</td>
</tr>
</tbody>
</table>

*Figure 2. Features of Formal and Informal Science Learning (Hofstein & Rosenfeld, 1996, p. 89)*

**Experiential Learning**

Smith (2001) identified two ways to look at experiential learning. First, it may be an instrument to allow students to utilize, apply, and feel - to directly encounter the topic
being studied, instead of learning abstractly through written and spoken words, such as with vocational training. Second and most commonly, experiential learning may be experienced through every day lived experiences.

**Kolb’s theory of experiential learning.** Kolb & Kolb (2005) described six propositions concerning learning:

1. Learning is a process, not an endpoint. It requires feedback, reconstruction and reflection of the experience.

2. All learning is relearning, which is maximized when student beliefs and ideas are included to develop assimilated, new refined ideas.

3. Learning requires understanding an experience through opposing methods of experiencing, feeling versus thinking, or doing versus watching.

4. Learning consists of feeling, thinking, doing and watching.

5. Learning occurs from an experience between the person and environment.


Kolb (1983) developed a model to describe learning styles that suggested all learning is defined by how one processes experiences. The model is based on concrete experiencing and abstract conceptualization, or said another way, perception and processing (Hurst-Wajszczuk, 2010). While diagraming the two concepts, Kolb chose two intersecting lines, reasoning, “the modes of active experimentation and reflection, like abstractedness/concreteness, stand in opposition to each other” (Kolb, Osland, & Rubin, 1974, p. 29). Kolb reasoned that a learner can do only one or the other at a given moment. Similarly, “reflection tends to inhibit action and vice versa” (Kolb et al., 1974, p. 29). Kolb suggested that each learner’s learning style could be identified and located
on his diagram. How a learner thinks or feels, and if he or she prefers to watch or participate define one’s learning preference (Hurst-Wajszczuk, 2010).

Figure 3 illustrates Kolb’s learning styles, and provides a visual diagram of Kolb’s experiential learning cycle. Kolb initiated the cycle with a concrete experience, however other researchers suggested that learners may enter the cycle at any stage (Healey & Jenkins, 2000; Hurst-Wajszczuk, 2010; Raschick, Maypole & Day, 1998). The learning cycle consists of four stages. The concrete experience (feeling/sensing) proceeds to the reflective observation (watching) stage, which proceeds to the abstract conceptualization (thinking) stage, leading to the active experimentation (doing) stage, and then returning to the concrete experience stage, and the cycle continues until the learning is complete. Hurst-Wajszczuk (2010) suggested that some learners may proceed through the cycle in a different order, although all four processes must take place. “One might begin with active experimentation, for example, and then proceed to reflective observation and concrete experience, before arriving at abstract conceptualization” (Hurst-Wajszczuk, 2010, p. 422).

A person usually possesses strong traits that dominate one quadrant, although individuals very often see personal traits in each quadrant. First presented in 1976 and then revised in 1985, the Kolb learning style inventory identifies a learner’s primary preference of how they learn by pinpointing which quadrant their learning preference lays. It is important to remember that two individuals who place in the same quadrant may be very different in behavior and personality (Kolb & Kolb, 2005).
Figure 3. Kolb’s learning cycle and learning styles. (Chapman, 2013).

Smith (2001) and Hurst-Wajszczuk (2010) described the four learning style quadrants (Figure 4). Learners in the *accommodating quadrant* are dynamic learners who prefer trial and error learning methods and strive to accomplish a goal. The learners are product oriented. They rely on one-on-one mentoring relationships and become frustrated when prevented from actively working towards a goal. Learners in the *diverging quadrant* prefer to understand the problems and find solutions. They like to brainstorm and become frustrated when assigned busy work, are not given all the information they desire, or are given little feedback. Learners in the *assimilating quadrant* prefer to work with ideas, comparisons, and abstract thinking. They enjoy
creating models, plans, and theories, and become frustrated when they feel a lack of control of the information and time, and often deal poorly with practical application. Learners in the *converging quadrant* enjoy doing things. Perhaps appearing cynical, they are curious and question everything, and they look for practicality and application. They are frustrated by a lack of boundaries or limitations or rules, and by not being able to try something.

Although this study does not focus on the learning styles, they help to understand Kolb’s experiential learning theory. Each learner is unique, and educators need to be cognizant of their students’ learning styles to reach all students as courses are designed and implemented (Hurst-Wajszczuk, 2010). In a worst case scenario, “Learning may suffer where a marked mismatch occurs between the style of the learner and the approach of the teacher” (Healey & Jenkins, 2000, p. 185).

Arguments have been made to illustrate weakness in Kolb’s theory of experiential learning. Anderson (1988) recognized a gap of how different cultural aspects may change what is learned from identical experiences. Kolb’s model does not address the cultural differences in thinking and communication styles. Dewey (1933) did not advocate strict processes, because steps may be combined or skipped over. Jarvis (1987) agreed that Kolb’s model illustrates that experience, learning and knowledge are connected. Nevertheless, Jarvis did not believe Kolb explored the nature of the experience or learning in any depth. In spite of these issues, Kolb’s experiential learning model provides framework to understand how students learn, how lessons may be presented to students for optimal learning, and how educators may develop curriculum to reach the diverse needs of the student population (Tennant, 1997).
<table>
<thead>
<tr>
<th>Learning Style</th>
<th>Learning characteristic</th>
<th>Description</th>
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| Accommodator (Product oriented) | Abstract conceptualization + active experimentation (feel and do) | Greatest strength is doing things  
More of a risk taker  
Performs well when required to react to immediate circumstances  
Solves problems intuitively |
| Diverger (Heart oriented) | Concrete experience + reflective observation (feel and watch)        | Strong in imaginative ability  
Good at generating ideas and seeing things from different perspectives  
Interested in people  
Broad cultural interests |
| Assimilator (Equation oriented) | Abstract conceptualization + reflective observation (think and watch) | Strong ability to create theoretical models  
Excels in inductive reasoning  
Concerned with abstract concepts rather than people |
| Converger (Question oriented) | Concrete experience + active experimentation (think and do)           | Strong in practical application of ideas  
Can focus on hypothetico-deductive reasoning on specific problems  
Unemotional  
Has narrow interests |

*Figure 4. Kolb’s four basic learning styles (Hurst-Wajszczuk, 2010; Smith, 2001)*

**Reflection.** A brief description of reflection is necessary to understand its relevance as part of an experiential learning activity. Jordi (2011) proposed that reflection is the key to experiential learning, illustrating how reflection is utilized in formal and informal education. The longer and deeper the reflection, the deeper and
stronger that integrated learning will become. A quality reflection or debriefing session must take place as soon as possible after the activity. Improper planning or implementation will yield diminished results. During the experience, the teacher must be prepared to notice any student interest, and the teacher must be excited for every student’s discovery, because although it is well known to the teacher, it may be the first time the student has ever perceived this object or concept (LaMaster, 2001).

The importance of reflection and debriefing is a common, recurring theme throughout the literature. Medical field training programs rely on experiential learning as an important, if not primary, technique for student knowledge and skill acquisition. Unfortunately, in the case of nursing programs, there is little research providing guidelines to effectively debrief nursing students (Neill and Wotton, 2011). Quality student reflection and debriefing after clinical field experiences is an important goal in spite of burgeoning class sizes (Burnard, 1993).

Concerning environmental education, “The debriefing session at the end of the gaming session is an extremely important aspect of playing games…playing a game without debriefing is like playing a soccer game without scoring goals” (Dieleman & Huisingh, 2006, p. 846). Each participating student acquires a unique set of experiences that a debriefing session will explain, clarify, place into context, and potentially reveal how the lesson may be used in the student’s personal and professional life. During a reflection session, students hear peers’ experiences and realize that although they played the same game, each finished with different lessons and perceptions (Dieleman & Huisingh, 2006).
**Funds of Knowledge.** The funds of knowledge is similar to experiential learning, but differs by its cultural focus. Moll et al. (1992) defined funds of knowledge as the “historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being” (p. 133). Funds of knowledge are not general cultural history, they are specific, localized, unique knowledge gained by each individual. It refers to social, financial, and dynamic aspects of each person’s life skills and knowledge, and the interconnectedness of the skills and knowledge with other members of the household and family. Moll et al. (1992) examined how members of families used their funds of knowledge to survive connections with their social environments, and in particular, how the families exchanged “knowledge, skills and labor that enhanced the households’ abilities to survive or thrive” (Moll et al., 1992, p. 133).

At home or with his or her family, the student interacts with many individuals within the immediate or distant family. The interactions are rich with various intents and purposes, ranging from learning trade skills to celebrating holidays, to hobbies and pastimes to religious activities. During all these activities, the students are able to participate with people they know and trust (Moll et al., 1992):

Much of the teaching and learning is motivated by the children’s interests and questions; in contrast to classrooms, knowledge is obtained by the children, not imposed by the adults. This totality of experiences, the cultural structuring of the households, whether related to work or play, whether they take place individually, with peers, or under the supervision of adults, helps constitute the funds of knowledge children bring to school. (p. 134)

Examining funds of knowledge in an educational context, Gonzalez et al. (1995) identified that schools tend to focus on what the students lack, such as language skills and
school sanctioned knowledge, rather than the knowledge these students bring to school, to utilize “as a foundation for learning” (p. 445), leading to teachers’ lower expectations and lack of understanding of each student’s potential. Teachers often overlook this prior knowledge during lessons and activities (Street, 2005). This prior knowledge could be used to engage the students, to enrich each lesson, and to provide relevance to classroom lessons. Historically, studies concerning funds of knowledge have focused on minorities and disenfranchised social groups (Gonzalez, et.al, 1995; Moll et al., 1992; Velez-Ibanez & Greenberg, 1992). However, each student, regardless of race, gender, cultural identity, or status, has his or her own private fund of knowledge that provides to the teacher a potential link between the student and each lesson concept (Gonzalez et al., 1995; Street, 2005).

**Historical view of experiential learning.** Experiential learning theory is not new to education and was discussed as early as Plato. He thought our own beliefs define the potential depth and perspective of learning. Every experience is unique. Plato used a chair as an example. We know the essence or form of the chair, yet can a chair be defined? Chairs have four legs and people sit on them. Thus is a table a chair? What if there are no legs, such as a beanbag chair? There are many definitions of a chair, yet Plato asserts that we all know what a chair is (as cited in Crosby, 1995; Stonehouse, Allison, & Carr, 2011).

Hume argued that knowledge utilized to think and reason was obtained originally through the senses. Conclusions based on data gathered by the senses could not be conclusive, but knowledge and thought could only be derived from sensual experiences. Innate ideas did not exist. Instead, knowledge was derived from direct experience during
everyday life (as cited in Kemmerling, 2011). Without being named, experiential learning was identified as integral to construct knowledge.

Rousseau believed that children learn by experience, and that verbal lessons should be avoided. He believed the best way to teach a child was to provide him with many experiences and things to explore, and then let the child pursue his or her interests wherever they may lead (as cited in Smith, 2011). Pestalozzi agreed that educators should nurture and guide the students to grow at their own speed and on their own terms. Educators need to be careful not to impede a child’s development. “Learning should be based on direct, concrete observation and experience. New learning must be followed by action” (as cited in Smith, 2011, p. 29).

According to Montessori, children are programmed to learn about everything around them if given the opportunity and the proper environment. She believed there is a natural order to learning, first the education of the senses and then the education of the intellect (as cited in Swiderski, 2011). Montessori stressed that students needed to use all five senses to gain full understanding of an experience, at a pace set by each student, and that learning should be exciting to students. She believed each student should choose what they wish to do and learn, which would lead to the ability to concentrate, be motivated, learn self-discipline, and gain a love of learning. (Montessori, 2004).

Dewey thought learning should begin as an experience, not an abstraction. He believed that rather than concern ourselves about some theoretical dimension that could never be attained, humans should be studied through their actual experiences (Dewey, 1998). Dewey illustrated there is a pattern to that experience. First there is a sensual or aesthetic quality with little reflection. Second comes meaning through reflection. Finally
there is closure. This pattern of experiential learning is derailed by rigidity and transmission (as cited in Hunt, 1995). Dewey proposed that every experience affects the individual. Attitude may become more positive or more negative, promoting or repelling the individual’s desire for further experiences. Every experience influences how all future experiences are accepted and embraced. A positive experience will promote curiosity, strengthen an individual’s resolve to continue on, and may promote passion that will energize that individual to gain more knowledge and experiences (Dewey, 1998).

**Experiential learning and the theory of informal learning.** Empirical naturalism was Dewey’s term for basing philosophical inquiry on natural experience. An empirical naturalist connects materialistic, rationalistic humans to the empirical, idealistic natural world. Dewey identified two connected aspects of experience. The first or primary experience is the direct, sensory view of the world, which is immediate and tangible. The primary experience is unrefined and is the basic foundation of knowledge (Dewey, 1929). Primary experience is non-cognitive; it is only the beginning, not the finished perception. The secondary experience, the reflective experience, defines the process once a primary experience is obtained. The raw experience is refined into a precise, well-defined bit of knowledge. The more sensory observations that are available, the more that can be arranged and evaluated. Secondary experiences “explain the primary objects, they enable us to grasp them with understanding instead of just having sense contact with them” (Dewey, 1929, p. 7). Educators must guide the reflection when students acquire a new experience.

Scientific study involves primary and secondary experiences. A scientist acquires data from his or her senses, reflecting and evaluating new information, using previously
acquired knowledge as the foundation. The goal is “to be able to make predictive statements about future experiences in the form of a hypothesis” (Hunt, 1995, p. 27). Dewey (1929) explained that all refined methods can be traced back to primary experience. The process is circular. Primary experience also keeps secondary experience grounded, to remain focused on authentic experience.

Dewey did not believe in a reality that could never be known by humans. The senses, added with reason, act together as pathways to learn, know, and function in our world and environment. Dewey’s goal for learning was to know about and understand our world as we experience it and he was the first to suggest that the metaphysical and epistemological learning journey begins with feelings rather than objectives. The goal for education is to understand and use experiences by incorporating thought, not by looking for the correct answer. Dewey suggested that teachers should guide the students to attach each student’s personal experiences to a lesson, to find understanding (Hunt, 1995). Each lesson should conclude by reflecting on the concept and adding new meaning to the experience, what Piaget called accommodation.

From experiential learning to informal learning, now this study will examine interest, a focus of this current study. In the next section, the four-phase model of interest development will be examined.

**The Four-Phase Model of Interest Development**

The current study examined what experiences the students found interesting during their Stone Laboratory field trip. Interest, defined by Hidi and Renninger (2006), is a “motivational variable, referring to the psychological state of engaging or the predisposition to reengage with particular classes of objects, events, or ideas” (p. 112).
Interest can be distinguished from other motivational variables three ways. First, by including affective (such as positive emotions) and cognitive (such as perception and related activities) components as separate but interacting systems. Second, the affective and cognitive components of interest are physiological. Third, interest is a result of an interaction between a person and an object.

Hidi and Renninger (2006) described two types of interest that are integral for the model. Situational interest is the combination of focused attention and an affective reaction that is triggered by a stimulus and may be momentary, or may last a while. It is usually externally maintained, it is motivating, and may positively influence cognitive performance. Individual interest is a person’s predisposition to reengage with something that is motivating, and will have a positive impact on attention and recognition.

Hidi and Renninger’s (2006) four-phase model consists of two phases of situational interest and two phases of individual interest. The phases and their characteristics shall be described in sequential order as they occur.

Phase 1: Triggered Situational Interest – This interest is triggered by environmental or textual objects or features such as unexpected or surprising information, recognition of a person, or a source of intensity. This situational interest is usually externally supported. Teachers may use puzzles or games to trigger student situational interest. Triggered situational interest may motivate the person to reengage with the object, and potentially move to the next phase.

Phase 2: Maintained Situational Interest – This interest involves focused attention, persistence, and personal involvement. This situational interest is usually externally supported. Teachers may utilize project based learning, assign meaningful activities, use
collaborative groups, or tutor a student one-on-one. Maintained situational interest may
or may not motivate the person to reengage with the object over time.

Phase 3: Emerging Individual Interest – This interest is at a new psychological
level, developing stored knowledge, a value system for the interest, and positive feelings. The individual desires to follow the interest if given the option, and generates his or her own curiosity and challenges. Work may seem effortless. This individual interest is usually internally supported. External support from peers or a model is necessary, which also contributes to the knowledge level. Teachers may support individual interest by providing an enabling learning environment. Emerging individual interest may or may not lead to the next phase.

Phase 4: Well-Developed Individual Interest – This interest remains at the new psychological level, with greater stored knowledge, more value and positive feelings. The individual continues to focus on the interest, generate curiosity, persevere when challenged, and solve problems. This individual interest is usually internally generated, although he or she still needs external support from peer and models, and now contributes to others’ knowledge as well as learns from others. Teachers may support well-developed individual interest by providing an enabling learning environment that also provides interaction and challenges that lead to knowledge construction.

The four-phase model consists of four sequential, multidirectional phases. Each phase builds onto the previous phase, deepening the interest and building knowledge. Interest may progress through the phases, and will stabilize in one phase, or it may reverse its direction and move to a lower phase, and perhaps disappear altogether.
There are three alternative interest development models of note. The model of domain learning (Alexander, 2004) describes situational and individual interest. There are three stages: acclimation, competence, and expertise. Interest develops in relation to the person’s academic expertise. Only individuals out of high school are able to develop expertise, and the progression is irreversible, so that once interest has developed into expertise, it will not diminish.

The person-object theory of interest, described by Hidi and Renninger (2006) is similar to the four-phase model because interest is a relationship between a person and an object. It involves positive emotions, and the interest is specific to the object. The person-object theory of interest differs from the four-phase model because the person-object theory grades values and feelings and differentiates levels of knowledge to define interest.

The psychology of constructive capriciousness (Silvia, 2001) defines interest as a basic emotion, and defines interests as motivation for individuals to engage in activities with specific objects for their own sake, and is an adaptation to promote knowledge, experience, and skills. The emotion of interest is a catalyst for development of interests. Although it includes situational interest, the psychology of constructive capriciousness model does not have any stages or phases, and it places interest and interests within the individual alone, not through an interaction between the individual and an object.

The four-phase model of interest development suggests that positive feelings about an activity and solid knowledge content are important. A teacher who supports the development of students’ interests will have students who are engaged and motivated. The students will require less external support, and will require more internal support
through questions and encouragement. As students develop stronger interests, they will need models of scientists or people engaging in their discipline (Hidi & Renninger, 2006). The students also want to generate their own questions, and then explore options for solutions. Teachers must remember that interest cannot develop if left unnurtured. It is important to support a student to sustain a developing interest (Hidi & Renninger, 2006).

**Ecological Framework**

The ecological framework as posited by NRC (2009) provides a set of lenses useful to examine the cognitive, physical, and cultural processes in informal science learning research. “Ecological” defines the relationship between the physical environment with the cultural environment and the associated individuals. The ecological framework accepts that individuals who have an experience will vary in what they learn due to personal development and differences in their background, differences such as schooling, family income, family culture, peers, and environment (Bronfenbrenner, 1977; NRC, 2009).

The NRC (2009) proposed three lenses to analyze informal science learning, people-centered lens, place-centered lens, and culture-centered lens. The people centered lens examines the development of interest, knowledge, affective responses, and personal identity. Prior knowledge, whether from a family member, peer, or teacher, is an important factor that defines any individual’s actions (NRC, 1999), and defines how the individuals view their world. “A major implication for thinking about informal science learning is that what learners understand about the world is perhaps as important as what we wish for them to learn through a particular experience” (NRC, 2009, p. 34). The
people-centered analysis will explore how individuals acquire knowledge, affective responses, and develop interest. NRC (2009) proposed the term “people-centered lens” because it focuses upon individuals’ affective reactions as well as cognitive reactions. Instead of the term people–centered lens, this study will use the term “cognitive/affective.”

The place-centered lens related to the physical aspects of learning informal science. The setting defines what resources, tools, and equipment may be used. A physical science classroom provides a given set of physical resources, and a natural history museum provides a completely different set of physical resources. Individuals will respond to the different physical settings and associated tools with different skills and knowledge used and gained (NRC, 2009).

The culture-centered lens related to an individual’s connections to his or her communities. Culture consists of the interactions between an individual and a community. The community may provide values, skills, knowledge and personal identity to the individual. Conversely, the individual brings prior knowledge and experiences to the community. Individuals will belong to multiple communities. The cultural aspects of each individual define how the individual will act, perform, experience, and learn in different environments (NRC, 2009).

**Field Trips**

**Student engagement during experiential learning.** Students find outdoor learning activities to be realistic, interesting and interactive. “Fieldwork often fosters enthusiasm” (Falk & Dierking, 2000; Hudak, 2003, p. 220). But to maximize connections with past knowledge and classroom concepts, students still need to discuss
and reflect over the new revelations. One method to connect concepts to experiences is
through the immediate social network. Students may peer teach, explain what to look for
or how to complete a task, read placards and signs to each other, and discuss their
personal understanding of what they are experiencing. Rennie (2007) observed that quite
often the students who stepped out as peer instructors have been students who performed
poorly in class. This direct participation during a field experience creates a more positive
attitude about the subject.

While discussing urban ecology field trips, Fail (1995) explained that students
begin to feel like investigative scientists when they experience a connection with the
natural environment in urban areas. It is important that students develop personal
connections with the environmental curriculum because students gain understanding that
may lead towards deeper interest, increasing awareness and care, leading to increasing
passion for the subject matter, no matter whether it is the environment, animals, or a
social situation (Tal 2004, Tal & Morag 2009, Variano & Taylor, 2006). With increased
interest or passion, learning is promoted as students construct more abstract connections,
deeper observations, give in to curiosity leading to simple investigations, and discuss the
subject matter with peers and teachers (Falk & Dierking, 2000). An emotional
connection may inspire the learners to pursue a career in the sciences (Cwikla et al.,
2009). Thus a successful field trip with an effective curriculum has the potential to be
life changing for students.

Field trips as an experiential tool. Hutson, Cooper, and Talbert (2011) stated,
“The positive impact of a single, purposeful field trip suggests that students can
successfully develop connections between academic content and future careers when
placed in appropriate contexts” (p. 46). This may be particularly true for students who are academically challenged or described as ‘at risk’ due to low performance on high-stakes tests or performance in the classroom (Hutson et al., 2011).

There are multiple views of what defines a field trip, which may also be termed as an instructional trip, school excursion, or school journey. Krepel and Duvall (1981) described a field trip as:

A trip arranged by the school and undertaken for educational purposes, in which the students go to places where the materials of instruction may be observed and studied directly in their functional setting: for example, a trip to a factory, a city waterworks, a library, a museum, etc. (Krepel & Duvall, 1981, p. 7).

Tal and Morag (2009) described field trips as, “an important means of teaching, as evidenced by a long tradition in the history of education. Field trips are usually arranged by schools, have educational purposes, and take place in interactive settings” (p. 246).

Hefferan, Heywood, and Ritte (2002) described the field trip experience as “a microcosm of life in the workplace, requiring preparation, effort and logistical consideration, data collection, peer collaboration, multidisciplinary interaction, improvisation and more effort” (p. 189). Lei (2010) described a field trip as “The viable method of extending the traditional classroom and laboratory environment to outdoors because they support or reinforce the educational value of interactive and applied field work” (p. 413).

Falk and Dierking (2000) explained that field trips take students to locations that are unique and cannot be duplicated in the classroom. Each student observes natural settings and creates personally relevant meaning to the experience. Interactive exhibits help students play with concepts, which is an activity often not possible in the classroom.
Rennie (2007) described how formal field trips consist of planned, well-orchestrated experiences where students follow a documented format. Programs are usually run by the venue’s staff, and each student’s experience is similar to all the other students’ experiences. Government agencies, museums, and businesses offer excellent formal experiential learning activities and programs. Teachers find formal programs comfortable because the students are bound to a choreographed agenda. However, there are minimal opportunities for students to personally interact and connect to the experience.

In contrast, informal school field trips are less structured and offer students some control and choice concerning their activities or environment (Rennie, 2007). Teachers must be prepared for the shift from the structured classroom to the unstructured informal field trip (Kisiel, 2003). Teacher strategy includes preplanning, allowing students to experience the learning activity, and then following up the trip with student debriefing and reflection (Rennie, 2007). Regardless of whether the field trip is led by teachers or venue staff, it is important that they are competent and motivated to maximize student learning (Wiegand, Kubisch, & Heyne, 2013).

Non-school related informal field trips, such as family activities, contribute significantly to children’s science knowledge and interest. Rennie and McClafferty (1995) expounded that science knowledge and interest may be compromised if the majority of experience occurs through the media, such as television and the Internet, because the children have difficulty determining reality from entertainment. To connect science lessons to relevance in the natural world, students first must have direct, personal experience in the natural world (Rennie, 2007).
Benefits of field trips. Michie (1998) listed four benefits derived from field trips: Authentic, hands-on experiences, increased learning, improved attitude to science, and improved social climate between students and other students and between students and the teacher, which ultimately improves the classroom atmosphere. Students on field trips utilize all their senses and sharpen their skills of observation and perception, increase their vocabulary, and develop an increased interest in the outdoors (Hoisington, Savleski, & DeCosta, 2010; Nabors, Edwards, & Murray, 2009). Students develop a positive attitude for learning, thus motivating them to develop connections between the theoretical concepts in the classroom and what has been experienced (Falk, Martin, & Balling, 1978; Hudak, 2003). Learning experientially inspires students to ask questions, discuss observations, consider past experiences, or simply ponder the topic (Farmer, Knapp, & Benton, 2007b). Even as they are traveling to and from the field trip venue, students gain knowledge and understanding about their neighborhoods and communities (Nabors et al, 2009). Field trips provide students increased knowledge about specific topics (Sturm & Bogner, 2010; Wiegand et al., 2013). If the students enjoy themselves, their interest will increase, further reinforcing the knowledge gain (Ainley & Ainley, 2011).

Benefits from field trips are not guaranteed. Field trips are not meant to be short term teaching instruments. Students may acquire short term learning, but without reinforcement from reflection or debriefing, the learning may only be temporary (Dierking & Falk, 1997). If done correctly, Farmer, Knapp, and Benton (2007a) illustrated that one year after a well-orchestrated field trip experience, many students remembered what they had seen and heard, and displayed a newly developed pro-environmental attitude.
Informal learning research. Hofstein and Rosenfeld (1996) discussed three reasons informal learning at informal venues should be researched. First, research should explore how to design and evaluate educational programs and exhibits that will create meaningful interactions and positive attitude among visitors. Second, research should explore how to adapt informal learning methods into a formal education program. Third, research should explore how visitors learn science during an informal learning experience. Hofstein and Rosenfeld (1996) suggested six questions that address the research goals:

1. What do children, adults and family groups do and find interesting in (field trips, casual visits, science projects, community-based science programs, the science media)?
2. What do children, adults and family groups learn from (field trips, casual visits, etc.)?
3. What are the factors that influence what and how much they do and learn?
4. How do (field trips, casual visits, etc.) influence children’s perceptions and attitudes about science?
5. How could (field trips, casual visits, etc.) be designed and implemented to better achieve important learning goals?
6. How might (field trips, casual visits, etc.) be integrated into the formal science curriculum? (p. 92).

Informal venues. An informal learning venue is any non-school location where learning might take place, including museums, science centers, zoos, and field stations (Falk & Dierking, 2000). The venue is defined by its setting and purpose. Visitors at a zoo, by definition, will observe the animal exhibits. Visitors at a science center will have
structured, hands-on activities at many different stations. A field station will be highly experiential, with both formal and informal learning methods in place (Falk & Dierking, 2000).

Biological field stations create a uniquely positive learning environment for students, where each student is able to explore, discover, and reflect over the things that they personally find interesting (Klug et al., 2002; Lei, 2010; Malinowski & Fortner, 2011; NRC, 2009; Woodhouse & Knapp, 2000). Students in preschool through higher education find biological field stations interesting and motivating. The field station experience can be life changing. Many biologists and environmental scientists today proclaim that a field station experience strongly influenced their decision to pursue biology as a career (Arvey & Riemer, 1966).

Little information is published about biological field stations (Arvey & Riemer, 1966), but biological field stations provide a significant service connecting students to authentic science experience. Biological field stations are typically small satellite facilities of a college or university. In the early 1900’s, field stations typically focused on nature study. Today, research is a primary mission for roughly half of existing field stations, the other half focus partially or entirely on student education and field experiences (Arvey & Riemer, 1966).

Biological field stations utilize the habitats available to them (Arvey & Riemer, 1966). They are considered either marine oriented or inland based. Marine field stations are located on fresh or salt water and focus on the local ecosystems. Inland field stations, also known as land based field stations, may focus on the forest, prairie, desert, mountain, stream, lake, or mixed habitats, which define the educational curriculum that the station
can offer. Also, the seasonal weather determines whether the field station may be open year round or only during the accessible times of spring through fall. A typical field station will consist of rustic dormitories or cabins, a dining facility, and a classroom/laboratory facility (Arvey & Riemer, 1966).

Successful biological field stations utilize multiple approaches to help students interact with the field science. Early grades have short, dynamic activities to explore, experience, and discover. Later grades explore, experience, and discover through more intensive experiential activities. If the students are young or apprehensive about a field experience, the teacher might provide students some schoolyard experiences before the trip (Klum, Hodder, & Swain, 2002). In all cases, students participate and develop personal ownership with their learning, and derive personal meaning from their experiences (Malinowski & Fortner, 2011).

Literature suggests that a field trip to an informal venue will benefit students. Museums, science centers, and zoos have been studied significantly more often than biological field stations. The biological field station research that has been accomplished tended to examine one and two day student visits and the change in student attitude and learning during and after the field trip. However, there is a paucity of research examining four-day immersive experiences or the identification of student perceptions garnered during their experiences at a field station.
Chapter 3: Methods

Research Design

This dissertation used a case study design to investigate research questions. A case study design is suitable when the goal is to explore a real-world situation, group, culture, or program to investigate what goes on there, and how participants perceive things (Creswell, 2013; Stake, 1995; Yin, 2009). In this dissertation, the case study design was used to examine high school students’ experiences in an immersive science program. The program was bounded in terms of the student participants (students from a rural high school), the field station’s specific program and geographical location (located on a 6 acre island in western Lake Erie), and time (a four-day immersive experience). To achieve the goal, this case study utilized interviews, photovoice, and observations, leading to the analysis searching for patterns of common meaning derived from the student participants’ experiences during the field program, ultimately resulting with a final case description (Creswell, 2013).

To examine the students’ experiences, this study borrowed methodology from phenomenological research which focused upon lived experiences with the purpose of gaining deep understanding of the participant’s perception of the experience (Creswell, 2013; Marshall & Rossman, 2011; Moustakas, 1994; Polkinghorne, 1989; van Manen, 1990). No artificial or experimental situations were set up, the participants engaged in a phenomenon that was entirely natural and unmanipulated. Insightful descriptions of experiences were gathered from participants who shared the same experience, to understand the essence, or the makeup of the experience, to better understand what the experience was like for the participants.
Phenomenological research focuses more on the description of participants’ experiences, and less on the researcher’s interpretation of the participants’ experiences. There is an emphasis for the researcher to reflect on his or her personal experiences and biases, which Moustakas (1994) called epoche, to be able to focus on the phenomenon with a new perspective, “in which everything is perceived freshly, as if for the first time” (Moustakas, 1994, p. 34.) Phenomenological methodology involves identifying a phenomenon, identifying and bracketing out personal bias and predispositions, and then collecting data from several persons who experienced the phenomenon.

Phenomenological data analysis involves reducing interviews into significant statements, combining statements into themes, developing textual description of experiences of what the participants experienced, and developing structural description of how participants experienced the phenomenon in terms of conditions, situations, or contexts, and then combining the descriptions to convey the overall essence of the experience (Creswell, 2013; Moustakas, 1994; Polkinghorne, 1989).

**Validation and Credibility**

Throughout the development and implementation of this study, credibility and validation was an important priority. Method triangulation was employed through multiple sources of interviews, observations, and photovoice. Theory triangulation, using multiple theories or perspectives to interpret data, is evident through the use of the experiential learning, the four phase model of interest development, and the ecological framework model. Two peer analysts provided critical evaluation of the study, and multiple peers independently coded the data for coding agreement. Member checking, a valuable credibility check in qualitative studies (Lincoln & Guba, 1985), consisted of
providing the interview transcripts to the students to review the interviews for accuracy, with only one minor correction needing to be made. Finally, data gathered from a summer study of Stone Lab, along with the observations from this study helped to create a thick, rich description of the Stone Lab program, from which the students generated their experiences. The intent is for the reader to understand the setting and immersive experience that the students encountered during the four day field trip at Stone Lab.

Creswell (2013) recommended using multiple validation strategies when performing qualitative research. Triangulation is the action of investigators to validate the accuracy of their conclusions drawn in a qualitative study (Creswell, 2013; Marshall & Rossman, 2011; Patton, 2002). Patton (2002) described four categories of triangulation methods: Methods triangulation (mixing qualitative and quantitative methods), triangulation of sources (mixing data sources such as interviews and observations), analyst triangulation (including outside analysts), and theory/perspective triangulation (multiple perspectives used to interpret data).

Creswell (2013) identified eight commonly used strategies that qualitative researchers use: triangulation, prolonged engagement and persistent observation, peer review or debriefing, negative case analysis, clarifying researcher bias, member checking, rich thick description, and external audits. Prolonged engagement helps build trust between participants and the research, helps the researcher understand the culture and environment of the setting, and gives the researcher context to the participants’ interview comments. (Creswell, 2013; Patton, 2002). Peer review is a validity check concerning the entire research process. The peer reviewer evaluates and looks for holes in the method, data, and analysis, and allows the investigator to examine the research through a different
lens (Creswell, 2013; Marshall & Rossman, 2011; Patton, 2002). Reflexivity provides separation or bracketing of the researcher’s effects and biases from the data (Creswell, 2013; Moustakas, 1994; Patton, 2002; Polkinghorne, 1989; Yin, 2011). Negative case analysis examines data that does not fit with the identified patterns and themes. The negative, disconforming data is reported and assessed to why it does not fit (Creswell, 2013; Polkinghorne, 1989). Member checking requires the investigator to share the data or interpretation with the data source participants so that each may judge the accuracy and credibility as portrayed by the investigator. The participants may agree with the work, or they may suggest alternative wording or meanings to the data or analysis (Patton, 2002; Stake, 1995). Creswell (2013) preferred to create a focus group of participants and then share an early draft of the analysis listing the themes and descriptions gathered in the data. Rich and thick description gives the data context to assist the reader of the research to understand and transfer the findings to their personal perspective, and thereby interpret the data for themselves (Creswell, 2013; Patton, 2002; Polkinghorne, 1989). An external audit consists of an individual who has no connection to the study, who will examine the study for accuracy of the data, the process, the analysis, and the conclusions (Creswell, 2013; Patton, 2002).

**Reflexivity.** Patton (2002), Stake (2010), and Yin (2011) recommended disclosure of any conditions that may influence a research project through self-awareness, political and cultural awareness, and knowledge and acceptance of one’s personal viewpoint. The most common conditions that require disclosing are personal demographics, organizational affiliations that relate directly or indirectly to the research, and advocacy for a program or methodology associated to the research. This researcher
discloses advocacy for the Stone Lab and for outdoor nature education in general. The following sections reveal potential sources of bias that will be acknowledged and bracketed prior to data collection and analysis.

**Researcher’s Philosophy.** Nature, science, education, and students have been major cornerstones of my life. My belief that nature is the bridge to connect students to science is apparent in my teaching philosophy. Science is a way of thinking as much as a way of knowing. Science is an integration of all the other subjects learned, then added to the study of facts and discoveries of our natural world. Student knowledge and interest in science is critically important for our nation’s economy, healthcare system, and way of living. Thus this researcher’s position as a science educator can truly, directly affect his students and ultimately, our country.

This researcher believes that children need to be reintroduced to the wonders of life and nature because many are not experiencing the outdoors as they grow. Environmental, social, psychological and spiritual implications of this separation will be detrimental to the student, and to society as a whole. Contact with nature is necessary for healthy child and adult development (Wilson, 1984).

This researcher believes that student learning is dependent upon both formal and free-choice experiences. After leaving the elementary grades, students report a steady decline of interest, choice, and enjoyment of classroom activities. Part of this decline might be related to greater use of empirical teaching methods which eliminate student choice, reduce the variety of information, and minimize the real world applications.

**Researcher’s Biography.** My science background is deep and broad; however in the context of this research, this biography will focus on only related history. I grew up
outdoors, and developed a love of animals, plants, and all of nature. At a very young age I became interested in fishing, and have become an accomplished fisherman over my lifetime. Other activities in which I excel include photography, hunting, Paleozoic fossil collecting, and training Labrador retrievers. I acquired my Medical Technologist certification from the American Society of Clinical Pathologists (ASCP) and followed a career path in medical Lab science. After 16 years of being a generalist medical technologist and a supervisor, I eased away from the medical Lab to open a private paleontology Lab in my home while being a “stay home parent.” I performed volunteer wildlife biology work, became a certified volunteer educator for the Ohio Division of Wildlife, and founded the Perry County Chapter of Big Brothers/Big Sisters. I was an active educational volunteer in local schools, when in 2000 I was asked to sit on the Ohio Department of Education Science Standards Writing Team, where I participated with 43 other educators to develop and write the science standards used for ten years in Ohio public schools. Soon after, I became a substitute teacher and observed that many students were no longer experiencing the outdoors and nature and were losing interest in science. I was compelled to acquire my Master’s Degree in Education and my AYA Life Science Ohio teaching license. My Master’s Thesis was an in-depth study of Nature Deficit Disorder and its effects on students’ understandings of basic science concepts. After gaining three years’ experience in the field of secondary education, I decided to work on a doctoral degree in Science Teacher Education to focus on ways to reunite students with science.

During my tenure as a high school teacher, I took three different groups of students to Stone Lab on the school’s biennial field trip, which had previously occurred
for more than 14 years. Experiencing Stone Lab for the first time, I recognized the importance of the experiences the venue offered the students who attended. Since that first trip to Stone Lab, I believe the field station offers one of the most exciting and relevant science educational programs available to high school and college students, as well as for science educators and enthusiasts.

**Role as researcher.** My role as researcher changed as the study progressed. Typical of qualitative research, the researcher was the collection and evaluation instrument. Therefore, it is imperative to provide information concerning the researcher’s background, beliefs and values in regards to the research questions and analysis (Creswell, 2013; Patton, 2002). All researchers have bias, but good researchers “set up traps to catch their biases” (Stake, 2010, p. 164). Disclosure of researcher bias enhances the credibility of the research data, analysis, and conclusions.

In this dissertation study, I attempted to be a quiet observer when in the classroom, a participant-observer when observing the participants as they progressed through specific Stone Lab activities and explored on Kelley’s Island and South Bass Island, and I was a researcher who interviewed participant students. During the pilot study, I was a researcher who observed the Stone Lab operation and interviewed staff and instructors to learn about Stone Lab. In all cases, I have been the key instrument for gathering qualitative data.

**Ethical and political considerations.** Protection of human subjects is paramount priority for this researcher. Even as the Ohio University Institutional Review Board (IRB) grants permission for this or any research project I will perform (Appendix K), it is the responsibility of this researcher to insure protection for the participant subjects
(Stake, 2010). No danger was expected during the interviews in this study, but still, this researcher maintained diligence, observant and prepared to see emergent danger.

Interviews entailed “minimal risk in terms of the health and well-being of the participant (Moustakas, 1994, p. 110). Although unexpected and not anticipated, participants might have exhibited different effects from the questioning, such as discomfort, anxiety, guilt, anger, defiance, insensitivity, hope, increased awareness, a sense of liberation, and thoughtfulness (van Manen, 1990). Any information that the researcher deemed private or damaging was removed or if relevant to the study, disguised to protect the identity of the participant. Confidentiality was complete unless the participant was fully informed and gave permission for a specific instance to be used openly (Moustakas, 1994). Pseudonyms were utilized during the narrative report.

Specific to this study, just as the IRB is concerned for the safety of the students, this researcher was equally as concerned for student safety. At all times when working with students, this researcher was vigilant for any negative effects the interviews or data collecting methods may have on any student or participant. Student safety was the number one priority.

Not all students in the targeted science classes attended the Stone Lab field experience. Students needed to apply to attend, present permission slips, and pay the trip fee. The researcher explained to the students attending the field trip the purpose of the study, that participation was strictly voluntary, and that all names would remain confidential. The students were told about the multiple stages of the study, but not the actual focus on science interest. To participate in this study, a student needed to return a signed permission slip from his or her parents allowing permission to participate. The
students also signed a form, acknowledging that they were volunteering to participate in the study, there was no remuneration for participating, there was no risk in participating, and they had the right to stop participating at any time without any fear of penalty. All Ohio University ethics procedures were addressed and obeyed.

Photovoice methodology required further ethics considerations. Any images taken by the students were considered confidential, unless the individual in a photograph signed a permission release for his or her image to be used in the final dissertation reports. No pictures would be placed on-line by the researcher or shared with anybody other than the participants, with the exception of images utilized in this research as data.

All collected data was stored either in the researcher’s home computer which is password protected, or in a locked file cabinet, also located in the researcher’s home. The data could be accessed and reviewed only by the researcher, the researcher’s dissertation committee if requested, the individual participant to view their photovoice images, and an external reviewer who would not have access to any of the subjects’ identifications. The files would be maintained until the dissertation has been completed and the associated publications have been printed, at which time the files will be destroyed. Student confidentiality remains a paramount priority.

**Site selection.** The primary site for this study was Stone Laboratory Biological Field Station (Stone Lab), located on Gibraltar Island, a six acre island located in western Lake Erie. The field station hosts up to 80 middle or high school students plus chaperones per day in April, May, September, and October. During their time on the island, students participated in 5 immersive courses including ornithology, aquatic invertebrate biology, island botany, plankton biology, fish biology, including activities on
“BioLab”, one of the large research vessels. The students also took field excursions on Kelley’s Island and South Bass Island.

Arvey and Reimer (1966) examined biological field stations and recognized two different types, marine and shoreline based field stations, and what they called inland based field stations. Biological field stations were also differentiated as being research based, instructional, or both. The marine biological field stations tended to be larger and more instructional because less habitat would be overwhelmed by constant student usage. Inland biological field stations are often research based, fearing that an influx of humans would alter the terrestrial environments. For this study, a field station with a priority on student instruction was desired. Stone Lab was the primary option for this study due to convenience as well as having met the needs of this study.

The cooperative school, Rural Ohio High School (ROHS) (pseudonym), provided the source of student participants for this study. This school was selected because the science classes participate in a four-day Stone Lab field trip at a time of convenience for this study. Literature endorsed several requirements when selecting a site to conduct research, all of which this study meets: the site selected must be accessible to the researcher; a mix of participants should be available; there should be a variety of levels of interest among participants; the study can be conducted ethically; and the data and credibility can be reasonably assured (Creswell, 2013; Marshall & Rossman, 2011). Creswell (2013) made other suggestions which have been addressed: this researcher has never met the students in the selected school, however, does the researcher have a working professional relationship with the science teachers who have supported this research project.
Sampling and participants. Participants in this study consisted of students ranging from ninth through twelfth grade at ROHS, which was selected because biennially, a group of students travel to Stone Lab for a four-day immersive science experience. The two cooperating teachers made their classrooms and students available for this study. Creswell (2013) declared that the participants of a study must experience the phenomenon being explored, and that the participant population characteristics should not be diverse in order “to find common experiences, themes, and the overall essence of the experience for all participants” (p. 150). Only students who chose to attend the trip and pay the fees would experience the phenomenon of a four-day field experience at Stone Lab. Of those students, only those who had parental permission to participate in this study were considered as the participant pool, from which 6 participants were chosen for the individual case studies. The researcher sought IRB permission and obtained permission on 3/12/2013, IRB Approval Form 13X062 (Appendix K).

The rationale for the decision of type and quantity of participants was defined by the question and by the available sample pool (Patton, 2002). To gain insight into student perspectives, it was necessary to perform individual interviews. Onwuegbuzie and Leech (2007) described 22 sampling designs, and Patton (2002) described 15 sampling designs that might be employed in qualitative research. Both studies included the following sampling methods, which were of interest in this study. Typical case sampling focused on the “normal” or typical student. The typical student would be defined by the classroom teacher, who knows the range of students’ skills, knowledge, and interests. Maximum variation sampling focused on creating as diverse a participant group as possible - for example, focusing on gender and minority groups. Extreme case sampling identified
students who were either highly interested in science, or minimally interested in science, which would lead to comparisons between student experiences. Stratified purposeful sampling provided the option to utilize all the aforementioned designs (Onwuegbuzie & Leech, 2007). First the sampling framework was divided into the stratified sections, in this case high and low interest in science. Ideally, students who fit into each stratum would have been further separated into female and male groups, so that there were a total of six students in the study, three female and three male, and three students from each strata. The stratified purposeful sampling plan would have been ideal, however the participant pool consisted of only six students who returned permission-to-participate forms signed by their parents. From the self-reported survey, the study participants consisted of three students with low science interest and three students with high science interest, four female and two male students.

Published research that is somewhat similar to the current study utilized a variety of sampling strategies. Zandstra (2012) gave eleventh grade students at one school a quantitative survey, and then chose the students with high and low knowledge and science interests scores to participate in focus group interviews. Anderson (1999) utilized homogeneous sampling as he conducted interviews with one class of seventh grade students that attended a field trip. Falk and Dierking (2000) utilized convenience sampling to observe and later interview two women during a museum visit.

Sample size is an issue in which little consensus is found throughout the literature (Onwuegbuzie & Leech, 2007; Patton, 2002). “If interpretations and theories remain strictly localized, then the size of the sample is not as crucial” (Onwuegbuzie & Leech, 2007, p. 115). The context within the current study was very narrow, bounded by
location, time, event, and participants. The sample sizes should be large enough to
achieve data saturation, in which no new emergent themes are uncovered with further
data collection, yet small enough to develop depth. Patton (2002) suggested a general
sample size would be ten individuals in a phenomenological study and five cases in a
case study. Guest, Bunce, and Johnson (2006) suggested that data saturation occurred
with twelve interviews, illustrating that 92% of codes developed from a series of
transcripts were created after twelve interviews in one study, and 88% of the codes
developed in another study. However, the overarching themes in those same studies
were thoroughly established after six interviews, suggesting six interviews may be
“sufficient to develop meaningful themes and interpretations” (Guest et al., 2006, p. 78).
In this study, there were six participants, and each was interviewed three times, for a total
of 18 interviews.

**Participant introduction.** The participating students shall be briefly introduced,
although each will be more thoroughly introduced at the beginning of his or her specific
case study. The students chose their own pseudonym initials, which were used
throughout this study. Any full names that are encountered in this study are pseudonyms
of non-participant students, which will allow the reader to discern participants (initials)
from the non-participants (full pseudonym name).

WM-H was a senior female student who loves the sciences. She intends to be a
neuropsychologist, and has her entire academic career mapped out to reach her goal. She
has had excellent grades, she was the lead in two school plays, she had gone to State
Science Fair, and placed well in a national speaking contest, all in spite of harsh home
circumstances in which she worked a job and cared for her younger siblings.
TK-H was a junior female student who discovered science at Stone Lab two years ago. Her excitement concerning life science was palpable, and she enjoyed talking about science with anybody who would listen. Her loquacious nature provided the most in-depth descriptions of experiences, and the lengthiest interview transcripts of the study.

LK-H was a junior female student who enjoyed the sciences, but was bored in school biology class. She wanted to move ahead and learn more, and was frustrated by her peers who held the class back. She will be attending post-secondary science courses her senior year. She intends to go to medical school and become a pediatrician.

DR-L was a senior male student who embraced math and math-related science. He thought life science makes a nice hobby, but is otherwise uninteresting. He participated in the Stone Lab activities, but found them boring. This was his first experience seeing big, open water.

LM-L was a sophomore female student athlete who preferred math over any subject. She enjoyed science only when math was involved. She was a participant of few words, tending to answer questions in short and simple answers.

LZ-L was a senior male student who preferred English and Psychology over science. He was very socially oriented. He joined science club because he had friends in the club and they said it was fun. His experiences at Stone Lab centered on interactions with peers.

The two participating teachers shall also be introduced. A pseudonym has replaced their names.

Mr. J was a highly energetic educator who taught biology and ecology at the time of this study. He included as many labs and hands-on activities as possible, and tried to
include field trips related to the class. From observations, he was a popular teacher among the students. He was co-advisor to the science club, science fair, drama club, and Christian club. He has held a teaching license for 12 years. This was his fifth field trip to Stone Lab.

Mrs. K was a passionate long-term educator who taught chemistry and physics. She preferred life science, but grew to enjoy physics in particular. She believed students needed to be doing science, or better yet, be immersed in science to understand science. She has held a teaching license for 30 years. This was her tenth field trip to Stone Lab.

![Data gathering methods for the three phases of this study.](image)

**Figure 5.** Data gathering methods for the three phases of this study.

**Data Collection**

The goal of this study was to obtain insight into student experiences gained from a field trip experience at Stone Lab. The insight developed through data acquired through
qualitative research methods (see Figure 5), namely interviews, observations, and photovoice with essays and interviews, which will be described later in this section.

**Interviews.** In the current study, semi-structured interviews were conducted at the school prior to and following the Stone Lab field trip (Appendices C and D). Informal conversational interviews occurred randomly during the observation phase of the study. Unstructured interviews were conducted after the field trip to allow the participants to comment on the photographs they took during the trip as part of the photovoice method, which will be discussed later in this section.

Interviews are conversations with selected individuals who have knowledge that might help answer a research question (Kvale & Brinkman, 1990; Rubin & Rubin, 2012; Seidman, 2006; Wengraf, 2001; Yin, 2011). An interview conversation may concern concepts of how people understand or perceive their world and culture. The interviewees are encouraged to answer thoughtfully, openly, and with depth of details concerning the topic. Questions may inquire about who was there, what was said, what decisions were made, and what the history of issues and controversies were.

Vadala, Bixler, and James (2007) utilized interviews to elicit participant’s recollections of how and where they played, how their interests developed from childhood to present, and the results of such play. Smith and Woodward (1999) utilized photographs as a source of conversation during interviews, a method called photo-elicitation. The purpose of photo-elicitation interviews was to validate a body of photographic work by bypassing the critics and asking those familiar with the topic to respond to the photographs. Anderson (1999) utilized interviews to gain an understanding of student knowledge of physical science, before and after a field trip.
experience. DeMarie (2001) used photovoice while working with 3 to 12 year-old children. The children took pictures while at the zoo, and the researcher interviewed the students about their pictures to understand why each photograph was taken.

Researchers identified different types of interviewing. Rubin and Rubin (2012) identified four types of qualitative interview questions: Focus groups; Internet interviews; Conversational interviews, and of interest in this study; Semi-structured and unstructured interviews. Rubin and Rubin (2012) suggested structured interviews are not qualitative. Patton (2002) accepted the designations unstructured, informal, and conversational interview, but what Rubin and Rubin (2012) called semi-structured interviews were identified by Patton as an interview guide approach. Patton also identified a third type of interview, the standardized open-ended interview or structured approach. Kvale and Brinkman (1990) identified interviews as a conversation with structure and a purpose, and did not differentiate interview types. Wengraf (2001) identified lightly structured, semi-structured, and heavily structured interviews. Seidman (2006) recognized the existence of tightly structured survey interviews and open-ended, unstructured, conversational interviews, but only accepted in-depth phenomenological-based interviewing, which combines life-history interviewing and focused in-depth interviewing. Yin (2011) recognized two types of interviewing, structured interviews and qualitative interviews. This researcher accepted and supported the following typology of interviews: unstructured, semi-structured, and structured.

Patton (2002) and Rubin and Rubin (2012) described unstructured interviews as having no script and being highly flexible. A general topic is central to the interview, but the questions are formulated as the conversation proceeds. The interviewer finds
opportunities to pursue data, and must be flexible and able to form quick insights to formulate proper, non-leading questions. Each informal interview is unique, thus may be problematic to analyze, particularly if a longitudinal analysis is desired. Identifying weaknesses associated with unstructured conversational interviews, Patton (2002) declared that time availability is important, often requiring multiple unstructured interviews to acquire the desired data. Also, the researcher’s conversational skills and ability to grasp insights and formulate new questions will affect the data quality. During analysis, unstructured interview data is difficult to compare, place into categories, and develop patterns, since all the participants were responding to different questions and topic thought processes. The current study utilized an unstructured interview format after the Stone Lab field trip to revisit the images taken by each of the participants. It was planned to only discuss the five images selected by each of the participants as part of photovoice methodology, however due to unanticipated time constraints, the unstructured image interviews needed to be expedited and conducted prior to the completion of the participants’ image selections and essays.

Rubin and Rubin (2012) described semi-structured interviews as utilizing a guide of prepared questions that lead the interview, but allow for follow-up and probing questions to elicit depth and detail concerning the interview topic. Questions may still be spontaneous and flexible, but the interviewer has specific topics to explore. With semi-structured interviews, analysis for patterns is simpler than unstructured interview analysis, since all interviewees are questioned about the same subject matter (Patton, 2002). Patton identified the systematic nature of the interview in analysis, providing
access to common topics and categories to find and develop patterns. The current study conducted semi-structured interviews before and after the Stone Lab field trip.

Yin (2011) described structured interviews as having designed, highly focused, well-worded questions that are presented verbatim and in a designed order to every participant. The benefit of structured interviews is revealed when multiple interviewers are interviewing participants in one study, such as in a poll or survey (Patton, 2002). The current study did not utilize structured interview formats.

There are three common types of questions: main questions, follow-up questions, and probes. The main questions are derived from the study’s research questions. Follow-up questions ask the interviewee to elaborate on key concepts, themes, and ideas, to provide more depth. Probes are standard comments and expressions used to encourage the interviewee to continue talking or to provide examples and details, such as “That is interesting. Tell me more” (Kvale & Brinkman, 1990; Patton, 2002; Rubin & Rubin, 2012; Seidman, 2006; Yin, 2011).

Interview data may be limited for reasons including a participant’s inability to remember the correct facts or all the facts, a participant invents facts or creates a story, or a participant distorts responses due to emotional issues related or unrelated to the phenomenon, personal bias, or inability to open up to the researcher. The interviewer may weaken the interview data through poor questioning such as with leading questions, accepting responses with little depth or exploration, or poorly worded questions that are unclear or multi-focused (Kvale & Brinkman, 1990; Patton, 2002; Rubin & Rubin, 2012; Seidman, 2006; Wengraf, 2001; Yin, 2011).
Photovoice. Photovoice allows the researcher to see the world from the viewpoint of the study’s participants (Wang & Burris, 1997). A visual image is powerful when associated with the photographer’s explanation and purpose for the photograph. Photovoice helps students to relive their experiences, to help them recall the aspects of their experiences. Through photography, the participatory photographers may illustrate their personal perspectives to experiences that outsiders can never achieve. Photovoice enables imagery and explanations which are able to reveal weaknesses and strengths in a program. For these reasons, although photovoice in research has been utilized as an instrument for community needs assessment, the method has merit to be used as a voice for students participating in an educational system.

In the current study, each participant received an Olympus VR 310 digital camera with an 8 GB graphics card. They used photovoice to illustrate what they believed was important as they participated in a four-day field experience. For example, a participant might experience the macroinvertebrate activities and discover they really enjoyed operating the nets and capture systems, and would take photographs of the activity’s aspects they felt were interesting. Participants were instructed to begin taking photographs on Tuesday when they loaded onto the bus at the beginning of the trip and to continue until they arrived back at school Friday evening.

Photovoice essay. Using the photographs, the participants revealed and explained what they found important and why they found it important, not only providing essential data, but also lending valuable first person analysis to guide data interpretation. The Monday following the field trip, the participants were instructed to select five of their images that best captured the experiences that they found most interesting or meaningful.
Then the participants wrote a short essay, or minimally one full paragraph to describe why the photograph was significant for them, describing the people, the location, the event or activity, the tools, and/or the feelings that made each chosen photograph symbolic or noteworthy.

**Photovoice interview.** The original plan called for participants to take part in a final unstructured interview that was dedicated specifically to each participant’s photovoice images. However an unexpected time constraint required that the unstructured interviews occur before the five photovoice images were selected and described. Instead, the researcher conducted unstructured interviews, by asking the participants to slowly scan through the full collection of images that they took during the field trip, and explain or discuss each image, why they took the image, and what, if anything, it meant to them. Because the images were the participant’s voice, it is important to gain as much understanding and confirmation as possible.

**Photovoice background.** Photovoice methodology was a qualitative method utilized by Wang and Burris (1997) to provide a voice to the voiceless, the poor, the underprivileged, and the vulnerable, those unable to read or write and/or are unheard and misunderstood by society. Using cameras, the participants illustrated through photographs their lives, their stories, their needs, and their grievances. Wang and Burris (1997) worked with Chinese women from a remote, rural, poverty stricken region of China, a social group often overlooked by their national government. The results revealed the women had desperate need of basic resources, especially clean water.

Photovoice has been used in health care research to provide the infirm a way to communicate their personal perspective of the hospital system or their disease.
Photographs represented the participant’s voice to what is, or should be publically known issues. Wang and Burris (1997) concluded, “Photovoice provides a community-based diagnostic tool to redress the inadequate theory on which programs may be based” (p. 384). They identified three goals for photovoice: To enable subjects to keep a record of their own and their community’s assets and worries; to open dialogue through discussion of the photographs; and to communicate with legislators. Photovoice is flexible and is able to be used in many versions of participatory research. The recorded images are available to provide immediate data, and during an interview, the participant subject may describe the image, or answer questions about the image (Cook & Buck, 2010).

Photovoice has been used in schools. Pre-service teachers took photographs of their pre-service teaching experiences to understand the issues and to discuss possible solutions concerning working with students with disabilities (Graziano & Litton, 2007, Kaplan & Howes, 2004). Students used photovoice to examine sexuality in school (Allen, 2008). In spite of limitations imposed by the school administration, the students were still able to demonstrate the sexuality in the school culture. Jones (2004) and Zenkov and Harmon (2009) used photovoice through at-risk student participants in after-school programs. Chio and Fandt (2007) used photovoice through student participants to examine student teacher relationships. Britt (2011) used photovoice through middle school participants to explore self-image of students within their school.

Through these studies, photovoice has been used in multiple ways. Photovoice created a relationship between the researcher and the participants and redefined the role of the participants as co-collaborator (Chio & Fandt, 2007; Graziano & Litton, 2007). The participants were able to share their experiences and stories through photographs,
and were given a voice to represent themselves in concrete ways. (Chio & Fandt, 2007).
Photovoice helped students to focus on the events in question, making them better experts than if merely questioned about the events at a later time (Goodhard, Hsu, Baek, Coleman, Maresca, & Miller, 2007). In this current study, photovoice was used in all these ways.

**Observation.** In the current study, observations were planned before, during, and after the Stone Lab field trip. Prior to the field trip, two days were dedicated to observations in the participants’ science classrooms during a planned class activity. The researcher observed only the science classes in which participating students attended. The researcher focused on the behavior, engagement, and interactions of the participants. The pre-trip observations introduced the field trip bound students to the researcher as well as the researcher to the students, opening a channel of communication that helped the students open up during the interviews (Patton, 2002; Stake, 2010).

During the field trip, the researcher planned to observe the participants while they interacted with specific activities at Stone Lab and while exploring on Kelley’s Island and South Bass Island. The plan was for the researcher to be alert for emergent observation opportunities in which a participant engaged in an activity. The planned island observations were hindered by two unexpected occurrences. The researcher was asked to teach ornithology during the Stone Lab sessions, thus was only able to observe the participants during the ornithology session. Second and more incapacitating, the researcher consumed tainted food at a restaurant on the journey to Stone Lab, and suffered the ill effects of food poisoning from 5 pm on Tuesday until long after returning
home on Friday. Observations were made when possible, but not in the manner planned prior to the study.

After the field trip, the researcher observed the participants for one day during a planned class activity that allowed the students to engage in the lesson. Again, the researcher observed for participant behavior, engagement, and interactions. The researcher continued to be alert for emergent observations.

Sparks (2011) cited observations as a source of important data to understand visitor engagement at a museum. Falk and Dierking (2000) discussed the importance of observations to understand how visitors experience a museum, through engagement, patterns of movement, and through overheard comments. Borman and Associates (2005) observed approximately 200 classrooms to gain understanding of teaching methodologies being used, classroom practices, and procedures being used.

Observation is an important data gathering method that allows the researcher to collect firsthand information (Patton, 2002; Yin, 2011). The researcher is able to determine the context of the setting, plus the relationships between the setting, the participants, and the social aspects involved. The researcher may perceive things that participants familiar with the setting may overlook. Finally, Patton (2002) explained that a firsthand observation will help the researcher through the analysis.

Yin (2011) recognized that a complex locality will not allow everything that is happening to be observed. The act of field observations requires planning to succeed in a highly fluid environment. When and where to observe needs to be predetermined. The researcher must acknowledge what is observed may not be the most important or data-laden activity taking place at that moment, and the observed activity may not be
representative of all that is occurring at the locality (Yin, 2011). Yin (2011) suggested finding a representative activity and then observe it at different times of the day. Another option is to observe different sites, or similar sites with different people. When deciding the observation protocol, it is necessary to recognize the benefits of the observation plans, and the consequences of the decision. Yin (2011) stressed that it is important to speculate how the decision will affect the findings and conclusions.

Patton (2002) recognized six decisions that must be determined during the observation planning phase: the role of the observer, the emic versus etic perspective, who performs the observations, disclosure of the observer’s presence and role to others, duration of the observations, and the focus of the observations. Meeting Patton’s expected decisions in the current study, this researcher was the sole observer and spectator in the classrooms, but was a participant observer on the field trip. Although the interviews and photovoice are highly emic, the observations are more etic in nature, with the observer recording and interpreting what was seen and heard. The participants had full knowledge of the observer’s role in the study. In the school, observations took place in the science classrooms. During the field trip, participants were observed during ornithology class and non-course activities. Finally, the focus of the observations was on evidence of participant interest and engagement with the activities. Emergent data was possible, but the focus was primarily on participant affect and behavior. The observations in this study addressed all six of Patton’s (2002) pre-planning requirements.

**Survey.** Students who provided signed parental permission forms were asked to complete a short questionnaire (Appendix A). This survey provided each participant-population member’s name, address, method of contact, parents’ or guardians’ names,
and best times to contact the parents or guardians. The survey then asked the participants to describe their favorite and least favorite subjects and activities, and to describe their future plans. The survey ended with a single Likert-like question for each participant to self-identify his or her level of interest in science. Each participant’s pseudonym was added to the survey.

This survey was not drawn up to be a research instrument, but rather, it was created to introduce the students’ names and interests to the researcher, and to develop a general impression of each participant’s interest in science. Scoring was subjective, and each participant was compared to the full sample population. At the conclusion of this study’s data collection, the personal information was trimmed away from each survey so that all student personal information was destroyed in a shredder. The remaining data was identified only by each participant’s pseudonym. The survey information was treated as data.

Data Analysis

Data analysis began with the onset of participant observations and interviews (Figure 6). The data that was formed into a case study focused on the individual participants’ experiences during the field trip, and was cross analyzed to illustrate themes and common experiences, as well as unique experiences. The data was broken down further to address the research questions that were directing the analysis: how are the participants experiencing the field trip? How are the people, physical, and cultural aspects of the experiences affecting each participant’s response to the experience? What aspects of the experiences are leading to the development of interest?
The researcher recorded observations and thoughts in a daily journal, and began creating a mental, inductive analysis as data was collected. The researcher transcribed each interview and observation as soon as possible after the conclusion of the interview or activity, and included interview notes concerning non-verbal cues. Interviews were coded using apriori codes that were derived directly from the ecological framework, and emergent codes that were derived from the participants’ words or actions. The codes included:

**Apriori Codes:**

**Cognitive/Affective centered lens**

Prior Interest

Interest development (trigger, reinforcement, and engagement)

Plans for future

**Affective Responses**

Awe and Wonder
Boredom

Others significant to this study

Physical centered lens

Tools

Setting

Cultural centered lens

peers

teacher

Emergent Codes:

View of Science, how did the participant’s view of science change after experiencing the field trip?

Transferability - can Stone Lab lessons transfer to the formal classroom?

Among the apriori codes, the cognitive/affective lens codes included learning, interest, and emotion. The focus of this study was on interest. Learning, although an important issue, was not the focus of this study.

The majority of interest codes broke down into trigger, reinforcement, and engagement, however definitions of these three subcodes overlapped significantly and could not be resolved, thus all three subcodes were merged into just one large subcode – interest development, which served the purposes for this study. The remaining codes listed under interest were intermittent and isolated.

Participant affective response was a challenging code, because subcoding required each affective reaction to be identified, which was subjective and wrought with
guesswork. The affective responses considered for exploration were exhibited by more than one participant and were directly related to the field experience.

The physical lens codes included setting and tools. The majority of codes from this lens were based on setting. Tool codes were more often insinuated or implied and not directly mentioned.

The cultural lens codes identified what the participants valued in their lives and during their Stone Lab experience. Each participant had a different ratio of cultural codes that included peers and teachers. Family-related codes were merged into prior interest under the cognitive/affective lens.

Two emergent codes were identified. First was change of view of science, or how did the participant’s view of science change after experiencing the field trip? The second, transferability of Stone Lab lessons to the formal classroom, was not analyzed because it was outside the scope of this research. Similarly, the nature of science was coded only in the pre-trip interviews when participants shared their personal definition of what science is. This code did not tie directly into the research questions and was dropped from the analysis.

In insure that the focus of the data was upon the participants’ voices, personal bias and predisposition were identified and bracketed out through the assistance of peer analysts who provided critical evaluation of the study, and multiple peers who independently coded the data for coding agreement. Data for each participant was maintained in a unique case file. Finally, a cross-case analysis was conducted to search for notable relationships or differences relevant to the research questions among all
participants. The cross-case analysis categories included prior knowledge, affective responses, interest development, setting, peers, teachers, and changes in view of science.

**Photovoice images.** The photovoice data consisted of the photograph documents linked to the essay, which were transcribed and described by theme. The photographs and essays were linked together to maintain the singularity of the context. The photovoice files were associated with each specific participant’s case file. The images in each participant’s photo gallery that were not selected for photovoice were placed in a separate file, and these were linked to the photovoice interview conducted after the field trip.

**Photovoice essay.** Five of the six participants provided images and essays for their photovoice activity. The participants selected on average five images to illustrate what they considered important during the experiences. Each essay was treated as an interview document, since it is the participant’s personal voice, or photovoice. Each linked photograph and essay was coded using the same apriori codes used to analyze interviews. All identified codes and categories were of interest, because the students were photographing what they considered interesting and significant, and then specifically selected these five photos as highly significant to their field trip experience.

**Photovoice interview.** During each photovoice interview, participants were asked to discuss their full set of field trip digital images. The researcher transcribed each interview as soon as possible after the conclusion of the interview, and included interview notes concerning non-verbal cues. Photovoice interviews were coded and analyzed similar to the semi-structured interviews, with the exception that the photovoice interviews have comments that were linked to specific images. It must be restated, only images specifically selected by the participants will be included in the final analysis,
since those images are the ones considered most important to the participant.

**Observation.** The observational data provide insight to behavior and context (Yin, 2011). The researcher will need to infer feelings, engagement, and expected behavior, which, by themselves, are merely interpretive. However, the observational inferences are strengthened when combined with other data, such as interviews, developing method triangulation. In this study, field notes from observations were transcribed into each participant’s file, identifying actions and interactions relevant to the research questions. Emergent data was recorded for possible use if a pattern or theme was identified. The codes used for interviews were applied to the observation coding, and the patterns were noted and included in each of the case studies. Due to food poisoning, the observations planned for the Stone Lab trip essentially did not occur, with the exception of observations taken during the ornithology class and casual observations during the island visits.

**Survey.** Although the primary purpose of the initial survey was to learn about each of the members of the population pool, the data was useful during analysis. Each of the responses was open-coded and included with the full data set, to be used to develop a contextual profile for each participant student.

**Procedures**

Beginning this section is a brief outline of methods, instruments, and procedures that were utilized in this study, followed by a fuller description of the methods, instruments, and procedures.

**Outline of methods, instruments, and procedures.**

Prior to Stone Lab Field trip (March, 2013)
1. Student pool completed survey (Appendix A).

2. Distributed and collected parent permission forms (Appendix B).


4. Observed science classes in which study participants attended, specifically focusing on participant interaction with teacher, activities, and peers.

5. Distributed digital cameras to participant students; insured they understood how to operate cameras.

Beginning April 23, 2013, Field Trip to Stone Lab

1. Observations of the Ornithology classes and emergent student interactions with the learning and exploration aspects of the field station. (Researcher observation data limited due to food poisoning during full extent of the field trip).

2. Participants took photographs of activities that they considered significant or meaningful.

Beginning April 29, 2013 Post field trip

1. Observed science classes, specifically focusing on participant interaction with teacher, activities, and peers.

2. Assigned each participant the task of choosing 5 digital images that they took, write a paragraph describing the image and why they feel it is one of the top 5 important or notable images in their gallery (Appendix E). All images chosen with individuals in the background must have those individuals’ parents sign the photovoice release form (Appendix F) or faces must be blurred.
3. Interviewed each participant with Post Field Trip Semi-Structured Interview protocol (Appendix D).

4. Interviewed each participant with Photovoice Unstructured Interview.

**Full description of methods, instruments, and procedures.** IRB approval (Appendix K) was granted on March 12, 2013. On March 26, 2013, this researcher talked to the students attending the Stone Lab field trip, explained the research, and passed out forms (Appendix B) for students’ parents or guardians to sign, if the students were attending the Stone Lab field trip and if they wished to participate in the study. A short questionnaire (Appendix A) was given along with the permission form to help the researcher become familiar with each of the students in the potential sample population, and to have a self-reported level of interest in science for each student in order to determine the strata for sampling. The forms were returned, and on Friday of that same week, the student pool of participants was determined.

This researcher observed student participants in their science classrooms. The pre-trip interviews (Appendix C) were scheduled and conducted in the school conference room. The data was transcribed and held for analysis.

Prior to leaving on the field trip, the six participant students were given Olympus Model VR-310 digital cameras to use during the field trip. The students were shown how to operate the cameras and how to take adequate and quality photographs. The students were instructed to take photographs of what they believed was interesting or significant during the trip experience. The idea of photovoice was discussed, so that each participant understood that their personal perspective of the experience is important, and that the photographs will help them to describe their experience. After the students returned the
cameras to the researcher at the conclusion of the field trip, the students received an electronic file with all the images they had taken, for both reciprocity and to prepare the photovoice interviews.

Once at Stone Lab, the participating students merged with students from two other schools where the science teachers are close associates of the ROHS science teachers. The students haphazardly self-selected themselves into four groups, and each group attended a different class, and rotated through five courses over the two days.

The participant students were only observed during the ornithology class during the courses, but were casually observed during evenings as the researcher was able, due to the researcher having acquired a severe case of food poisoning. The researcher observed the participants during the Kelley’s Island hike and field exploration. The students separated, making observations of all participants impossible, so the researcher observed one or two participants for 15 minutes, then searched out another participant to observe for 15 minutes, until all the participants were observed. Then the researcher joined the majority as they hiked to the alvar, a unique ecological habitat located on the island’s shoreline. Again, true observation was difficult due to the raging effects of food poisoning. The final day, the participants were observed as they took part in experiential activities on South Bass Island.

The Monday after returning from Stone Lab, the participating students were assigned the task to examine the photograph images that they acquired during the field trip. Each participant was to choose five photographs that most vividly revealed something they believed this researcher should know about their experiences (Appendix E). What was interesting? What was important? The participants were asked to write an
essay with a minimum of one paragraph for each image, describing in detail the reason they chose the image, and what they want the researcher to see or know, for this is their voice and their message. A student’s words are his or her truth, and the images are a record of their experience and reality (Koltz, Odegard, Provost, Smith, & Kleist, 2010; Wang & Burris, 1997). The participants were asked to complete this task within one week.

Post field trip semi structured interviews were conducted the week after returning from Stone Lab (Appendix D). The interviews were one school period in length, and all concluded prior to the end-of-period bell. It was at this time the researcher discovered that the school scheduled testing for the final three weeks of school, which required the planned photovoice interviews to change focus. No participants had their photovoice images or essays completed. The researcher decided to conduct the final interview by asking each participant to talk about each image they had taken, with this researcher inserting probing questions as needed.

Assumptions and Delimitations

Assumptions. Assumptions are the things in this study that are out of the researcher’s control, but if they are removed, the study would become inconsequential (Simon, 2011). Stone Lab has been in operation since 1895. Education is an important aspect of the facility and the programs have developed over time to be powerful, relevant, and engaging. Malinowski and Fortner (2011) illustrated the positive benefits experienced by middle school students after a two day visit to Stone Lab. Anecdotal evidence abounds supporting the positive effects Stone Lab has upon students and researchers who spend time at the facility. This study assumed that student interest and
attitude increased after a visit to Stone Lab. The focus of this study was not if the students will benefit from the field trip, but rather what was it about Stone Lab’s activities that created interest.

Another assumption lay with the self-reporting questionnaire filled out by students at the beginning of this study (Simon, 2011). The advantage of self-reporting was to obtain the participant’s personal responses. There was always the chance that the participant was not being honest, or deceived him or herself, or may have blended different experiences. This study assumed honesty from the participants’ interview and survey responses, based on participant anonymity and confidentiality, and because participants had the freedom to withdraw from this study at any time without ramifications.

**Delimitations.** The delimitations are characteristics of the study that are in the researcher’s control that limit the range and provide boundaries that provide the context and focus of the study (Simon, 2011). Stone Lab was the primary delimiter, because it was a unique field station, located on a 6 acre island and creating a mystique not encountered at inland field stations. The experiential phenomena that students encountered took place at and around Stone Lab.

This study was also delimited to ROHS students who opted to participate in the Stone Lab field trip during late April in 2013. The school offered to provide support for this study, and the biennial field trip occurred at a convenient time, making this specific student population an optimal group to invite into the study.
Summary

This case study consists of interviews, observations, and use of photovoice methodology. The researcher investigated the nature of the experiences of six students from ROHS as they attended Stone Lab, and investigated if and how their experiences triggered interest in science. The students were purposefully stratified as determined on the basis of their self-reported interest in science. Data from each student was transcribed and analyzed for themes and patterns, and a cross-case analysis was conducted to search for notable relationships or differences among the other participants.
Chapter 4: Data Collection and Analysis

Introduction: Advanced Organizer

The purpose of this multiple case study was to describe the nature of high school students’ experiences in an immersive four-day field experience at Stone Laboratory and to investigate if and how their experiences trigger interest in science. The literature research noted a gap in identifying student reactions with experiences and activities on field trips, particularly at biological field stations (DeMarie, 2001; Falk, 2001; Falk & Dierking, 2000). Little is understood concerning how informal learning activities influence a person’s cognition and how students internalize the experiences (Falk, 2001). A multiple case study approach has been used to examine high school students’ experiences in an immersive science program. The cases are bounded in terms of the student participant’s rural demographics, the unique nature of Stone Laboratory Biological Field Station, and the specific four-day April field trip. Four central research questions guided this multiple case exploration of student experiences, opinions, and emotions:

1. What was the nature of high school students’ experiences in an immersive four-day experience at Stone Laboratory?

2. How did high school students experience the various activities at Stone Laboratory?

3. How did high school students experience the physical and social resources at Stone Laboratory?

4. What aspects of the Stone Laboratory experience triggered interest in science?
Interviews with the six participants constituted the primary data source, followed by photovoice, observations, and a brief survey. Ancillary data was collected from teacher interviews and document analysis.

**Organization of the chapter.** This chapter contains the findings from the multiple case study. There are three major sections in this chapter that present the findings from the data. The first section, intended to provide context to the reader, will describe Stone Laboratory, the spring workshop program, and will conclude with the Stone Laboratory field trip log of events. Further contextual information is available in Appendices G, H, and I. The second section will examine data findings of each of the individual student participants, presented as six individual case studies. The third section will examine the themes through a cross-case analysis.

**Presentation decisions.** Data analysis concerning each student participant’s interviews, photovoice, and observations will be examined in that participant’s specific case study. Analysis was performed through the formation of codes that were created through two channels, apriori codes that were derived directly from the ecological framework, and emergent codes that were derived from the participants’ words or actions. The codes were grouped into themes depicting the three lenses of the ecological framework or into emergent themes. Participants have been identified with pseudonym initials. Students with high interest in science have the designation “-H” after the initials, students with low interest in science have the designation “-L” after the initials. Any names that appear are pseudonyms of non-participants. In this manner, the reader is able to immediately recognize any interactions between participants, versus participants and non-participants.
It was deemed important to provide the reader an understanding of Stone Laboratory. As a biological field station, Stone Lab is unique because it is located on an island, accessible only by multiple boat trips. Once students arrive, they are immersed in a science culture for the duration of their stay on the island. This study is not focused on Stone Laboratory; however it is important to understand many of the experiences that the student participants discuss. The intent is to provide context, not to provide a fully complete description of Stone Laboratory and its functions.

**Stone Laboratory**

To understand the participants’ experiences during the Stone Laboratory field trip, it is necessary to understand the unique nature of Stone Laboratory as an educational venue, and its influence upon the tangential experiential trips to Kelley’s Island and South Bass Island. With this context, the reader will better understand the relevance of each participant’s experience on the field trip.

Stone Laboratory is unique among biological field stations. It is located on Gibraltar Island, a small, six acre island located in the Western Basin of Lake Erie, near South Bass Island (Appendix G). Owned by The Ohio State University and managed by the Ohio Sea Grant College Program, Stone Laboratory’s mission is:

- To serve The Ohio State University, the Ohio Sea Grant College Program, and the State of Ohio as the premier facility on Lake Erie by:
  - Improving the quality of science education through high-quality, hands-on programming for students in grades 4 through adults;
  - Creating opportunities for student research, training, and internships;
  - Initiating special educational opportunities for high school students and teachers;
  - Fostering informed decision-making through education, outreach, and training programs for managers and elected officials; and
  - Encouraging and supporting research on issues facing Lake Erie, the Great Lakes, and the environment that will provide the knowledge needed for
better management decisions. (Ohio State’s Stone Laboratory, 2013b, http://stonelab.osu.edu/about/mission/)

About 200 college students attend classes at the lab each year, with another 5,000 high school and middle school students visiting Stone Lab for tours and workshops (Markey, 2012). A brief examination of Stone Lab’s commitment to college level education and research must be acknowledged. To provide quality opportunities for researchers, Stone Lab is equipped with 3 large research boats, one which is capable of trawling. The fleet also includes one work boat and several motor boats. The classroom building has two large laboratory work rooms on the first floor, smaller workrooms on the second and third floors, most equipped with instrumentation ranging from quality microscopes, digital equipment, binoculars, nets, and boots. With the quality and reliable equipment in hand, Stone Lab is at the forefront of research as scientists try to solve biological and environmental problems effecting Lake Erie, for example, supporting threatened species such as the Lake Erie Watersnake and Lake Sturgeon, and battling invasive species, algae blooms, and industrial and phosphate pollution.

Of particular concern to this study is Stone Lab’s commitment to provide quality, hands-on educational opportunities for primary and secondary students. The fall and spring workshop program benefits from the summer courses and research programs by having quality, up-to-date equipment available for the students to use, or see operated in real-life research. The opportunities that Stone Lab offers to workshop program students are not possible in school classrooms.

The spring and fall workshop curriculum is the only instructional activity developed by Stone Laboratory staff. The curriculum has been crafted and shaped over
decades of workshop programs. Instructors consist of recent environmental science or biology graduates, or upper level environmental and biology major college students who are gaining work experience. They are supervised by the Stone Laboratory Assistant Manager, who is a licensed AYA 7-12 life science teacher, who is responsible for the workshop program. During each winter, all instructor positions are advertised, and all applicants are interviewed for knowledge, enthusiasm, and communication skills. The instructors are employed from early April until early November. Upon arrival in early April, the new instructors are trained how to teach each of the subjects offered in the workshop program. Each workshop has certain facts that should be taught in the first few minutes before the instructor takes the students outside to explore and discover what was just taught. The instructors facilitate the workshop sessions throughout late April and May and then again in September and October. During the summer, the instructors work on the island as Stone Laboratory assistants performing maintenance, guiding tours, and teaching at the Aquatic Visitor Center.

The island can accommodate up to 80 visiting students and teachers. Workshops are usually one or two days in length, although some schools will stay longer. The visiting school’s teacher preselects the workshops that the students will experience, and occasionally, the teachers will do much of the initial classroom teaching, leaving the Stone Lab instructors to lead the field and laboratory experiences. The workshop program course options are listed in Appendix H, and are further described with the associated Ohio Science Standards (2002) which align with the workshop field courses.

There are up to five different workshop classes going on at one time. Attending students are separated into cohort groups, and then rotate between different workshops.
Each workshop class is a maximum of 2 hours in length, but usually ends 15 minutes early to allow students some personal time between workshop classes. A full description of an ornithology workshop class is detailed in Appendix I and Appendix J. The student group in this study consisted of 50 high school students, with each four cohort groups consisting of 10-15 students.

**Stone Laboratory field trip log of events.** Through their interview statements, the student participants will refer to the following events throughout the case studies. The following is a record of the events that the students experienced on their Stone Laboratory field trip. The Stone Laboratory field trip began with 26 students departing on a school bus on a spring Tuesday at 9:30 a.m., and traveled for four hours to the Miller’s Ferry dock at Catawba Island. After the ferry ride to South Bass Island, the students took a bus to the Stone Laboratory dock, where a Stone Lab biologist gave a talk about the Lake Erie watersnake, capturing one for the students to see up close. The students then traveled by boat to Gibraltar Island. Two other closely associated high school groups merged with ROHS, and the 50 students were assigned housing. The students were allowed time to unpack and become familiar with the island until dinner time. The students initiated a pickup volleyball game. Weather on this first day was pleasant, sunny, and warm with temperatures in the 70’s. However clouds began to move in at sunset. An organizational meeting and lecture about rules, expectations, and the schedule took place after dinner, followed by evening activities, including volleyball and a bonfire. Student free time occurred whenever they were not obligated to classes, meetings, or curfew. During free time, students were able to explore or socialize as they chose, within the rules.
The next day, Wednesday, began with pouring rain, moderate northwest wind, and temperatures in the 40’s. The students participated in four two hour classes, two before lunch, and two after lunch. One of the teachers presented a post-dinner program describing some of the research and history concerning Stone Laboratory and Gibraltar Island, and then students were free to explore the island, relax, or explore specimens collected during the daytime. Thursday, the weather was less severe, with off and on downpours, but strong northwest winds persisted and temperatures remained in the mid 40’s. Students participated in one two hour class, and then traveled to South Bass Island via water taxi to ride the jet boat to Kelley’s Island. The rain had stopped as students were taxied to the jet boat. At Kelley’s Island, the students ate lunch in a local restaurant, and then hiked approximately two miles to the state wildlife area, when the rain began in earnest for about 30 minutes and then stopped. Students explored the glacial grooves, island geology, the Lake Erie shoreline, amphibians and reptiles within the wildlife area, plants, fossils, and unique habitats in the region such as a local alvar. (Catling and Brownell (1995) define an alvar as a unique biological environment located along shorelines that consists of a limestone platform with no or little soil, but in summertime support a unique, prairie-like micro-ecosystem). Students had the option to explore on their own or follow any one of the teachers. While the students explored the alvar, and until returning to South Bass Island, a heavy rain pounded the island and jet boat. At a defined time, all students and staff met at the wildlife area entrance, and then proceeded back to the jet boat to return to Gibraltar Island. After dinner, two guest speakers presented a program about the history of a local conservation organization, and about research on Lake Erie concerning pollution, fisheries, and invasive species. After the
meeting, interested students participated in a cat dissection, while other students relaxed at the bonfire, played games, talked, explored, or enjoyed their free time on the island. The final day, Friday, was sunny and slightly warmer with temperatures in the mid 50’s. Students packed and transported their bags to South Bass Island for storage, and spent the remainder of the day on the big island. Among the activities was a program at Perry Monument. Because the national monument was closed due to the sequester, the teachers presented a talk about the Battle of Lake Erie while the students looked out over the lake where the battle occurred. When the program concluded, the students and teachers split into 3 groups, and explored a wildlife museum, crystal cave, and the South Bass Island State Park shoreline to look for snakes. For the remainder of the day, students were allowed to explore the town of Put-in-Bay, and met at 4 p.m. at the Stone Laboratory Fish Hatchery to take the bus back to the ferry, and proceed home, arriving late evening at their school.

**Case Studies**

Each case study will consist of three sections, the contextual profile, the student’s experience, and an examination of how each case fits into the ecological framework, or more simply stated, this is who they are, this is what they experienced, this is how their experiences tie to the questions and framework. An attempt was made with each contextual profile to introduce the reader to the student, to give the reader a glimpse of the student’s personality and behaviors. The first three students, WM-H, TK-H, and LK-H, very much enjoyed science and biology in general, the final three students, DR, LM, and LZ, had minimal interest in biology or science.
As discussed earlier, photovoice is a data gathering method that gives the student participants a voice, to provide the students a way to share their experiences from their personal perspectives. This circumvents the problem of the researcher misinterpreting what the students consider important, because the students are announcing what is important to them (Wang & Burris, 1997). The students are the experts and will drive the analysis through their voices.

Case Study 1: WM-H

Contextual profile. WM-H is a female senior high school student who enjoys physics, statistics, animal science, and English, as well as reading, drama, friends and science club field trips. “I am planning to attend [college] to study neuroscience and psychology, it would be awesome, to be a researcher.” When asked what she thinks about science, WM-H responded, “I love it. I am a really, really curious person, so with science you can, I don’t know how to explain it, you can go in and figure things out, I am not sure if there is a how or why and even if there is not a how or why, that means there is something new to be discovered, it is not like English or social studies where it has already happened. And there is nothing new anymore.” She has taken most of the available science classes, and also belongs to FFA, which she explained was “really fun.” She took the FFA Leadership tract, and has succeeded in speaking competitions.

“I am sort of a weird person, OK, I like writing research papers.” During an experiment she looks forward to the analysis, the statistics, and the application of the results. “And I like presenting it to people, this is what I did, look how awesome it is (laughing).” (WM-H, April 10, 2013, interview)
A significant aspect of WM-H is the fact that she works two jobs to help support her siblings. In spite of a difficult home life and busy school life, WM-H’s demeanor appears to be lighthearted and dedicated to follow her dreams.

In spite of her time commitments at home, WM-H is active in Science Club, FFA, and Musical Drama Club, in which she held the leading role in two productions during her senior year.

Three observations in physics class revealed that WM-H seemed connected with the teacher. From her front row seat, she worked on her assigned seat work, and looked comfortable taking a question up to the teacher, sitting down with the teacher, and talking out a problem. WM-H appeared to be committed to the work and learning the assigned material. During an egg drop project, WM-H was partnered with DR, the male student sitting next to her. WM-H appeared to do all of the work, simply taking charge of the work without preamble. In spite of doing most of the work for the team while her partner was off talking with friends, she commented that she preferred to work alone and was happy to do the assigned work without her partner’s assistance.

WM-H acknowledged that her teachers motivate her to succeed and to try new ideas or subjects. The FFA teacher encouraged WM-H to go into public speaking, where WM-H discovered she is very good at performing. It may have helped to develop her courage and desire to take the leads for the school musicals and dramas. WM-H recognized that as a senior, she would not grow any further with the FFA teacher’s influence, so she turned to the two science club teachers, who encouraged her to strive for college and to go on the Stone Lab trip. WM-H also received support from her sister, who would not allow her to slow down or quit anything. Her step-mother was familiar
with Stone Lab, and was very supportive of the trip. WM-H also identified her friends as a source of support by discussing science, asking questions and looking for answers.

Cognitive/ Affective lens.

Interest in science. One week after the field trip, WM-H described her Stone Laboratory experience:

RESEARCHER - Have you thought about Stone Lab…
WM-H - All the time
RESEARCHER - …Since we got back
WM-H - (laughing) yeah, because I am still talking to Kayley and Alan and they are, like, randomly, we will go like, do you remember this one time (laughing) at Stone Lab, and I go, yeah, I remember.
RESEARCHER - How are those conversations helpful to you as you think about the topics?
WM-H - They remind me of the little things I might have missed, when I was, looking back I was paying attention to thinking about the labs and the classes, and trying to tell my parents, this is why it was important. And I kind of missed the little stuff like how much fun I had playing volley ball, and the conversations in the cottage, and that experience, (laughing), and looking around the castle and exploring the island, and I missed some of the little stuff, that going back and talking to my friends, oh, do you remember this? But yeah, do you remember this? It helps put it all together. (WM-H, May 2, 2013, interview)

In one of the most poignant comments made by any participant in this study, WM-H tried to describe the Stone Lab trip:

It was really intense, I just felt, very curious, but also, (pause), I don’t know how to explain it. Amazed. Because I had never been put into a situation where you were like in depth, going into all this stuff, it was like, it wasn’t in a classroom, like you were there learning, and it wasn’t like learning, you were exploring, you were doing all this stuff, I was like this is awesome. It was also very exhausting, you are doing so much and even though it was like, I was cold and wet and muddy, through all of that, it was just wonderful, it was great, and I just remember, not when I was at Stone Lab, but after, when I came home, I just missed it so much, it kind of hurt a little bit. I just want to be back at Stone Lab. For one more day. (WM-H, May 2, 2013, interview)

In another exchange, WM-H added to her memories of the Stone Lab experience:
Going to Stone Lab, I didn’t know what to expect in the first place. So everything was, you turn around and there was something new. And you are, oh, I didn’t know that was going to happen. OK (laughing) It was not that I was not expecting it in a bad way, it was, I didn’t know we were going to be doing a cat dissection, I didn’t know we were going to Kelley’s and actually go into a quarry. When they said rock pile, I wasn’t picturing (laughing) a rock pile, a rock pile.

(WM-H, May 2, 2013, interview)

WM-H described how her interest in science intensified since the Stone Lab trip.

“I want to be outside again, I want to go exploring (laughing)” She also stated:

It made me sure of what I want to do, to go into a science career. I realized there is so much that I wanted to learn and do and I wanted to be the one who was figuring things out and telling people about it, so when we were exploring and learning I was like, I really want to be, not necessarily outside, but I want to be the one exploring and learning all the time. That is just what I want to do with my life. (WM-H, May 2, 2013, interview)

WM-H had a well-developed interest in science before the Stone Lab trip. “I love it. I am a really, really curious person.” To continue and nurture her interest in life science, WM-H participated in the Agriculture Sciences (Ag) program, which was more experiential and less lecture based learning. Biology did not meet her needs. Ag and Biology overlapped, but Ag “is fun,” it offered more application, anatomy, and physiology through a hands-on program that augmented her classroom knowledge. She enjoyed the critical thinking and presentation that is necessary in the Ag competitions as well as with science fair.

After the Stone Lab trip, when asked what activities or topics or ideas that she learned resonated with her, WM-H replied:

I really liked the fish lab and I liked learning about the different parts of the fish and we talked about plankton and phytoplankton and zooplankton, and I liked looking under the microscopes, that was really cool. I think I would have liked the dissection if I had a different group. There was this girl, and she was like ripping it apart with her hands and digging in there. She took out the beating heart with her hand, and she was holding it, with the intestines hanging on her fingers,
and she was laughing, and I was, I don’t like this. (WM-H, May 2, 2013, interview)

WM-H revealed moments of discovery as she experienced the island. The rocks were “cool to me, they were all spotty and patchy, but they were still, it looks rough, but when you touch it, it is smooth, that was weird.” “When I first stepped onto [the beach], I didn’t expect it to be gravel, it was weird, I am used to sandy beaches, like even on Kelley’s [Island], it is sand. It was weird” (WM-H, May 14, 2013, interview).

WM-H talked about a picture she had taken of an odd structure she found on the beach on the first day:

WM-H - That is a little thing we found, I don’t know what it is. But it was cool. RESEARCHER - Do you want to know what it is? It is a grinding plate from a fish from in their throat. 
WM-H - Oh, that’s nice. (WM-H, May 14, 2013, interview)

This is an example of an experience that was not reflected upon in a timely manner, and time eroded her interest away.

WM-H provided many significant comments concerning her interest during the Stone Lab field trip. The following will be a chronologically abridged series of observations of WM-H’s interest as she experiences the Stone Lab classes and activities.

WM-H found the Science Cruise interesting:

It was just really windy and cold and we went out like to the, out, we went out of the bay to go get the fish, and the waves were really strong at one point, (laughing and excitedly), and it tipped sideways, and I was, Oh my God, I am going to die, but no, it was OK. We got back OK. We checked the temperature of the air and the water and then we also did, what was it called, it was a test to see how far in the water you could see, and we obviously couldn’t see very much because the wind was messing everything up. But it was pretty interesting, it was a few simple tests, but it was cool. It was. It was a really cool experience, I don’t think for any specific reason. I just liked being out on the water, seeing that side of this, we weren’t in a lab, we weren’t on the island, we were out in a boat (laughing) out in the waves. So it was cool. (WM-H, May 2, 2013, interview)
WM-H’s interest engagement was greater than the fear elicited from the rough water.

On Wednesday, the first day of classes, WM-H attended four of the Stone Laboratory classes. When asked what activities or topics or ideas that she learned resonated with her, WM-H replied:

I really liked the fish lab and I liked learning about the different parts of the fish and we talked about plankton and phytoplankton and zooplankton, and I liked looking under the microscopes, that was really cool. I think I would have liked the dissection if I had a different group. There was this girl, and she was like ripping it apart with her hands and digging in there. She took out the beating heart with her hand, and she was holding it, with the intestines hanging on her fingers, and she was laughing, and I was, I don’t like this. (WM-H, May 2, 2013, interview)

These observations contrast positive and negative experiences and how they affected WM-H’s interest. She was excited and seemingly all activities were interesting her, however it took one insensitive peer to curtail WM-H’s interest in the fish dissection.

At the entrance to the abandoned rock quarry on Kelley’s Island, the teachers directed the students to the glacial grooves after explaining how they were formed and suggested to the students to read the informational signs along the trail. WM-H identified the glacial grooves as a notable experience:

Definitely seeing the glacial grooves, I, we go fishing up on Kelley’s Island, so I have been there before and I have been to the grooves, but I never really paid attention, they were just like a tourist attraction, but now I was actually looking at them, and reading the signs and learning about them, it was really cool. (WM-H, May 2, 2013, interview)

Although she had experienced the glacial grooves in the past, on the Stone Lab trip, the teachers gave value to the glacial grooves by directing students to see the formation and read the informative signs. WM-H’s previous casual experiences with the grooves
provided a connective relevance and led to deeper observations and evaluations of the activity.

Once in the quarry, the idea of exploration and discovery may have been recognized by WM-H, but they were unexpected in a school related function. WM-H was asked what she found interesting about the rock quarry with the fossils, and she replied:

(Long pause) I don’t know, it was just, really, interesting, like there was a giant rock pile. And no one really thinks about it, but when you go up and look at it and go explore it, there is really cool stuff. And it is not just cool stuff to look at, it is stuff you can take with you and tell people about. That is pretty interesting. (WM-H, May 2, 2013, interview)

WM-H had never seen rock piles, and this opportunity enabled her to explore and discover.

While looking at her digital photographs from quarry exploration, she made comments such as, “That is a slug. He is squishy. I was trying to take a picture of the slug and we put him down and I don’t know where he is now” (WM-H, May 14, 2013, interview). WM-H continually observed trees growing out the side of cliffs and was curious how they survived because there is no dirt there. “And these are some really cool tree roots. And a little tiny bush. That is going to be a tree growing out of nothing one day.” “More cool tree roots that are growing out of nothing. It just amazes me, I don’t know why that happens, but I like it.” Experiences and observations fed into and strengthened her curiosity. Several photographs later, WM-H returned to the question of how do the trees grow on solid rock:

This is a huge [rock] we were able to break off to see if there are fossils under there. And that was the piece, and there was just soil under there. It was weird, just soil, no fossils or anything, looking at it, we saw all the roots and were, oh, that is how they probably grow out of nothing. (WM-H, May 14, 2013, interview)
From the quarry, WM-H and many others walked to the alvar. WM-H chose this experience and photograph (Figure 7) as one of her photovoice experiences. She wrote:

This picture was taken on Thursday at the alvar on Kelley’s Island. I learned that this was one of very few of this kind of ecosystems. I was really interested in it, and took this picture right as I got off of the path and onto the alvar. At first, it just looked like a sparse limestone cliff, but in reality, there is a lot of interesting life here. Just in this picture, some green moss or algae can be seen and a small tree or shrub. While exploring, I found some other interesting things. While here, we had to be very careful because it was slippery and there were lots of holes. I stepped in one of them, but thankfully didn’t fall off the cliff. In addition to some of the interesting things found there, this picture also captures the amazing view that could be seen all across the alvar. This picture definitely reminds me of the curiosity I was filled with throughout the trip.

WM-H was excited to have the opportunity to explore and discover. The alvar was an unusual ecosystem that made this setting significant for students who recognized the rarity of alvars. She described the algae and plants that lived on the at-first-glance barren rock as she became aware of the ecosystem that existed at this site. She acknowledged a developing curiosity as her awareness sharpened.
As WM-H panned through her many digital photographs during the final interview, she commented on the series of images taken at the alvar, creating a worthy illustration of her experience at the alvar:

That is the alvar. It was cool. This is the water on the alvar, the little places where things can grow, and that is the picture I used for photovoice (Figure 7), that was like a black algae, it was weird and squishy, and I didn’t like it. It felt, I couldn’t get the feeling off my hands, it made me uncomfortable. That is a little pool. It was like a stream almost, it went down and cut through the rock and I, yeah, it was cool looking. That was, we were starting to get closer to the edge, and I didn’t want to go very far, so that was where I stopped (laughing). I was trying to get a picture of the algae going down in it, it was slimy and weird, I like this, it wasn’t like the black stuff, the black stuff was oily, and that was just slimy, so it was OK. (Laughing) I am a texture person. This is looking back across. This is
another picture where it got carved out and it was, it wasn’t like a pool, it was like a stream and it was pretty deep, not deep, but deep for the alvar. More of the slimy moss. I got my foot stuck in that. I really like it because you are looking out on the horizon and you can see where the water meets the sky and the water meets the alvar, it gives you a good viewpoint. That was just water. More rocks. This is like a little bench. This is another thing of water, I saw something swimming in it, and so I was trying to get a picture of it and then it darted away and I don’t know where it went. I really like this picture because, it is not waves, it is actual layers of rocks, and the water over it, and you can see the layers. I thought that was really cool and it reminded me that out by my Mom’s house in the creek, we have this (garbled by background noise). And we climbed around on this, around and down to that and jumped down there so we could get over there. (Laughing) it was terrifying, actually. And that was a pool of the green stuff and it was nasty looking. And that is Alan and me and I am yelling at him at the time, don’t get close to the water, you are going to fall and hurt yourself, but he kept going. And that was a rock that was like a perfect square. Not perfect, but like a 90 degree angle there, a 90 degree angle there, like why? This is a picture of where we were, it wasn’t like, it was one big pool on these rocks, and it was red, and I realized after I took the picture that this was all red and it was just red, but it was interesting. (WM-H, May 14, 2013, interview)

This account, defined by the long series of snapshots she had taken, shows WM-H’s experience to be full of emotion, curiosity, adventure, discovery, and interest. Friends and peers are included. She explored with her senses, presenting tactile descriptions of the different algae on the rocks. She compared what she was seeing to her prior experience at her mom’s creek.

The next day on South Bass Island, the only activity that WM-H discussed involved the walk along the State Park beach as students searched for Lake Erie watersnakes. WM-H encountered an opportunity to hold a watersnake, an experience that she seemed to have hesitantly desired. Figure 8 shows her successfully holding a young snake. She described the experience in her fourth photovoice caption:

This picture was taken on Friday at South Bass Island. We went hunting for Lake Erie water snakes, and found a small nest of them. I love snakes and wanted to catch them, but after watching Stanley get bitten a few times, I was nervous. The snakes’ bite stings and has an anticoagulant so that the person bitten continues to
bleed for a while, and I hate blood. However, Stanley let me hold the snake he caught and got a different one. The snake was very smooth and wiggly. He/she was so adorable, and I really wanted to take him/her home, but apparently that’s not allowed. I was thrilled to be able to hold him, though. It was a lot of fun to search for the snakes and finding them was extremely rewarding for me.

Figure 8. This is WM-H’s photovoice image 4 of a juvenile Lake Erie watersnake.

WM-H’s interest in the snake was embraced and enhanced when she was able to hold it with her own hands. She changed from being hesitant and fearful to wanting to take the creature home. The hands-on experience seemed to be the bridge from fearfulness to understanding and an open mind.
Prior interest and knowledge. Although she had experienced the glacial grooves in the past, the teachers on the Stone Lab trip gave value to the glacial grooves by directing students to see the formation and read the informative signs:

I have been there before and I have been to the grooves, but I never really paid attention, they were just like a tourist attraction, but now I was actually looking at them, and reading the signs and learning about them. (WM-H, May 2, 2013, interview)

WM-H’s previous experiences with the grooves and with fish provided relevance and led to deeper observations and evaluations of those activities.

WM-H relied on a trusted peer who had previously attended the Stone Lab field trip. “She was telling me stories about her past experience at Stone Lab, and I was so happy to be able to be a part of her experience this year” (WM-H, photovoice). In another interview WM-H related, “She had already been there, so she was showing me the cool places on Gibraltar” (WM-H, May 14, 2013, interview). The peer was in essence a mentor, helping WM-H make sense of the novel setting and helping WM-H focus on specific experiences. WM-H’s experiences were directly tied to the friend’s previous experiences.

Another example of prior knowledge, WM-H recalled while talking about the alvar, “It is actual layers of rocks, and the water over it, and you can see the layers. I thought that was really cool and it reminded me that out by my mom’s house in the creek” (WM-H, May 14, 2013, interview). WM-H related the alvar rocks to rocks by her mother’s home; she had a reference point from previous experience, part of her personal fund of knowledge.
Similarly, WM-H’s previous experiences with squirrels defined what a squirrel should look like. During her explorations on South Bass Island at the state park she noted, “That was a black squirrel. I have never seen a black squirrel in my entire life. It was all black. It was cool looking” (WM-H, May 14, 2013, interview). WM-H’s perception of a black squirrel was significant. Her previous experiences with squirrels defined what a squirrel should look like, and her perception of the black squirrel caused her to redefine how squirrels should appear, an example of accommodation.

In one other instance, WM-H tied prior experience to her Stone Lab trip experience. She talked about the fishing trip:

I thought it was really interesting, in learning about it for me, I go fishing a lot, so I was paying attention because I was, oh, that is how my dad knows all that stuff. And I could use the information, so I thought it was really cool. (WM-H, May 2, 2013, interview)

WM-H’s prior interest in fishing made the fish class relevant, which helped trigger and develop her interest in the class.

Affective responses. WM-H summarized her feelings during the trip in one statement:

It was really intense, I just felt, very curious, but also, (pause), I don’t know how to explain it. Amazed. Because I had never been put into a situation where you were like in depth, going into all this stuff, it was like, it wasn’t in a classroom, like you were there learning, and it wasn’t like learning, you were exploring, you were doing all this stuff, I was like this is awesome. It was also very exhausting, you are doing so much and even though it was like, I was cold and wet and muddy, through all of that, it was just wonderful, it was great, and I just remember, not when I was at Stone Lab, but after, when I came home, I just missed it so much, it kind of hurt a little bit. I just want to be back at Stone Lab. (WM-H, May 2, 2013, interview)

WM-H revealed many different emotions throughout her interviews. The boat trip involved a great deal of emotion that made the experience memorable. “It was really
cool, even though it was scary” (WM-H, May 2, 2013, interview). The setting of the lake and sunset created an ambiance which led to an emotional response that she had not entirely grasped at the time of the interview, “That is a picture of the sunset, the picture where the pine tree was growing out of nowhere, and then we took a picture of the sunset, that was cool” (WM-H, May 14, 2013, interview). The tone of her voice revealed more emotion than her words. But in another interview, WM-H described the sunset more vividly, “And it was at sunset, that is where I got that really cool sunset picture, too. That was amazing” (WM-H, May 2, 2013, interview). WM-H was generally excited as she talked about her different experiences on the three islands. “We were looking all around together and that was interesting. It was fun, because, I like being by myself when I am exploring” (WM-H, May 2, 2013, interview). When she observed the rainbow, WM-H described, “This one is clear and pretty big, which really excited me. We just stood and stared at how lovely it was” (WM-H, May 14, 2013, interview). She was “thrilled to hold” the snake ((WM-H, May 14, 2013, photovoice). One experience resulted in a negative affective memory. WM-H described the fish dissection when the student pulled out all the internal organs, “which fully disgusted me” (WM-H, May 2, 2013, interview).

In an emotional comment as WM-H viewed the group picture taken just before the groups departed Stone Lab, she was saddened that her newly formed bonds were breaking and the new experiences at Stone lab had concluded. Looking at the group photo on the steps of Stone Lab, WM-H commented, “And then everybody else, here we are, now I will never forget any of you (laughing)” (WM-H, May 14, 2013, interview). WM-H was a senior and would be graduating in a few weeks.
WM-H identified the rainbow experience as one of her most significant experiences on the Stone Lab field trip. Through photovoice, she illustrated a powerful experience while on Alligator Bar, where she shared a moment with friends and saw the beloved rainbow, resulting in excitement, awe, and wonder:

This picture (Figure 9) was taken after returning from Kelley’s Island. Alan, LZ, Stanley and I went out on Alligator Bar and saw this beautiful rainbow behind Perry’s Monument. I was amazed because I hardly ever see them and when I do, they’re really faint or small. This one is clear and pretty big, which really excited me. I wasn’t really a big fan of Stanley, but this moment brought us all together. We just stood and stared at how lovely it was, and I got this picture. Then LZ-L tried to push me into the lake, and we were back to messing around. Even though it was a small moment, Stanley and I spent more time together and managed to be friendly to one another. It also brought LZ-L and Alan closer together and we formed quite a group to go and explore the rest of Alligator Bar.

Figure 9. This is WM-H’s photovoice image 3 of Perry’s Monument and a rainbow.
Setting. Setting was significant in WM-H’s photovoice images. Figure 7 of the alvar illustrated the desolation and vastness of the rock ledge and lake. Figure 8 illustrated WM-H holding a snake, with the shoreline, beach and lake behind her. Figure 9 illustrated the lake and island with the rainbow overhead. In her caption to Figure 10, WM-H described the setting, “This picture was taken on Tuesday on South Bass Island at the OSU fish hatchery. Jennifer and I were waiting for the boat that was going to take us to Gibraltar Island. This picture is significant because it was where I got my first good glimpse of Stone Lab, and I was so excited…It was hot this day, and we had taken off our hoodies, so we could lie on the ground. The sun was very intense on the water, so we were also wearing our sunglasses.” In each situation, the setting was significantly connected to the experiences.

WM-H described the importance of the specific Gibraltar Island setting:

Once you get there you can’t help but be sucked in…the island is definitely a big part of why I enjoyed it, you are on a little island and you can go explore your interests. (WM-H, May 2, 2013, interview)

Tools. WM-H used tools during the Stone Laboratory field trip. Although never specifically naming the hammer, she did utilize a hammer at the rock quarry to acquire fossils. “This is a huge chunk we were able to break off, to see if there are fossils under there.” She acknowledged that she enjoyed “looking under the microscopes” at the plankton (WM-H, May 2, 2013, interview). Since she did not participate in the dissections, she did not utilize any of the dissection tools. WM-H did utilize her camera to take images of the activities and her experiences on the field trip.


**Cultural lens.**

**Peers.** The field trip cohort arrived at the South Bass Island office of Stone Lab during the early Tuesday afternoon. WM-H identified her arrival at Stone Lab as one of her key photovoice experiences during the Stone Laboratory field trip. In Figure 10, WM-H chose an image showing fun, friendship, and joy. She is with her best friend, who had attended the Stone Lab trip two years ago. Her friend diminished the frightening unknown, turning the trip into an adventure:

This picture (Figure 10) was taken on Tuesday on South Bass Island at the OSU fish hatchery. Jennifer and I were waiting for the boat that was going to take us to Gibraltar Island. This picture is significant because it was where I got my first good glimpse of Stone Lab, and I was so excited. Jen and I couldn’t wait to spend the rest of the week exploring and learning and having a fun time. She was telling me stories about her past experience at Stone Lab, and I was so happy to be able to be a part of her experience this year. It was hot this day, and we had taken off our hoodies, so we could lay on the ground. The sun was very intense on the water, so we were also wearing our sunglasses. I was wearing the ones she got me for Christmas and every time she looked at me she laughed. This picture really captures how excited I was to begin the trip. It also has one of my best friends in it, without whom, the trip wouldn’t have been the same.”

WM-H relied on a trusted peer who had previously attended the Stone Lab field trip. The peer was, in essence, a mentor, helping WM-H make sense of the novel setting and helping WM-H focus on specific experiences. WM-H’s experiences were directly tied to the friend’s previous experiences.
Figure 10. This is WM-H’s photovoice image 1 of enjoying the spring sun while waiting for a ride to Gibraltar Island.

WM-H documented the impromptu volleyball game as an important first experience on the island, “It wasn’t just playing volleyball, it was, I got to meet [another schools’] kids and got to spend time with the [the other attending schools’] kids we brought along, it was a good experience for building relationships and friendships” (WM-H, May 14, 2013, interview). She found value in building casual relationships with
students from other schools was important to create a friendly learning environment.

Besides the volleyball game, WM-H wanted to explore Gibraltar Island:

The first day when we went, and we were, Jen had already been there, so she was showing me the cool places on Gibraltar, and she took me down the steps and we found all kinds of sea rocks and stuff that I have heard of, but I never found any, so that was cool. (WM-H, May 2, 2013, interview)

That evening, WM-H created a memory with friends as they discovered a new place on the island:

Alan had found how to get to, Mrs. K called it the keyhole, and he found a way to get on top of it. Where the tree was. And it wasn’t actually that dangerous. It was dry, so you weren’t slipping or anything, then we were able to sit there and look. I don’t know why it was so awesome, but I was like, I thought this was impossible, but it was easy, it was cool. And it was at sunset, that is where I got that really cool sunset picture, too. That was amazing. The three of them and me, just made it a really great experience, and I don’t think I would have had the great experience without all of them there. (WM-H, May 2, 2013, interview)

WM-H recognized that she learns while talking to friends, “we talk about stuff like that all the time, we sit around and we have questions and we answer each other’s questions because we all know different things and we are interested in different things” (WM-H, May 2, 2013, interview). WM-H was compelled to be around peers, and was happy to be alone to explore, enjoying the solitude. “I like being by myself when I am exploring, but at the same time, when you are with other people, they find things, and then you find things, and we can all share all the things together” (WM-H, May 2, 2013, interview). WM-H related to the interactions with others, but those interactions augmented her experiences and were catalysts and magnifiers of the experiences, the peer interactions did not define WM-H. This can be seen during WM-H’s comments concerning the boat trip on rough waters:
It was just really windy and cold and we went out like to the, out, we went out of the bay to go get the fish, and the waves were really strong at one point, (laughing and excitedly), and it tipped sideways, and I was, Oh my God, I am going to die, but no, it was OK. We got back OK. (WM-H, May 2, 2013, interview)

Her friends were present, but it was the experience that she focused upon. As stated above, WM-H enjoyed talking about the experiences with her friends after the activity, “Going back and talking to my friends, oh, do you remember this? But yeah, do you remember this?” (WM-H, May 2, 2013, interview). Friends made the trip seem special. The social interactions appear to link directly to quality of experiences, adding depth to the experience.

Cited in the affective response section, it is significant to note how WM-H’s caption to Figure 9 embraced the importance of peers with an experience.

This picture was taken after returning from Kelley’s Island. Alan, LZ, Stanley and I went out on Alligator Bar and saw this beautiful rainbow behind Perry’s Monument. I was amazed because I hardly ever see them and when I do, they’re really faint or small. This one is clear and pretty big, which really excited me. I wasn’t really a big fan of Stanley, but this moment brought us all together. We just stood and stared at how lovely it was, and I got this picture. Then LZ-L tried to push me into the lake, and we were back to messing around. Even though it was a small moment, Stanley and I spent more time together and managed to be friendly to one another. It also brought LZ-L and Alan closer together and we formed quite a group to go and explore the rest of Alligator Bar.

Family. WM-H did not receive much support from her family, although her family remained important to her. She was raising her three younger siblings, and the oldest sister pushed WM-H to do her best in the things she loves. WM-H could not depend on her parents for support or conversation. She was frustrated by a parent’s inability to discuss a topic critically or with an open mind. Prior to the field trip, she exhibited some anger and frustration as she spoke about how her father would not interact with open discussion. In spite of the family issues, WM-H connected her family to some
of her experiences on the Stone Lab trip. “I go fishing a lot, so I was paying attention because I was, oh, that is how my dad knows all that stuff. And I could use the information” (WM-H, May 2, 2013, interview). “I love the castle…I was trying take pictures so I could show my mom when I got home” (WM-H, May 14, 2013, interview). “That is the cottage where I stayed, I wanted to take a picture of that to show my dad. I stayed in a house. He expected me to be staying in a tent” (WM-H, May 14, 2013, interview). WM-H’s fund of knowledge defined her values, as well as what her family and culture thought was important.

WM-H also embraced a personal value system that can be glimpsed in her statement, “We found fossils and I couldn’t bring the fossil I found home because it was attached to a giant rock and I didn’t want to hurt it” (WM-H, May 14, 2013, interview). She saw value in the fossil, and chose to not risk damaging the fossil rather than to claim it as her own and potentially destroying the fossil. She also illustrated personal values through the caption of Figure 8, “I really wanted to take him/her home, but apparently that’s not allowed. I was thrilled to be able to hold him, though.” She accepted ethically right from wrong, and was happy to abide by her decision to release the snake.

**Teachers.** Teachers have had a critical impact on WM-H’s success in school. She entered the agriculture program in eighth grade, and the teacher directed her into the speaking program, in which she excelled. The FFA teacher “encouraged me to try things that I never had done before. I would not have done science fair if I had not done public speaking” (WM-H, April 8, 2013, interview). During her senior year, the science
teachers mentored, empowered, supported and quietly financially helped WM-H to succeed:

I can talk to Mr. J about things and he encourages me about Stone Lab, because I wasn’t going to go, I can’t pay for that, but he was like no, we can pay for this. And Mrs. K is just goofy, I love her so much, it is really helpful that with her around will lighten my mood and make me feel better. (WM-H, April 8, 2013, interview)

The teachers enabled the experiences to occur and be meaningful, such as when the teacher’s presence overrode her fear of the leech. “I actually got to hold it, I actually tried. It was scary” (WM-H, May 14, 2013, interview). She would not have had the experience without the teacher’s personal encouragement.

The teachers imposed a value system which was new to the students - trust and responsibility. During the Stone Lab experience, WM-H recognized that the teachers gave the students freedom to think for themselves:

The amount of freedom and trust in the students. The teachers obviously were around, but they weren’t breathing down your neck. It was like they were there if you had a question, and they would come and make sure you weren’t drowning and stuff like that, but you were allowed to go off by yourself and with your friends and they trusted us not to do bad things. We were allowed to go and do our thing and check back in and it was kind of new, it was weird, in a good way. (WM-H, May 2, 2013, interview)

WM-H observed the teachers being playful, making those moments memorable, such as when the teacher kissed the frog, “Mr. J holding a frog. He kissed the frog. He didn’t turn into a prince, so my whole childhood was ruined, thanks Mr. J, yeah, and then we passed the frog around” (WM-H, May 14, 2013, interview).

Transferability. When asked to choose experiences between school and Stone Lab, WM-H responded:
Between Stone Lab and the classroom? (Quickly and loudly stated) Stone Lab all the way!!! (Laughing) You are immersed in the experience, you are left to your own thing, they are like, hey, there is the island, go do your own thing. And then you come back and you have the option to ask questions and the option to, like Mr. J might say, so, what did you do today, and you can say or some people would say oh, we went out on the boat, we did this, and some people in the botany class would say we did this, and personally, I don’t know about botany, so I didn’t talk about that, but he never, I never had to take a test on it. I knew it was interesting, but I didn’t, I got to do the things I really wanted to do. (WM-H, May 2, 2013, interview)

WM-H did see value including hands-on experiences in the classroom:

Kids respond to going out and doing things, even if they are not hands-on, being able to have the experience and actually see it done and do it, it makes it more relevant. I think if we did that at school, it would definitely make the day a little more interesting. (WM-H, May 2, 2013, interview)

However, WM-H also recognized that Stone Laboratory is a unique setting that cannot be reproduced in a classroom:

When you are on the island, you don’t really have a choice (laughing) you choose to be there, but once you get there you can’t help but be sucked in, but here at school it is, in a classroom setting you can choose to go off with your friends and just be stupid or you can choose to enjoy the experience. (WM-H, May 2, 2013, interview)

She also recognized the uniqueness of the learning activities at Stone Lab compared to other field trip venues and the classroom:

When you go on field trips, it’s always something that is guided. Like you have a worksheet, or you come back and you take a test. But at Stone Lab, it is, you are paying attention to what interests you and even though you go to classes, and they ask you questions, you are living there, you are on the island, and you really don’t have a choice but to explore and learn things.

At school, you can tune it out and your teachers come back and they are like, oh, what is the answer to this question, and what did you learn? At Stone Lab it is like, you don’t have to worry about it, but you don’t think about it, you just, you are immersed in it. (WM-H, May 2, 2013, interview)

**Summary.** WM-H is a female senior high school student who enjoys physics, statistics, animal science, and English, as well as reading, drama, friends and science club
field trips. She intends to attend college to study neuroscience and psychology. WM-H enjoys science. She likes to figure things out, to discover new things. She enjoys writing and presenting papers. She enjoys the analysis, the statistics, and the application of the results. She has taken most science classes, and also belongs to FFA, taking the FFA Leadership tract, and has succeeded in speaking competitions.

A significant aspect of WM-H is the fact that she is supporting her siblings by working two jobs. In spite of her difficult home life and busy school life, WM-H’s demeanor appears to be light hearted and dedicated to follow her dreams.

After the Stone Lab trip, WM-H admitted her fear of being on the boat in rough seas, but in spite of her fears on the boat, WM-H still enjoyed the experience, saying that just being out on the water made that experience special. She discussed another negative moment during the trip, the fish dissection. A student from a different school disgusted most of the class by ripping the fish’s organs out and holding the beating heart.

Most of experiences were positive, and were discussed after she brought up the negatives. WM-H enjoyed the fish lab and the trawl, which she contributed to her going fishing with her family. This relevance made the fish unit interesting for her from the start. During the fishing trips, WM-H had seen the glacial grooves, but thought nothing of them. But on this field trip, she was told about the glacial grooves, and this time she was aware of them and perceived them. She talked about friends, and how they make an experience better. She thoroughly enjoyed the experience that inspired her interests even beyond her pretrip interest levels. She wants and plans to continue to explore and discover and learn for the rest of her life.
WM-H’s favorite setting on the field trip was the quarry, which included the rock pile and alvar. She spent considerable time discussing the search and discovery of fossils, describing the rocks, and exploring the alvar. She was amazed at the freedom the teachers gave to the students. Students were allowed to explore and discover, and were constrained by only a few rules, such as don’t climb the high wall, and meet back at the quarry entrance at 3 p.m.

WM-H’s emotions and feelings were strong and diverse. In just one statement, she showed intensity, curiosity, amazement, awe, exhaustion, and joy. During the opening discussion about unpleasant experiences, WM-H spoke of fear, disgust, and anger. However the primary tone of her experience at Stone Lab was excitement and happiness.

A recurring theme throughout WM-H’s pictures is trees growing from the rocks. She was very curious about how the trees were able to grow. At the quarry she flipped a rock and found roots underneath the rock, and commented about that might be the answer. Even though WM-H claimed she did not care for botany, she still developed curiosity concerning the trees that seemed to carry on during the entire Stone Lab field trip.

WM-H discussed the joy of learning without expectations. She liked that she was not forced to pay attention to things that did not interest her. She spoke of botany, and how it did not really interest her, but it did not matter, because she would never have to be tested over the information. She enjoyed the immersion, the freedom, and the free choice. Her opinion was that if you enjoyed something, you would enjoy it more after
the trip. If you did not have any interest in something, you would still enjoy the experience. “It is an experience, not a lesson” (WM-H, May 2, 2013, interview).

Case Study 2: TK-H

**Contextual profile.** TK-H is a junior female high school student who is highly interested in sign language and other languages. She knows what she wants to do in life, but is not sure of the path to achievement. She does not see herself as a “typical teenager.” TK-H enjoys science, math, visual arts, Egyptian history and American Sign Language, church, swimming and hiking. She enjoys teaching herself new languages. She plans to go to college to be an ASL mentor, and possibly to be a water or soil engineer or math teacher.

Her parents and church are important sources of motivation and empowerment. Two years ago, with no admitted interest in science as a freshman, TK-H was encouraged by friends to attend Stone Lab. “I loved everything about it.” She bonded with friends that she already had and made new friends, and she discovered how interesting science could be. “Everyday life, science is all around us, trees over there, birds flying through the air, you can see it, if you look. Open your eyes!” (TK-H, April 8, 2013, interview). She is active in the science club and is an officer as a junior. She is also in FFA, and enjoys the many hands-on opportunities the agriculture curriculum offers. She enjoys and has been successful with science fair projects. She has been studying various aspects of arsenic saturation in cemetery soils.

TK-H looked to be highly engaged in her biology classroom activities. Seated in the fourth row, she appeared to be focused on the teacher and the lesson throughout the class periods. The class seemed to use her for answers and guidance if the teacher was
busy with another student. She smiled as she worked with the fruit flies at the table and at
the microscope. Each day, TK-H arrived to the first period biology class 30 minutes
early, to talk with the teacher, to help take care of the animals in the room, and to help
where needed. During the day, when she did not have class, she spent the time in the
room as a teacher’s aide.

**Cognitive/ Affective lens.**

**Interest in science.** TK-H was excited to begin her second experience at Stone
Lab. She chose Figure 11 of Stone Lab as one of her Photovoice images, and wrote:

“This is Gibraltar Island. This is the place that half the action happens. We get
delicious food that isn’t even in the same spectrum as our school lunches because
these meals are so delicious. We get to slow down, at least a little bit because our
itinerary moves pretty quickly, and look at the world around us. We get to learn
about invasive species and endangered, well use to be endangered, Lake Erie
watersnakes. We get to hang out with friends and learn about our teachers in a
way that no other students get to experience. This particular picture was taken on
the first day of our trip.

TK-H identified her interests on the field trip, the food, the classes, the setting, the
ecosystem, the watersnakes, her peers and teachers. TK-H identified her favorite classes:

I liked the Dutchman’s breeches, or whatever the flower is called. It is only
supposed to have 5 stamens, but all the flowers I looked at had 6, so Ms. G and I
were kind of like laughing at it and saying of course I would get the weird flower,
and she wanted us to identify it, which of course I knew it was Dutchman’s
breeches, because I had seen it before, but trying to get it to key, when it is
supposed to have 5 not 6, so we had a little issue with that.

Then I liked the birds, because I like the word tertiary, just randomly not
because it has anything to do with feathers, but randomly. And I liked Mrs. K’s
activity where you use the chemicals and analyze the water around you. That is
pretty cool. Because that is basically what I did for science fair, was testing water
and using chemicals to find other chemicals, and I really like that. (TK-H, May 9,
2013, interview)
TK-H thought the water quality labs were important:

Everybody around Lake Erie lives practically around that water. It is their source of everything. Entertainment and money, boat wise, and to be able to test it using random chemicals, is cool, plus you get to go out and do something with your hands. I think that is the whole, joy of Stone Lab, the kinetic [sic] learning, where you can work. You don’t have to just sit there and be bored at the back of the classroom. You can go and do stuff. (TK-H, May 9, 2013, interview)

TK-H found the macroinvertebrate to be interesting:

I liked the macroinvertebrate walk on Alligator Bar. We saw several [species of animals] that I had not seen before, we found a water beetle that is actually kind of rare and we don’t usually find it, and we found it, and we were kind of excited about that, (laughing) really geeky things, that was pretty cool. (TK-H, May 9, 2013, interview)
The macroinvertebrate experience was enjoyable and memorable for TK-H. Her description is explicit and suggests a level of excitement and interest in the experience and discovery as she continued:

TK-H - I was just picking up rocks and looking at the bottom of it and saying, oh look, there is a thing. Mr. J, what is this? ‘Cause we really don’t know, we aren’t going to take our papers out there with the list of what’s there, because it is not waterproof. Just the learning experience and digging under rocks and leaves and sticks and (laughing)…

RESEARCHER - Have you done that before?
TK-H - I have. Well, I go creeking sometimes but not often enough. But enough to, oh, there’s a bug, but I never know what it is, so it is nice to have the teacher there who can say oh yeah, that is um a lalalala (laughing). They just give out random names and I am like OK, I am pretty sure you just made that up, but OK, we got this. (TK-H, May 9, 2013, interview)

During the just-discussed plant class, TK-H found a plant with a flower aberration and was intrigued to why it should exist. While discussing her photograph gallery during the final interview, TK-H explained:

TK-H - This is the Dutchman’s breeches, the six versus five, there are supposed to be five, but I kept counting six, so I was trying to get evidence that I had six and I don’t think any of them really show you six.

RESEARCHER - Were you interested in plants before this trip?
TK-H - Enough, like we went to the Hocking Hills and I like the trees, especially that grow around water, so the Indians would make campsites around it so there had to be water somewhere in order for them to be there. Or just the medical uses for all the different flowers, the limbs, and barks, and how you can eat termites with, weird things. So I like the usefulness of plants, rather than just keying random plants. (TK-H, May 16, 2013, interview)

TK-H was interested in plants and was quite curious why the flower did not key out as expected. Her curiosity may have stemmed from her admitted preference of working with plants rather than simple identification with no application.

TK-H’s experience at Kelley’s Island trip provided many comments:
Researcher - Was there anything that stood out from that day?

KT - Food. Oh my gosh, that hummus was delicious. It was the best hummus that I have ever had. Or I was extremely hungry, one of the two. Other than the food, (laughing) going back I have no idea what it was called, but after the hike part where we had to go back through the forest (pause)

Researcher - We walked back to the alvar.

TK-H - That. Because I called it the albarge and that is not what it is (laughing). Just being able to explore that and see all the different formations nature has made around it, was pretty cool. And then you get to see all the plants and animals, mostly plants, all the way back there and have different teachers point out to you, that is this, and it does this. That’s kind of cool. (TK-H, May 9, 2013, interview)

TK-H identified a variety of interests in this statement, suggesting she was fully involved with the experience. TK-H provided an excellent complete description of her quarry experience at the Kelley’s Island that illustrates the connectivity of the setting, people, and emotion, weaving together to develop interest:

TK-H - Well, LK-H and I wore our big rain boots, muck boots basically, and went through and we were flipping rocks, and I found this giant spider that kind of terrified me, and I put it back, and we found dead frogs, and a lot of baby salamanders and tadpoles, and things like that, to all those back to back vertebrates, it was just learning about all those, even though we see them, it was nice to play with baby salamanders.

We were the only two who wore our boots, because we brought them in our bags, and we had tennis shoes on the rest of the time, but we switched because we knew it was going to be muddy. We get back there and [the teachers] and a bunch of kids who know us from BCHS, are walking and are trying to avoid the puddles and LK-H and I are just splashing through them, and racing past them, and we get back there, and all we wanted to do was find a frog, we just wanted to find one frog. But instead we found all the salamander babies and the spider and we eventually found what we thought was going to be a nice frog. It was dead. It was just sitting there, dead. That is kind of sad. And so LK-H switched over to wanting to find tadpoles, and all we could find were the salamanders, so we kept on searching and we had to go into this back area that was almost too deep, it hit the top of our boots, and had it splashed at all it would have been in our boots. But it was fun because we finally found tadpoles. Why are they in the deepest part of this area?

RESEARCHER - Is there some aspect that you found most interesting while you were exploring?

TK-H - How squeamish how other people are, they are just tiny tadpoles and salamanders, that are hanging out in water, you pick them up and if you hand dries out, they are the ones that are going to die. And you are screaming because
oh, you see something moving in the water. You aren’t even near it, and you see them, and we make fun of them, really is all we were doing, because it was pretty fun. And then being able, since we have gone previously, seeing them before, we would show others and teach others, hey, this is a salamander, this is a tadpole, see the difference? And, because everybody else was saying, “oh it’s tadpoles,” and no, that is not it, they have little legs popping out of, they are salamanders, so, that was fun. (TK-H, May 9, 2013, interview)

Concerning teaching others, TK-H explained:

I always kind of learn not only by doing but also by teaching others so when I teach anybody else anything, I definitely know more about it. So they ask questions, and I never thought of that, so I go and do my own research, and doing things like that helps me learn, solidifies it in your brain. (TK-H, May 9, 2013, interview)

Thursday evening after the guest speaker presentations, students had the option to participate in the dissection of two pregnant cats. TK-H identified this as one of her most important experiences through photovoice (Figure 30). She explained:

The cat dissection. This actually meant more to me the first time I went on this trip, but it was so important that I feel like it must be shared here as well. Last time I had never dissected anything before this trip. On the first day we dissected a fish, after killing it and its heart was still beating. This was weird for me because I’m not exactly a huge fan of blood and as previously stated I hadn’t dissected anything. So after all that about the fish, now on to the cat.

The cat dissection is on the third day. We didn’t really know what to expect, but Mr. J. was there and since we were all in his Biology 1 class we decided we had to go; we may have also been hoping for a little help because our frog dissection was to be in the next week or two. Now to present day, well present trip. This time around we knew what to expect and we were able to help the other kids who were asking questions about what to do and what things were. It was great to help others, because I learn by teaching. We also got two different kinds of kittens out of this particular momma; one had six fingers on each front paw and the other was small. After a closer look at the smaller kitten we determined that it would have most likely been a still born, based on its size and the fact that its skull had not formed over its brain.
TK-H described the dissection activity:

Ellen was with me the whole time, up until the end, because we kind of stayed a little bit extra and actually dug out the heart and dissected what would have been the still born cat and looked into those but other than that, everyone else just wanted to see the babies and then they left. Once they left, we were, oh we can actually learn something, so we started getting into it, it was pretty cool. Mr. G was there and then Mr. J came back and he was interested in it, so both of them were teaching us as we were just doing hands-on activities with cats. [Italics added] (TK-H, May 16, 2013, interview)

TK-H recognized that individualized instruction provides better learning opportunity than group instruction. Explaining why she liked performing the dissections, TK-H responded:

The fact that it is only hands-on. You can’t not put your hands-on it. And you are learning something the whole time, whether they are actually teaching you
TK-H believes that experiential, hands-on learning is conducive to learning. She explained how the teachers set up the dissection:

Some of it was explained beforehand, and then we got into it, and it was kind of silence, let’s see what they are going to do, and then we asked so many questions that they ended up teaching as we did it too. It was all, what are you interested in? Because we were asking the questions. Ellen always wanted to get the heart out, and she was like, where do I cut in here, so we learned about the heart and the muscles around it and the tissues and how it functions and once it was out we did the esophagus versus the trachea versus everything in there. Seeing the spinal cord in the back and learning based on what we were interested in, not just this is a lecture presentation for the class. We have to do this. And then, getting into the stomach, even though there wasn’t too much in it. (TK-H, May 9, 2013, interview)

TK-H’s most notable experience on the field trip occurred on the last day at the steps of Perry’s Monument:

I liked Mrs. K.’s rendition of [the Battle of Lake Erie and the reason for constructing] Perry’s Monument, because two years ago we had the same speech, but it was [performed by The National Park Service who operate the memorial], then we had to sit through the movie, and all that stuff, but this time she kind of went straight forward and she did an awesome job. (TK-H, May 9, 2013, interview)

Asked how the experience affected her during this notable experience, TK-H answered, “Almost more interested than I usually am because I am not a history person, whatsoever, so to hear it and actually and enjoy it and actually learn something was kind of different for me” (TK-H, May 9, 2013, interview). TK-H suggested that even history can be interesting when it is taught in an experiential way.

During the visit at the wildlife center, TK-H observed and commented on one exhibit that connected to her sense of touch:
I like the petting wall poster thing, that you can touch all the different animals furs that you never get to do, it is not a random porcupine that you go and play with up close, no, that sounds like a bad idea, to be able to get up close and personal with the wall, is nice, different textures, and also I want this kind of animal as a pet. It is soft and it is a mountain lion (laughing) never mind. (TK-H, May 9, 2013, interview)

The exhibit was a sense-of-touch exhibit that captured TK-H’s interest. Although this is not a study of visitor experiences in museums, it should be recognized that well-constructed exhibits can have an experiential component that can elicit interest through visitor interactions.

When asked in the posttrip interview about how she felt about the Stone Laboratory trip now that it is over, TK-H replied “I just want to go back again!” (TK-H, May 9, 2013, interview).

TK-H acknowledged that her interest in science changed “a little bit” since the Stone Laboratory trip. During the posttrip interview, in an extended discourse about her summer internship with the county extension office and how everybody in the office attended Stone Lab at some point in their career, TK-H has reconsidered her future plans to include teaching in a similar environment. She recognized that the social connections to Stone Lab are important to other people, and the connections remain strong long after attending Stone Laboratory. And she recognized that Stone Laboratory is a common denominator for many people who are working in the biological, agricultural, soil and water fields. Her recent Stone Laboratory experience has caused TK-H to reconsider her future.
The at Stone Lab activities and the island explorations motivated TK-H’s desire to continue to explore and discover, however once she got back home, her obligations are preventing her from satisfying her needs to get back out into the natural world:

I just want to be outside. I had a rather large paper I had to write before the Tuesday, we got back that weekend and it was due that Tuesday. I had a six page paper that was due, in a college course that I hadn’t started yet, which is bad. I just wanted to be outside. I have a creek that runs through my backyard too, so I just wanted to go out there and have fun and I couldn’t because I had to be inside at the computer writing my paper, so it, I just want to go outside. I want to learn things, which when you are outside you kind of have to, whether it is because, oh, that’s a bird, that is a pretty bird, I want to learn about that bird, or this piece of grass looks different, what is it? Things like that. I love the outdoors. (TK-H, May 9, 2013, interview)

Prior interest and knowledge. TK-H had prior interest in plants that was greater and deeper than the Stone Lab plant walk and keying out identifications:

[Last year] we went to the Hocking Hills and I like the trees, especially that grow around water, so the Indians would make campsites around it so there had to be water somewhere in order for them to be there. Or just the medical uses for all the different flowers, the limbs, and barks, and how you can eat termites with, weird things. So I like the usefulness of plants, rather than just keying random plants. (TK-H, May 9, 2013, interview)

She wanted something more. That is when she discovered the aberrant flower on which she focused all her attention.

TK-H described an experience while at the quarry that blended with her funds of knowledge:

So my pastor just gave a sermon about how we should be all like trees, they grow around their surroundings and encompass them and everything, and so the fact that I found this was kind of ironic to me and it was also Wednesday, and I wasn’t able to get to church, cause we were there, so and it also kind of looked like a pregnant woman, so…and this is the side view. (TK-H, May 9, 2013, interview)
This statement suggests that TK-H assimilated the sermon into her observation in the quarry.

Peers who previously attended the Stone Lab field trip continued a traditional activity that placed value on otherwise worthless fragments of glass litter. “The sea glass, we were all collecting it because it is a big part of any time we are around water.” Because her peers searched for sea glass two years ago, TK-H embraced that activity on this trip. Comparing this Stone Laboratory field trip with the trip she went on two years ago, TK-H explained:

Most of it was the same as 2 years ago, but it was also completely different, I think it was my attitude about it, this time I am going to have fun, it is my last time, I am a junior, the first time as a freshman, I didn’t know anything, I didn’t know anyone, there were a few kids from ROHS I knew, and the one friend that I met. (TK-H, May 9, 2013, interview)

Affective responses. TK-H described how Stone Laboratory made her feel:

Good in the sense that you can hang out with all your friends because it was my group of friends, and a lot of us were seniors and juniors this year, there were only like three sophomores, so towards the end it was really very sweet, we get to go home, but we have to leave Stone Lab, we are never gonna be back here as a group. I kind of want to cry, but all of us were feeling the same way, all the hugs, oh my goodness. Way too many hugs. That was just at the end, it was bittersweet.

At the beginning, we were, it’s Stone Lab again, oh my goodness, this is awesome because most of us, there were only two people there who had not been there that were juniors and seniors. We were like, this is cool, we are here, we get to do all these things, and because we had been there before, almost leading everybody. It is all fun in the beginning, and then you get to the middle and it is, wow, I am exhausted. I need to sleep, but we are doing all these fun things. (TK-H, May 9, 2013, interview)

TK-H later exhibited an affective response as she described her feelings about the conclusion of the Stone Lab Trip, “We are not going to be in a group having fun stuff for a week again. And that is really what was sad and kind of depressing” (TK-H, May 9, 2013, interview).
TK-H tried to describe a sunset that she found meaningful, “I always kind of, God’s masterpiece that I am never able to paint or do anything with, and I finally made one 8th grade year with oil pastels and turpentine, but it is still not as good as that” (TK-H, May 16, 2013, interview). She seemed to be trying to verbalize her awe and wonder of the setting.

TK-H experienced a moment of discovery that promoted awe and wonder when she was riding on the boat:

My glasses, I had clip on to my regular glasses, and looking through them, I said oh, that is a pretty formation. As soon as I said that I kind of realized that I was probably the only person who could see it, because it was undoubtedly my sunglasses, so we passed around my sunglasses and all of us were oh, that is trippy, that is cool, whatever, and I put it over the camera lens and took the picture so I could prove, and then the next picture is just naturally, So this is what everybody else was seeing. I was clearly seeing pretty rainbow formations. (TK-H, May 16, 2013, interview)

This is an example of TK-H discovering something she found amazing, which led to experiential learning. The elation and social integration reinforced the learning, and the camera was used as a tool to capture the discovery.

Throughout the interviews, TK-H revealed a great deal of excitement and joy as she talked about the Stone Lab field trip, evident in the tone of her voice, her facial expressions, and hand gestures. In Figure 50, TK-H’s description of searching for amphibians in the quarry was rife with excitement as she related her story.

Physical lens.

Setting. TK-H tried to explain how the setting of Stone Lab was significant to her:

That building in general (the classroom building), isn’t where I associate with Stone Lab, it is more of the fantastic food, plus all the friends. I love campfires,
so that whole area, with the new benches and stuff was pretty cool this year. And then we also, back on the other side, where the waves splash constantly. (TK-H, May 9, 2013, interview)

When pressed to identify a spot on the island that she connected with, TK-H chose two sites due to the social connections at those sites, the campfire site, and the beach where students like to site and relax. TK-H seems to define Stone Lab by the food and friends, not the buildings or labs.

On multiple occasions throughout the interviews, TK-H commented on the food presented to the students. “The food is delicious so you feel like I don’t want to go home because I have to go back to my school lunches and actually making my own food at home. Here it is all prepared for me, which of course we paid for, but at that time that thought does not cross your mind” (TK-H, May 9, 2013, interview). “Oh my gosh, that hummus was delicious. It was the best hummus that I have ever had” (TK-H, May 9, 2013, interview). “[The classroom building], isn’t where I associate with Stone Lab, it is more of the fantastic food” (TK-H, May 9, 2013, interview). “We get delicious food that isn’t even in the same spectrum as our school lunches because these meals are so delicious” (TK-H, May 9, 2013, photovoice). TK-H was the only participant to speak of the food, which she perceived as an important element in the physical domain.

TK-H identified the bonfire (Figure 13) as one of her most significant experiences at Stone Lab. In her photovoice caption, she commented:

“Every night we have a fire, even in light rain. This is where we talk, learn, and have fun. We learn about each other, and most of us are rather slap happy; the fire is warm, which is great since it’s usually freezing in early spring, lake effect and all; we talk about some rather deep subjects to the tune of the crashing waves, and mating fish; and we eat, food, food, food and more food. People and food, that’s what we do.”
When asked what aspects of the campfire she enjoyed, TK-H replied:

That I was the last one every night and I helped Mr. J and Mrs. G pack everything up, it is fun to just hang around and be quiet because I am exhausted at that point and I just want to go to sleep. But if I go to the cottage, everybody else is being loud and obnoxious, so that is my fun, and there is also food. (TK-H, May 16, 2013, interview)

TK-H enjoyed the campfire because it was quiet and restful. Her enjoyment was directly connected to the social aspects of being with the teachers and others on this quiet surrounding.

Water was a significant part of the second and third days on the trip. As she described the photographs that she had taken, she explained, “Rain, that is an image of Mrs. G’s walk...And it is raining and it was kind of miserable and we were all soaked
and, look at the color of the grey [sweatshirt]” (TK-H, May 16, 2013, interview). There was no extended sitting time in the classrooms, the classes went outside even in the cold rain. She also identified the water during the boat trip:

The water, how it, that was a really windy, choppy day. I love the, even the next week, you lay in bed, and you feel, I’m moving, the boat, it was worse the first time around, but this year it wasn’t quite so, so rocky. (TK-H, May 9, 2013, interview)

The setting left an impact that she felt for days after the trip. Did that recurrent sensation inspire more memories of the trip?

The Kelley’s Island experience provided another set of observations involving setting, “[Looking at] signs going to the beach. Beware. Watch out. No this, no this, no this” (TK-H, May 16, 2013, interview). The signs provided a new paradigm for the students on this experiential journey, rules from the outside world.

Through her photographs, TK-H was the only participant to describe the early morning setting as students were roused from their sleep:

That is the next morning I was too lazy to get out of bed. Mr. J is down there yelling at us to get up and then not wanting to make him sing to us because he promised he would last night, and [pictures of] our breakfast. The sun was really bright that day, brighter than all the others. (TK-H, May 9, 2013, interview)

This description of the final morning created a visual image outside the cottage. There is a social connection to this setting as the teacher interacted with the students.

**Tools.** TK-H did not directly identify any tools as significant to her Stone Lab experience, however she did mention tools throughout her comments. “We were trying, all of us, tried into the microscope to get pictures” (TK-H, May 16, 2013, interview). TK-H used different nets to capture macroinvertebrates, “I liked the macroinvertebrate walk on Alligator Bar. We saw several [species] that I had not seen before” (TK-H, May 9,
TK-H used the identification keys to identify macroinvertebrates, plankton, and plants, “I knew it was Dutchman’s breeches, because I had seen it before, but trying to get it to key” (TK-H, May 9, 2013, interview). She used the camera to capture the light effect caused by her sunglasses, “I put (sunglasses) over the camera lens and took the picture so I could prove, and then the next picture is just naturally, So this is what everybody else was seeing. I was clearly seeing pretty rainbow formations” (TK-H, May 16, 2013, interview). At the quarry, TK-H and LK-H were able to explore the wetland because they had the foresight to bring along boots, “We had to go into this back area that was almost too deep, it hit the top of our boots” (TK-H, May 9, 2013, interview). With the exception of the camera, the tools were integral for TK-H’s experiences, yet were not identified as anything more than enablers to an experience. The camera was used to document and prove a discovery.

Cultural lens.

Peers. Shortly after arriving on Gibraltar Island, the students located their rooms, dropped their bags, and began exploring the island. Many students started by introducing themselves to the students from the other schools, particularly by playing volleyball. TK-H explained through her second photovoice image (Figure 14) and essay:

These two pictures go together because they are each side of the volleyball net on the first day. Volleyball is pretty much the initiation ceremony onto the island; or at least it has been the past two years. This is when everybody meets everybody and we try to memorize names. People face plant into the sand and get laughed at, which is exactly what is happening to somebody in this picture, and laughter is what unites us all.
Figure 14. This is TK-H’s photovoice picture number 1 of the volleyball game.
At the quarry, TK-H and one friend brought boots, so they were the only two who were able to explore the vernal pools without getting cold, wet feet and pants. She enjoyed exploring with her friend, relating many interesting discoveries during their time in the vernal pools. She reported that the experience was made more special because she was with her friend whom she doesn’t get to talk with enough, paralleling TK-H’s description of the dissection, as she and a different friend completed the dissection together, which made the exploring and discovery enjoyable and memorable.

TK-H had peers who shared her values and who were comfortable talking about science. “KL is my best friend and we get very science’ey together.” Describing an experience, TK-H said, “We always just have fun, the three of us. We are inseparable, the three Musketeers” (TK-H, May 9, 2013, interview). To TK-H, peers discovering together makes an experience fun. Simply hanging out with friends provided positive feelings. TK-H liked the option to be with peers or to be alone. When asked if she liked being alone and independent, TK-H replied, “Yes, but only when you wanted it. You could also hang out with everybody too” (TK-H, May 9, 2013, interview). LK-H also recognized how alone time with her friends was comforting:

[Stone Lab makes me feel] good in the sense that you can hang out with all your friends because it was my group of friends hanging out with friends provided positive feeling… Ellen, LK-H, and I at different points escaped back there. Nobody at the campfire could find us. So we got yelled at a little bit because we were lost but we knew where we were. (TK-H, May 9, 2013, interview)

TK-H provided the best description concerning a significant experience with peers that was mentioned by other participants. Not related to the scheduled Stone Lab immersive science culture, an impromptu card game took place the last evening of the trip:
Ok, so I leave there and I go to play cups, which is spoons, if you are familiar with that, we didn’t have spoons, so we had these plastic Dixie cups, and it was a pretty vicious game. Stephanie and I are winning and neither one of us has any letters at this point, she had already been out, so those two are playing and DR-L is here. Well. At one point, we are laughing the whole time, because it is such a vicious game, but DR-L and I lunged over the table one time because we were the last two, knocked the table over, he’s flipped over and I am trying to get the cup this way, and it was really...he got a bruise from it, and he got the cup, even yesterday we were recycling after school like we always do on Wednesdays, and both of us reached for a can at the same time and I got it first and he was, no worries, I beat you at cups, that was the real game, and he went on this tangent about it, so we were talking smack about this game, it was so much fun. (TK-H, May 16, 2013, interview)

No adults were there. It obviously created many memories, and was a significant moment of the trip for multiple participants that will be retold over time. The event was emotional, and socially connecting for the participants. Though not part of the planned Stone Lab experience, this is an example of how social interactions create their own experiences and traditions during a field trip.

**Family.** TK-H thought of her family during the field trip. She took many digital images during the Stone Lab trip, some for specific members of her family. TK-H was interested in a fish that swam upside-down, “the fish is still upside down, which is what I was going for, to show my parents, because they think all upside-down fish are dead, and I have been trying to explain to them it is the swim bladder, it is inflated” (TK-H, May 16, 2013, interview). She needed to share this with her family, displaying confidence and trust that they would be interested, suggesting that she felt supported from home.

TK-H took a photograph of a map of the Lake Erie Islands, and explained that she took that image, “to show my parents where all the islands are located and the depths” (TK-H, May 16, 2013, interview). She desired to help her family understand her experiences, which included the setting. Her photographs included pictures of canons on
display at the South Bass Island Park. “All the guns. My dad was in the military, so whenever there is big guns you have to get pictures because he will tell you all about them, and I am, how do you know these things?” (TK-H, May 16, 2013, interview).

In contrast, TK-H related another instance:

RESEARCHER - Have you talked to other people about the plants…
TK-H - I took pictures of it to prove there were six and they are kind of fuzzy because the camera zoom thing doesn’t work all that well, but my family says, you are so weird, why do you care about that? Because it was a weird plant.
RESEARCHER - So you told them. What did they say?
TK-H - They were, yeah, that is, no big deal. Walk away. (TK-H, May 16, 2013, interview)

She liked to share her experiences with others. She was excited and vested in her experiences while on the trip, and her interest made her want to share this with her family and peers. She recognized that they sometimes did not care to listen or share her enthusiasm.

Teacher. “Teachers are always there in the background, like the man behind the curtain. If you truly show interest or show that you are not doing so well but they know you can do well, they are great, they are there, they are my councilors half the time.”

TK-H did not see the teachers as the generators of her interest in science, but as mentors, guides, and councilors. The teachers helped her develop her interest. The teachers allowed the students to explore on their own, yet the teachers were available and prepared when a student had a question or when a topic needed explained. For example, TK-H explained her interaction with the teacher during the macroinvertebrate activity:

Oh, there’s a bug, but I never know what it is, so it is nice to have the teacher there who can say oh yeah, that is um a lalalala (laughing). They just give out random names and I am like OK, I am pretty sure you just made that up, but OK, we got this. (TK-H, May 9, 2013, interview)
In another example, as TK-H was cleaning the lab from the dissection, two teachers “came in and had us run outside because they thought this looked so cool” (TK-H, May 16, 2013, interview). The full moon was rising directly alongside and then over Perry’s Monument. The teachers made every effort to help all the students to observe this significant phenomenon.

TK-H also recognized that the teachers were different on the trip. They were fun, they talked to students, and they did funny things. They had families just like the students. During the Kelley’s Island hike and exploration, students were spread out through the quarry, alvar, and beach areas. TK-H identified Mr. J’s method of calling students together as one of her six most significant experiences through photovoice (Figure 15):

Possibly the favorite part of the trip, at least for the kids, is meeting our teachers outside of the typical classroom setting. It reminds us that they are people too and that they are there for our learning experience. This is Mr. J ‘caca-ing’ which is his call thanks to hocking hill trips and owl calls, plus his family calls each other in a duck/owl call when they want each other. This trip is also made by the families that are there and the kids we get to play with. The teachers are made even more human by their families.
This moment of the teacher using birdcalls was important for TK-H and other participants and was mentioned on multiple occasions, perhaps because it revealed a new, unexpected insight about the teacher.

During one of the final activities of the field trip experience on the last day, TK-H participated in a maze activity that had just opened along the roadway. A group of students, including TK-H decided to try the maze. TK-H identified this sixth photovoice image (Figure 16) as one of the most important experiences of her Stone Lab trip:

The maze is probably the worst part, the best, but the worst part, it was terrifying, you were literally lost in this maze and Mr. C is, it is going to be fun, kids love it. No. It was fun, because we are all in the maze and none of us thought to partner up, so we are all yelling at each other across the walls, trying to get out of this
thing. At one point half of us went out the entrance, and Mr. J made us go back in and find the exit.

The teacher allowed the students experience the maze, but did not let them take the easy way out. The teacher supported the value of expecting the students to finish what they start.

Figure 16. This is TK-H’s photovoice number 6 of a teacher is preventing a student from taking the easy way out of the maze.

Transferability. Looking back at why she enjoyed Stone Lab’s classes, TK-H identified the non-lecture aspect of a lesson to be the significant difference. “In each class we went outside and did something. Whether it was collecting water or touring the island with Mr. G, or Mrs. G going out and finding plants, whatever. Going outside is a big
difference” (TK-H, May 9, 2013, interview). She explained that it is more than just going outside. Her school has an outdoor classroom. “There is no chalkboard, so nobody can teach out there. It is, let’s go sit. And usually the wind picks up and papers are everywhere, it is not good. We’ve tried, it is not very good” (TK-H, May 9, 2013, interview). She enjoyed the Stone Laboratory general class design, where each class “started indoors with the chalkboard and illustrations and diagrams, but then it changed to where let’s go do something, let’s go pick flowers, take a walk, find birds, or collect water for samples, or go collect bugs” (TK-H, May 9, 2013, interview).

TK-H prefers learning at Stone Laboratory:

You learn a lot, plus you are doing it outdoors, you are also learning what you want to learn about. It’s, if you don’t want to learn about it or you don’t care, you are still going to learn something, but you are not being forced to sit in back of the classroom and just watch people speak. (TK-H, May 9, 2013, interview)

Summary. TK-H is a junior female student who was highly interested in sign language and other languages. Before the Stone Laboratory field trip, she planned to work as an ASL specialist. She believes that lessons become interesting when, “put it in such a different way”. She belongs to science club and was excited to talk about the club and all the activities involved. Agriculture (Ag) was also well regarded concerning science interest. She had to be prompted to mention science fair. Her interest in her project was obvious as she talked about the process. TK-H is sustained by a support system provided by her parents and teachers. Friends are very important to TK-H’s association to science.

It is interesting that the first noteworthy Stone Lab experience TK-H mentioned was the teacher’s talk about the history of the Battle of Lake Erie. Ironically, TK-H
commented in the pretrip and posttrip interviews that she does not enjoy history. Next, TK-H discussed the dissections of the fish and cat. She did the cat dissection with a friend, and refers to her friend throughout the statement about the cat dissection. She acknowledged the situation as a positive learning experience, because she was with her friend, she had teachers there who allowed her and her friend to explore at their own pace, present to point out and explain what the students were looking at. She was excited to have the hands-on experience performing the dissection at her pace.

TK-H identified the plant class as one of the significant experiences on the Stone Lab trip. She located a flower that did not conform to the identification key. This intrigued her, and she tried to understand if the variations were constant throughout the plant, the stem or just the one flower. She was motivated from this experience. This flower discovery was very important to TK-H, and was brought up during a subsequent interview and in her photovoice selection. As TK-H continued to discuss each class and how interesting each was to her, the flowers were again the topic of discussion.

TK-H spoke of the water chemistry labs and their relevance to water quality, which she pointed out, was important for the local communities’ economies and health. She enjoyed the hands-on testing that had actual significance. This topic may have been relevant to TK-H because her recent science fair projects explored water and soil chemistries in a terrestrial environment.

She cannot wait to return to Stone Lab. She has a scholarship for one summer course, and is saving that scholarship for the summer after her high school senior year. She acknowledged that as wonderful as she expects that experience to be, it cannot be the same without her friends there to share the experience.
Since the Stone Lab field trip, TK-H has considered changing her career goals. She is thinking that she would enjoy teaching, and she enjoys the science more than she ever expected she would, so she is considering education work in an organization such as a county agricultural extension service. She discovered that during her internship with her local service, everybody in the office had been to Stone Lab, and she wants to be part of that social network of people who enjoy and love the same things as she does. This is an interesting cultural and cognitive/affective connection, that is both a result of attending Stone Lab, working with people who had been there before, being excited and talking about her experience, and learning how people who had been to Stone Lab years ago developed their love into a career in environmental or biological science. This is the ultimate of interest development, becoming intrinsically motivated to become an expert, to develop an interest into a career.

TK-H wrote this prelude to her photovoice images:

What is Stone Lab? Stone Lab is a wonderful place full of knowledge, nature, food, and people. In the trip we learn many things and we are constantly in nature, but, in my opinion, what truly makes the trip is the people. We get closer to the people we know from school, we meet new friends from other schools, we experience a new side to our teachers, and we meet the people who work in a science/nature field every day of their lives. Here are just a few pictures that truly encompass these things, but to fully get the experienced, one just has to go and be there themselves. I myself have gone two years, and absolutely loved it.

Case Study 3: LK-H

Contextual profile. LK-H is a female high school junior who enjoys health, biology, medicine, reading, hiking, soccer, FFA (Future Farmers of America), and volunteering, with a dislike for math and chemistry. She plans to attend medical school and become a pediatrician. LK-H grew up loving nature and “was inspired to get into
loving animals” during her visits to her grandfather’s farm. She recalled, “The creek was really fun, finding crawdads, trying to catch minnows, seeing the little life forms in the creek” (LK-H, April 9, 2013, interview) Family is very important to LK-H. Both parents encouraged LK-H and her siblings to read and learn, and to explore and embrace their interests. LK-H recognized her interest in science early. During middle school LK-H felt isolated from her peers because she enjoyed science. She attended a summer science program for middle school girls hosted by a university. She was worried about how others would view her interest in science, but was happy to discover that “we were all feeling nerdy.” The summer program was important, because it magnified her interest in science. “I thought it was going to be boring lecture, but we did a dissection, we made robots one time, and it was just really cool” (LK-H, April 9, 2013, interview). Since then, LK-H has learned that there are other girls her age who also enjoy science, and has found such friends in her school.

LK-H attended the Stone Laboratory field trip two years ago as a freshman. “I like [that] the focus is all on learning, it is fun learning, and I like the location because I love Lake Erie” (LK-H, April 9, 2013, interview). LK-H sees the experience as purposeful learning. “It is all applicable, it really helps, it is real science, not just here, take notes on this, you will never actually use it in life - this is an actual career, this is actually happening every day” (LK-H, April 9, 2013, interview).

In class, LK-H appeared unfocused and distracted, sitting in the very back of the room and talking to three other students at that table. During each observation day, she and her table were called out by the teacher to pay attention, but during biology lab, LK-H was engaged and highly focused on the work alongside her partner who was also very
interested in biology. When asked about her favorite ways to learn science, LK-H replied, “I prefer not being forced to sit in a classroom” (LK-H, May 9, 2013, interview). She is frustrated by classes where some apathetic peers fail to do the work and hold the class back, forcing the elimination of the hands-on activities to focus on note taking and other desk work. She explained that she does not enjoy note taking, preferring to learn through laboratories and hands-on activities. She clarified:

School explains it [the lesson], but experiencing it outside of school, or in school I guess, the hands-on things, but actually experiencing it is what helps me to understand it. I guess I am a hands-on learning [person], and being able to relate it to my life helps. (LK-H, April 9, 2013, interview)

**Cognitive/ Affective lens.**

**Interest in science.**  LK-H illustrated interest in science prior to the Stone Lab field trip. During the pretrip interviews, LK-H was asked about her experience in science fair, responding by talking about her projects with enthusiasm and pride:

I noticed that every year my project has something to do with washing hands. I never noticed that every year it had something to do with that. So this past year I did the impact of contact with sugars on blood glucose readings, how does the preparation of the testing site affect the actual reading? Diabetes runs in my family, so it is something that hit close to home and I never realized how prevalent it was in my family until I began asking for volunteers, and then all my grandpa’s siblings volunteered and I was wow, OK, that is fine I guess. (LK-H, April 9, 2013, interview)

The project was personal and was part of the definition of who she is. The realization that her family history involved diabetes added relevance to her study that scored exceptionally high at the state level of science fair.

LK-H displayed curiosity wanting to know how and why, as she spoke about the television show, “Myth Busters”: 
I like how outrageous the ideas, the testing they want to explode, in the end they end up blowing it up anyway. The large scale of those experiments is sort of cool because people send those in, like I want to know too, is that how it really works? (LK-H, April 9, 2013, interview)

Throughout the interviews and suggesting a lack of interest, LK-H did not provide any comments or descriptions of her experiences on the first day of the field trip except during her discussion of the digital images that she took during the trip. She took several digital images the first day, but her descriptive comments suggest a lack of personal connection to the activities depicted in her photos:

…Eagles nest, (pause) geese, (pause) TK-H took the camera, obviously I didn’t know, that was on the way to South Bass. Allison put on her sunglasses and it had already broken, but she put them on, (pause) water snake (pause) I like that picture of WM-H because she looks like an old man, (pause) a little heron, (pause) just trying to get a nice shot of the [eagle] nest, (pause) it was still warm, that was from South Bass, I was trying to take a picture of Gibraltar. Mr. J, (pause) dining hall (pause) I wish we got to go inside the castle, it would be so cool. (LK-H, May 16, 2013, interview)

LK-H identified a notable experience concerning the botany class, suggestive of a new interest in botany:

Mrs. G … showed us flowers that we could find anywhere, like in our backyard … we just passed by those little wild flowers and don’t think about what are they called, what family are they in … but when we actually went on the walk and she was showing us all the plants outside, that was when people were actually paying attention. Having that little wake up, you don’t think about plants often enough. She told us about the invasive species too, which, that is drilled into us so many times at Stone Lab. Ellen actually had a joke running about how we all are stemmed from immigrants, so they should stop hating immigrants, but, it was really cool. (LK-H, May 16, 2013, interview)

There are three important concepts within this statement. First, the teacher made LK-H aware of plants that she passed by daily but did not notice. Second, LK-H observed that a number of students were inattentive during the classroom lecture at the beginning of class, but the students connected with the teacher and activity once they
moved out of the classroom, and began the hands-on plant identification in the field.

Finally, the final portion of the statement illustrated LK-H’s critical thinking skills. She used metaphor and humor to talk about invasive species. LK-H verbalized her new interest in plants by adding:

What really appealed to me was the fact that we all think flowers are pretty but we don’t look at, what else, there are so many flowers we don’t really look at them we just kind of say it is a flower, so getting to know what a flower is, and she told us all the little parts of it, so that was cool. (LK-H, May 9, 2013, interview)

LK-H was amazed and interested how she had never noticed the intricacy and construction of plants and flowers. It required somebody to point out those everyday things by providing awareness and value. Another moment of awareness occurred at the wildlife museum. LK-H commented about an exhibit of beavers:

I didn’t know we have beavers in Ohio. I guess I never thought about it, but I probably have seen them before, we go camping on the Mohican River every summer, so I think we have seen them, I just didn’t realize we do have those in Ohio. (LK-H, May 16, 2013, interview)

LK-H was unexpectedly made aware of an animal’s existence through the exhibit.

LK-H enjoyed exploring, “Striking out on my own was different because all the other activities, I was with my friends all the time, but I was on my own, so I was trying to do, the best I could to find little tadpoles and frogs” (LK-H, May 9, 2013, interview). Based on her comment, LK-H preferred to be with friends, but was not against being alone. She did not verbalize it, but this passage infers that she enjoyed being alone as she explored. When asked what she found interesting about the exploring, LK-H responded:

Finding out what inhabits those little pools of water, because everyone has those little puddles of water, and they have tadpoles and stuff, but before I went to Stone Lab freshman year, I didn’t know what a baby salamander looked like, so the fact that it looks just like a tadpole I was so fascinated by that. (LK-H, May 9, 2013, interview)
LK-H was interested in anatomy and physiology, and was excited to participate in the cat dissection. Her discussion about the cat dissection connected to a fetal pig dissection that was about to commence in her school biology class:

I am really excited about this dissection in biology, because you can see pictures and you can write notes, but you actually get to touch something and take it apart and look at it, that is more meaningful to me. You have to feel the experience, not just watch it. (LK-H, May 9, 2013, interview)

After the trip, LK-H tried to explain the effect Stone Laboratory experience had upon her interest in science:

It has gotten me more excited for college, honestly, because it was being there, learning things I actually want to learn that I am happy to sit and listen to. It makes me feel let down at school, because I wish this was over already so I could get into the classes I want to take, so it has made me more excited to go to college. (LK-H, May 9, 2013, interview)

Having experienced effective informal learning, she does not think highly about classroom learning. She believes that college courses will be better than high school courses. LK-H continues, describing new interests that she developed at Stone Laboratory:

LK - I have always been interested in anatomy and physiology and also, horticulture and ornithology, those are things that I hadn’t really shown any interest in before, but I would say now at least I am thinking about those things. RESEARCHER - What do you think was the cause of the change? LK - Just taking in anything I was taught at Stone Lab, really helped open my mind to those things. (LK-H, May 9, 2013, interview)

The Stone Lab experiences helped feed LK-H’s intrinsic motivation, strengthening her interest in life science. “It has strengthened, enriched it [career path], “I want to go into medicine and it has encouraged that path” (LK-H, May 9, 2013, interview).
Prior interest and knowledge. LK-H experienced the quarry for the second time, and was able to draw upon her initial experience to help understand and reinforce what she previously learned. In a statement cited earlier, LK-H identified her experience from two years ago as significant, because this year she knew what to look for and what she was observing, “Before I went to Stone Lab freshman year, I didn’t know what a baby salamander looked like, so the fact that it looks just like a tadpole I was so fascinated by that” (LK-H, May 9, 2013, interview). LK-H did not glean much new information, but recognized that her previous knowledge was being reinforced. “I had already done these things freshman year, but I think it was still a good experience because renewing those memories, and having new ones because new friends went” (LK-H, May 9, 2013, interview).

LK-H described her quarry experience:

I remember it from freshman year, that is like a big thing that I loved doing. Just putting on muck boots and wading through all those pools of water, finding little creatures was really cool. And catching little baby salamanders, that was really fun. I always used to catch tadpoles with my little brothers and sisters at my grandparent’s house, so just like having a scientific aspect to that now is cool, and it is just such a cool place, the old quarry. (LK-H, May 9, 2013, interview)

At the start of this case study, LK-H discussed playing in creeks. Here, she recognized the connection between her past and present experiences. She identified prior knowledge from her first trip to Stone Lab, and then she identified prior interest with her siblings in a similar activity. LK-H related another experience which illustrated prior experience and interest with her family:

I think [the crystal cave] was really neat. When I was little we found a geode and I kept it and treasured it, so getting to go inside of one was really neat. And then telling my little brothers and sisters about it, it was really fun, too. (LK-H, May 9, 2013, interview)
Prior knowledge did not guarantee positive results or experiences:

I was, not disappointed, but I was hoping for more this year, because I had already done these things freshman year, but I think it was still a good experience because renewing those memories, and having new ones because new friends went. (LK-H, May 9, 2013, interview)

LK-H did not get to experience new activities on Gibraltar Island, but she acknowledged knowledge reinforcement gained two years ago.

Affective responses. LK-H identified the plankton lab as her most notable Stone Laboratory class experience. The length and description within her explanation suggests that she was moved by this experience, creating a sense of awe and wonder:

I really enjoyed looking at the phyto- and zooplankton because it was so cool to see something on such a small scale, but still life. You know? So, I found a lot of really cool one … I was like oh my gosh, it is moving! It was so cool, just getting to identify those tiny creatures. It [stirred a feeling of] awe, I guess. Life on such a small scale, you don’t really think about all those little beings in the water, so getting to look at them up close, and see what they are made of, and how they move, it was really neat. (LK-H, May 9, 2013, interview)

LK-H related another moment of awe and wonder during the Kelley’s Island experience at the alvar:

I kind of felt like I was on top of the world because it was like, you could stand on the edge of it and, the water’s not too far away, but you can still, you are still above it, you can still see so far away when you are up there. And I think it was really cool, because you could see the sky in the horizon and that is when it was going to start raining and you could see exactly where it was raining, on Put-In-Bay, you could see the rain coming down over there, and it was travelling towards you, to have that scope, was really cool. (LK-H, May 9, 2013, interview)

In another affective comment, LK-H identified the evening cat dissection activity as a notable Stone Laboratory activity. “I don’t know why, but it is kind of moving, because when you see those tiny little kittens, it is, it strikes you how similar they are to, how babies are” (LK-H, May 9, 2013, interview).
LK-H was moved emotionally by the evidence of the glacier’s enormous size and power. LK-H commented, “It is so immense, the history behind it is what appeals because you are always told that glaciers traveled through Ohio and blah blah blah, but the actual physical proof is right there, so seeing that is really neat” (LK-H, May 9, 2013, interview). LK-H had been told about the glacial grooves, but that information meant nothing until she saw the formation with her own eyes.

LK-H was excited by science, as illustrated in the contextual section. Her excitement was palpable as she talked about dissections at school:

I really enjoy dissections too. I did just last month we did a sheep brain dissection in Ag, and it was really fun. TK-H and I were really into it, and everybody else was really into the questions and we were like, wow, look at that, it is so cool, and people were staring at us. (LK-H, May 9, 2013, interview)

She noted how excited she and her friend were, and how her classmates seemed to lack excitement.

Finally, LK-H appears to have developed a connection to Stone Laboratory and Gibraltar Island. During this, her second time on the island, LK-H began to feel the island’s charisma. She reflected on the Stone Lab classroom building:

I like the history, the background behind it. That it has been there so long and so many students have come there, and have had life changing experiences and learned so much. I like that it has that feeling of age and that feeling of knowledge in it. (LK-H, May 9, 2013, interview)

Physical lens.

Setting. LK-H found the setting to be important. She enjoyed the history of Stone Laboratory, thinking about who was here and what happened in the past. As just cited, “That it has been there so long and so many students have come there, and have
had life changing experiences and learned so much. I like that it has that feeling of age and that feeling of knowledge in it” (LK-H, May 9, 2013, interview).

She admitted that these same activities back at school may not have interested her, but at Stone Lab, they were interesting and exciting. “At Stone Lab, it’s like, just those experiences and you have only a limited time to experience them, so I guess I wanted to jump onto every experience I could” (LK-H, May 9, 2013, interview). She enjoyed conducting field work, playing and exploring in nature.

From her comments, it is apparent that she appreciated the beauty that she encountered at the quarry:

LK - Oh, that is just by the quarry, it was really cool looking, the water was so clear you could see the reflection of the trees. I was on my own at this point, so I was just kind of exploring.
RESEARCHER - Nobody was with you?
LK - No.
RESEARCHER - Was it on purpose?
LK - Not entirely, that was the point where I had boots on and my friends didn’t so I could go walk through the water. (Pause) And that tree was really cool, I thought so. (Pause) And that was another picture with one the effects on it, the coloring is cool, (pause) and a miniature tree. I did like the solitude, I was just off on my own, so like, just exploring independently, I thought was nice. (LK-H, May 16, 2013, interview)

LK-H was noticing her surroundings. Her levels of observation focused on the uniqueness of her surroundings, illustrated by her commentary explaining why she took some digital photographs of scenery, “I don’t know. Honestly, I think it was because, just seeing the different environment of this area” (LK-H, May 16, 2013, interview).

LK-H identified her island housing as a significant setting, “The cottage was really significant to me because I was with my friends, we were all crammed into one room. That was significant” (LK-H, May 9, 2013, interview).
**Tools.** LK-H identified the plankton lab as her most notable experience on the Stone Lab trip. Students used microscopes to observe and identify plankton obtained during the Science Cruise. As was cited in the affective responses section:

I really enjoyed looking at the phyto- and zooplankton because it was so cool to see something on such a small scale, but still life…getting to look at them up close, and see what they are made of, and how they move, it was really neat. (LK-H, May 9, 2013, interview)

The tool provided the opportunity for LK-H to experience the microscopic community.

The boots were an important tool during the quarry experience. LK-H learned during her first Stone Lab experience that boots would allow her to explore the entire wetland area, “I remember it from freshman year, that is like a big thing that I loved doing. Just putting on muck boots and wading through all those pools of water, finding little creatures was really cool” (LK-H, May 9, 2013, interview).

LK-H implied the use of many tools, from the boat and the instruments onboard, to plant identification keys to binoculars in the bird class, however she never identified the tools specifically: “we were playing on the top deck, in the wind” and “she was having us try to identify them” (LK-H, May 16, 2013, interview).

**Cultural lens.**

**Peers.** When asked to describe a noteworthy experience while she was at Stone Lab, LK-H’s first response concerned the trip to Kelley’s Island aboard the Jet Express boat. The waves on the lake were 4-6 feet high and a moderately strong wind was blowing. The students were experiencing the motion effects of the boat, plus the wind and water spray as the boat sped through the rough water. “We were up on the top deck and we were playing around, the wind was blowing so hard, but just acting goofy with
my friends was really fun” (LK-H, May 9, 2013, interview). The boat experience was fun because friends were sharing the experience. During the final interview, she described the photographs that she had taken of this experience:

That was when we were playing on the top deck, in the wind (laughing) and everyone was laughing about my hair, and I was what are you talking about, so that is why I took a picture of myself, to see what they were laughing about. (Pause) That one looks almost like an anti-gravity area because their hair is floating upward. (LK-H, May 16, 2013, interview)

LK-H described an unplanned experience that was social and playful and highly stimulating to the senses. The combination made this a powerful memory.

Cited as an example of setting, the cottage was also an important for peer bonding. Instead of sleeping in the dormitory building, junior and senior girls had the option to room in the Barney Cottage, an old home restored to house students. LK-H was one of four students who slept in the second floor loft. LK-H talked about her housing arrangement:

The cottage was really significant to me because I was with my friends; we were all crammed into one room. That was significant. And the fact that we were upstairs and every time we made a noise, people would start yelling at us, so we started dancing, I guess as a freshman I didn’t get that experience, I am an upper classman, I have seniority now guys, you can’t yell at me. So that was something new and something fun. (LK-H, May 9, 2013, interview)

She also recognized that new friends on this trip redefined the experiences, “Making memories with my friends was something I was really grateful for. I am grateful because that was my last opportunity to go” (LK-H, May 9, 2013, interview). When asked how she feels a week after the trip, she responded, “I wish I could go back. I wish we could have spent more time there” (LK-H, May 9, 2013, interview).
wording suggests that she identifies this social group as important to her Stone Laboratory experience. She is not thinking of life without this social group.

Although LK-H enjoyed being with her friends and peers, she was not bound to them. She enjoyed being alone at times. “I did like the solitude, I was just off on my own, so like, just exploring independently, I thought was nice” (LK-H, May 16, 2013, interview). “They had already walked over there so I was, like, still on my own, wandering around in the middle of the woods” (LK-H, May 16, 2013, interview). LK-H was comfortable and confident being alone in an unknown outdoor locality. “Striking out on my own was different because all the other activities, I was with my friends all the time, but I was on my own, so I was trying to do, the best I could to find little tadpoles and frogs” (LK-H, May 16, 2013, interview).

LK-H encouraged underclassmen at school to attend the next Stone Laboratory trip:

I have been trying to encourage other people to get involved and I think I have actually succeeded, with a couple, so yeah, I think it has changed my view a little bit because I get to spread to spread the ideas, I already love science, but spreading my love of science now. (LK-H, May 9, 2013, interview)

LK-H concluded by talking about her final activity on South Bass Island:

We got a golf cart and Allison was going to drive, she kind of freaked out a little bit, because, where is the blinker, do I use my turn signal, what do I do guys? I was like, come on, you said you could drive this thing. (LK-H, May 16, 2013, interview)

**Family.** Family is very important to LK-H. Her parents strongly support science studies, thus have significantly influenced her interest in science:

My parents, and my grandpa, had a big influence on me, he is the one who has the farm, to see his relation to the animals, it is kind of how I was inspired to get into loving animals and all the stuff….whenever I have an assignment in bio that I
think is interesting I will discuss it with my little brothers… it is cool to introduce them to things, and to see what their feelings are about it. (LK-H, April 9, 2013, interview)

The family embraces and supports learning about the land, the animals, and exploration of processes, such as cooking and chemistry. The siblings support each other in their learning. LK-H’s grandfather’s interest in birds inspired LK-H to learn about birds by adding relevance to the class:

The ornithology class I found interesting because I remembered a little bit from last time as a freshman, but having a refresher was really cool and my Grandpa is really interested in birds, so why does it appeal to him, why is he interested in that. It was cool to hear all those names and everything and I actually used the knowledge the next day after we came back. We went to the zoo and the aviary, and we saw a red winged blackbird, and my Mom said, what is that bird called, and I said it, and she said that I was being sarcastic, because I said it so automatically, but really what is it called. And I said, seriously, it is very obviously a red winged blackbird, Mom (laughing) I guess being able to apply that just offhand knowledge was really neat. (LK-H, May 9, 2013, interview)

Her Grandfather’s interest in birds generated value, providing a reason to learn about birds. His interest added relevance to the class. After the trip, LK-H had the opportunity to apply her knowledge which reinforced the value of bird identification. Being able to identify the bird gave her pride, perhaps motivated her to learn more bird identifications, and helped her place value on the blackbird now that it has a name.

**Teachers.** LK-H stated during her pretrip interview, “Having a mentor, someone to look up to in the field of science helps” provide a dream, a goal, and a purpose for learning. LK-H wanted to trust, be comfortable with her teachers at Stone Lab, and expected each teacher to be a good educator. “Mr. J is obviously a good teacher, and so that was a fun experience” (LK-H, May 9, 2013, interview).
The botany teacher instilled a sense of value during the plant class, “She was explaining and she just pulled out the pressed flowers from the cabinet and it was really cool because she said there were some from even back to the 1940s in that cabinet, so that was really neat” (LK-H, May 9, 2013, interview). By showing plants important enough to be preserved from 70 years ago, the teacher’s respect for the preserved plants was felt by the students. Later during the same class, the teacher talked about invasive plants and how they should be pulled out of the ground if found, and the teacher followed through during the class by pulling invasive plants from the ground during the class plant walks. LK-H was observed pulling invasive plants from the ground for the remainder of the field trip.

LK-H spoke about one of the teachers who assisted the dissections:

Mr. G is a really great teacher too, so having him as an instructor was a really cool bonus. He reminds me of my grandpa, so his patience with the people who were just trying to cut into the cat, he was like, let’s take this slow, so that was kind of cool. (LK-H, May 9, 2013, interview)

LK-H only mentioned casual interactions with teachers only once. While describing her trip photographs, LK-H commented, “I was playing around with the camera and Mr. J stuck his face, so there you go” (LK-H, May 16, 2013, interview). This single instance revealed a candid behavior by a respected teacher that LK-H did not see in the classroom.

**Transferability.** Having experienced effective informal learning, LK-H did not think as highly about classroom learning, maintaining a perception that school science and the real world are not connected.

But experiencing it outside of school, or in school I guess, the hands-on things, but actually experiencing it is what helps me to understand it. I guess I am a hands-on hand learner, yeah, and being able to relate it to my life helps, if it is something I don’t care about I am not going to pay attention to it. In math, never
is my best subject, and I know I am not going to use this in life, like geometry, you are never going to use it, I don’t understand the point of it, I don’t think it is helpful, so that is something that I think I will not relate it to my life, and there is no way to experience geometry unless you are building something. (LK-H, May 9, 2013, interview)

When asked if there was anything specific she could identify at Stone Lab that caught her interest, LK-H responded, “I don’t know, I can’t pinpoint it, I would say, (pause) the fact that we still learn but it is, things you want to learn, it is willing, it is not being forced to sit in a classroom, that is what really helps keep me interested at least” (LK-H, May 9, 2013, interview).

LK-H was frustrated with formal classroom learning. She wanted to do more, go deeper, do hands-on, but was frustrated by unmotivated classmates, who held the class up:

I would like to do more hands-on things, but I know time plays a big part, and when the class is not cooperating doing notes, then we don’t have time for a lab, like in freshman year, bio I we barely got through the labs because we were barely able to get through the notes. Even though I was in an honors class, it was people didn’t really get motivated to get the notes done to do the labs. (LK-H, May 9, 2013, interview)

LK-H described some students during the Stone Lab classes as unmotivated and impeding the learning process. For example, while she was exploring plankton samples taken on the research boat trip, other students were trying to figure out how to use the microscope, a basic skill they should have known.

I really enjoyed looking at the phyto- and zooplankton because it was so cool to see something on such a small scale, but still life. You know? So, I found a lot of really cool ones, and everybody else was like, how do you focus these things? (LK-H, May 9, 2013, interview)

While LK-H was exploring and discovering, other students were trying to figure out how to use the microscope, a basic skill they should have known.
LK-H recognized that an experience by itself is not sufficient, that somebody needs to point out something to make others aware of its existence. After the Stone Lab trip, she began to notice things that have always been around her:

What really appealed to me was the fact that we all think flowers are pretty but we don’t look at, what else, there are so many flowers we don’t really look at them we just kind of say it is a flower, so getting to know what a flower is, and she told us all the little parts of it, so that was cool. (LK-H, May 9, 2013, interview)

It takes somebody or something to point out those everyday things, whether it is flowers or bird songs.

When asked for her opinion of how well Stone Lab activities and lessons might be transferred and presented in her classroom, LK-H responded:

The group of students is different, so that might lead to variation. Obviously the students who went to Stone Lab, they at least show somewhat of an interest in science courses. So, they wouldn’t go on a science based trip unless they kind of liked science. A lot of students in our science classes now only see it as a requirement, in biology especially, some seniors are so ready to be done with it, and they never saw it as an essential class. That might be a little different than classes at Stone Lab. But then again, if you have more hands-on experiences, they might be more interested in the class than they were before. (LK-H, May 9, 2013, interview)

LK-H’s statement identifies two segments of students, those who like science, and those who have to take science class to graduate. She is unsure whether Stone Laboratory type classes would succeed in her school. But the final sentence is interesting. Would the lecture plus hands-on methodology change how students view science? She spoke further about hands-on classes:

You are looking at it or hearing it, it is not the same as actually feeling it. It has to do with getting the students to pay attention, to actually want to comprehend, if you actually put something in front of them, they can experience, then I think the more open the learning, so that is why it should be included in every class. (LK-H, May 9, 2013, interview)
LK-H repeatedly mentioned hands-on learning during her posttrip interview. Her discussion about the cat dissection led to her comments about a fetal pig dissection that was about to commence in her biology class:

I am really excited about this dissection in biology, because you can see pictures and you can write notes, but you actually get to touch something and take it apart and look at it, that is more meaningful to me. You have to feel the experience, not just watch it. (LK-H, May 9, 2013, interview)

When pressed if she would enjoy the classes that were taught at Stone Lab instead be taught at her school, LK-H replied:

If someone said hey, do you want to go do this to me now (at school), I would be eh, not really, but at Stone Lab, it’s like, just those experiences and you have only a limited time to experience them, so I guess I wanted to jump onto every experience I could.” (LK-H, May 9, 2013, interview)

**Summary.** LK-H is a student who is very interested in the sciences. She recognized her interest in middle school, and also learned that her peers did not accept her as one of them because of her interest in science. She did not fit in with her female peers and felt alone. She participated in a science and women workshop with other girls her age, which reinforced her interest and let her know that she was not alone. The program may have anchored her interest and allowed it to develop to the point that she is presently headed for a career in medicine.

LK-H is family oriented. Her family is very important to her. She draws support from not only her parents, but also from her siblings. They explore and experiment regularly at home and commonly discuss science and science related issues.

LK-H does not enjoy note taking, preferring to learn through laboratories and hands-on activities. She is frustrated by students and classes where some apathetic peers
fail to do the work and hold the class back, forcing the elimination of the hands-on activities to focus on note taking and other desk work.

On multiple occasions, LK-H revealed interest in small creatures and microecosystems. Her words suggest awe and wonder as she talked about viewing the world of phytoplankton and zooplankton, as well as exploring an isolated wetland for larval amphibians. She reveled in personally experiencing the creatures and plants. In another instance, LK-H was made aware of plants, and learned the art of plant identification. By learning about the plant anatomy used for identification, she was made aware of the intricacies that she’d always seen, but never noticed until the teacher helped her to perceive plants. LK-H is excited about science, each experiential activity was enjoyed.

**Case Study 4: DR**

**Contextual profile.** DR-L is a male senior who enjoys math, science, Spanish, music, soccer, and reading. “I want to become a teacher, or if that doesn’t work out, anything that has to do with math, because that is what my favorite thing is” (DR-L, April 10, 2013, interview). Science is considered an enjoyable pastime subject:

> I like using it as something entertaining and fun, my dad is always watching sci fi, so I have always been interested in reading science magazines, learning about new technology, what they thought would never be part of our future, but is becoming more and more of our present. So yes, it would be more for the entertainment as opposed for what I would use for my job. (DR-L, April 10, 2013, interview)

DR-L had a firm belief of how a student should learn science. Math and physics were about formulas. Biology required listening skills and note taking. The way to pass was to listen, ask questions, work with peers, and work with the teacher outside of class:
In the classroom, the biggest part about learning science is listening obviously. With math, you can look at everything and see how it works out. It is the same with physics, too, but only if you know the exact formulas, and everything. Or how they work or how they can be changed. With science, if it is biology, and if you don’t listen that day or you don’t take notes, then you are done, because there are a lot of roles, and different parts of it, but there are so much stuff to remember, so it is listening and it is asking questions. (DR-L, April 10, 2013, interview)

DR-L felt that associating with the right people will help him learn:

Maybe your peers can help you. I know other students can influence whether I learn it or not. Or whether I listen or not. And then my teacher, when I was in Biology 2, Mr. J helped a lot. Teachers are good for asking questions. I stayed a lot after school to study. (DR-L, April 10, 2013, interview)

DR-L identified the benefits of a formal setting and of an informal setting:

School helps me to understand more than anything. But going home and experiencing something, or when I look stuff up on the Internet, they do help out when I come back to school the next day, where I am applying something to a theme, or whatever it may be. (DR-L, April 10, 2013, interview)

DR-L enjoyed helping the science teachers during his study halls. He served as an officer in science club, and created the school chess club. DR-L had never seen the Great Lakes or ocean, so the Stone Lab trip was his first experience seeing big water.

During the two pre-trip classroom observations, DR-L began each physics class in the front row, but halfway through each class period he moved to sit with male friends in the back corner of the room, where he worked on the classroom problems and his friends talked and did no class work. Although he appeared not to be paying attention, he often answered the teacher’s questions, always correctly. He also was the only person in class able to correctly answer the assigned problems. DR-L appeared to be very good in math, appeared unchallenged, and became easily bored. When asked, DR-L responded that he prefers math because “you can look at everything and see how it works out.” Physics is the same as math, “only if you know the exact formula” (DR-L, May 14, 2013,
interview). He explained that he did not enjoy biology, and that science is fun for recreation.

**Cognitive lens.**

**Interest in science.** In the new setting of open water and islands, DR-L wanted to explore, he had a sense and need for discovery of the unknown. “I felt adventurous. It was definitely different and foreign. I had never been to anything like that before. I thought it was kind of cool” (DR-L, May 14, 2013, interview). He was intrinsically motivated to learn about this new environment. Once he was taking part in the assigned classes, DR-L admitted he felt some interest and some motivation to participate:

> When I saw the minerals they had out in that one room, the bird room. They had that copper they found there on the island, stuff like that, and I wanted to learn a little bit more about anatomy and I wanted to know a little bit more about botany. (DR-L, May 14, 2013, interview)

DR-L talked about the one class that he enjoyed:

> The bird one was pretty cool. I definitely liked that one the most, because I feel I learned the most out of it. And plus my dad likes to bird watch, so it was interesting to me...My dad has talked about bird watching before, so I knew a little bit about that. I did not know we were doing that, but as soon as I heard, I was wow, that won’t be too bad. (DR-L, May 14, 2013, interview)

In spite of the bird watching hike occurring in a cold rain, some birds were observed in the bushes and trees. DR-L observed, “You are walking around all day and you take them for granted, but if you stop for a second and look around, you can see tons of different species, that I didn’t even know existed” (DR-L, May 14, 2013, interview).

Interestingly, the plant class did not have the same effect. “It would be cooler if it was like, what you could do with the different flowers or plants or stuff like that. I know some flowers you can make soaps out of, or they tell you where water is” (DR-L, May
DR-L revealed minimal interest in the botany class. During the final interview, he answered the researcher’s question and then changed the subject. This evidence suggests that minimal interest development occurred from the plant pressing activity.

DR - She is looking at a flower. I was getting Allison. (laughing)
RESEARCHER - What did your class do with the flowers?
DR - Oh, we were keying them out, and I think she went back and pressed some for her mom, but, I don’t care much about pressing flowers. [Back to looking at photographs] That is more botany class. That is just, I think that is out the window. (Pause) The clock. I was waiting for the class to be over. (DR-L, May 16, 2013, interview)

DR-L was anxious to look at the plankton specimens collected during the boat trip. The anticipation suggested interest, but he quickly lost interest because his specimen was void of any organisms. “I thought [the plankton lab] would be more fun if, my samples contained something because I looked through two of them and I did not get anything. After that, I was really bored” (DR-L, May 14, 2013, interview). Experiential learning activities in the field may come up empty at times, so teachers must be prepared to improvise to keep the students’ interest.

He believed his motivation was created through the passion of the teachers and the way they taught the subject matter. DR-L explained how an activity grabbed his interest:

The way that people teach it. The people there when they taught stuff, they really, you could really tell that they liked it. They weren’t teaching because they had to, or because they were getting paid to. It was like they were teaching because they loved the subject material and they liked being there. It was something that was part of them. (DR-L, May 14, 2013, interview)

DR-L saw a mounted gar (fish) at the wildlife museum and remembered characteristics specific to this fish, taught in the fish class at Stone Lab the day before.
“That was that long fish, I think those were the scales he was talking about in the fish lab which are like diamonds” (DR-L, May 16, 2013, interview). In spite of not finding the topic interesting and the climate distractions, DR-L remembered that small nugget of fact, showing that learning was taking place.

DR-L did not see the relevance of scientific knowledge in everyday life:

I think [Stone Lab] offered some good things, but it is not things that are so important that they need to be taught at school. I think they are things that are important and we need to know, but it is definitely not something that is required because if you grow up and you, unless you are an important scientist, you are not going to need to know the birds or whatever, but…yeah (DR-L, May 14, 2013, interview)

DR-L experienced and was engaged with the activities, but the experiences were not meaningful enough for him to describe it beyond a superficial way. He had fun, but found little to excite or motivate him to further explore any of the sciences. He may have failed to develop any connections to the science, or so much happened so quickly DR-L had not had time to internalize, reflect, and process them.

When asked to identify a specific activity that stood out to him, DR-L replied:

Everything. Like walking around, on South Bass, whatever, we were looking at the giant geode, playing Putt Putt, going down to the one beach and looking at the, looking for snakes, whatever. The smooth rocks a lot because I have never seen rocks that smooth before unless they were in a store. I remember Stephanie brought some home to put into a bowl for her family. I brought some home to show my Dad. Stephanie brought a whole handful. Watching the sun set when it was, when the waves were coming in. (DR-L, May 14, 2013, interview)

It is possible there is deeper affective response than appears in this interview.

There is another possible explanation.

Immediately after the field trip, it was observed at the participants’ school, that a foreign language teacher’s either lack of planning or understanding the students’
situations, caused a burden on DR-L and many of the students in the school, and hindered other subjects’ programs. A school is interconnected and when one teacher fails, it affects all the teachers and students. The foreign studies workload diminished the motivation and excitement that DR-L possessed upon returning from the Stone Lab trip. The ineffectiveness of the foreign language teacher unrelated to the science program, possibly prevented DR-L from achieving short term growth from the Stone Laboratory experiences. The posttrip interview took place after this situation occurred, so it is possible that DR’s responses may have been significantly different if the interview was conducted immediately after the field trip.

Prior interest and knowledge. DR-L participated on the Stone Lab trip with prior experience of playing outdoors, “We lived on a farm, and I definitely like to be outside, playing with sticks, beating each other up, I have brothers, so…” (DR-L, April 10, 2013, interview). He was comfortable and familiar with playing in the outdoors, suggesting DR’s prior knowledge and experiences in the outdoors may have bearing to how his Stone Lab experiences might be assimilated. DR-L found the bird class interesting, explaining that his dad was interested in birds, which provided relevance and value to the topic. “My dad has talked about bird watching before, so I knew a little bit about that. I did not know we were doing that, but as soon as I heard, I was wow, that won’t be too bad” (DR-L, May 14, 2013, interview). The topic of birds fit within DR’s family values, so he readily engaged with the topic. Another example of prior knowledge consisted of DR’s previous interest in rocks allowed him to approach the fossils and rocks with comfort and renewed interest. “I have always liked to talk about rocks and minerals like
that. I felt it was neat that there were fossils in them. I just liked going over what I had learned in the past” (DR-L, May 14, 2013, interview).

**Affective responses.** DR-L made this first field trip observation through photovoice while he was aboard the ferry that carried the students from the mainland to South Bass Island:

This is one of my favorites (Figure 17) because of the main point of the picture. The American flag. The red, white, and blue banner always causes a strong feeling that washes over me and helps me remember everything that so many people have given for us to live the way we do.

![Figure 17. This is DR-L’s photovoice image number 1 of a flag on the ferry.](image)

Shortly after arriving at Gibraltar Island, students explored and relaxed during the late afternoon and evening. Because DR-L had never experienced big water before, the
constant motion of the water drew his attention and created with DR-L a feeling of
calmness. He named this observation during his explorations of Gibraltar Island as one
of his five significant experiences:

I chose this as one of my favorite photos (Figure 18) from the trip because of how
soothing it is. It is one of the most calming photos I think I took there because of
how simple and clear it is. Water rolling over smooth rocks. If I listen to ocean
waves, it's like I'm back there for that single warm day.

Figure 18. This is DR-L’s photovoice image number 3 of the shoreline on Gibraltar
Island.

Looking out over the lake, seeing the vast open water and storms moving across
the lake and watching the endless waves and their effects upon the shoreline created an
affective response with DR-L:
You have a big green lake with solid waves coming in, a hard rocky beach, and then a big storm on the horizon. It always reminds me of how calm it was before the storm and then how much it rained once it arrived. I told SN when we saw the cloud that I could see the rain coming down from it and sure enough once it arrived she claimed that it was the truth. All in all that was one of the more enjoyable moments on the trip. (DR-L, May 16, 2013, interview)

He spoke on several occasions about the vastness of the lake. DR-L chose this moment as his most notable experience on the field trip. It is unclear if he was aware of the awe and wonder that he revealed, but it is evident during his interviews:

Just the vastness. It looks like the sea, I guess. I have never been to the ocean. We sat there and watched it, and then there was a big storm off in the distance so we came in and it went from dry and slightly warm to just pouring down rain, that was kind of a, that was a neat thing. The way the water moved, the way you could see the water had been going in the same pattern for like, a hundred years, it dug a circular shape into the rocks. (DR-L, May 14, 2013, interview)

This awe and wonder leads to a strong, personally relevant memory empowered by value and an emotional connection that will permit many new future connections for new interest and learning. DR-L also confessed that he felt a connection to Stone Laboratory:

Sometimes [Stone Lab] made you feel warm inside, like even though it was cold, it just felt like, something was really neat about it, like it was different, you can’t really explain it, but it was different. (DR-L, May 14, 2013, interview)

Through this abstract description of how Stone Lab made him feel, DR-L seemed to have been experiencing deep emotions that he could not define.

**Physical lens.**

**Setting.** DR-L selected an image of the alvar as one of his five most significant experiences on the field trip. He wrote:

This photo (Figure 19) strikes my eye because of all of the contrast. You have a big green lake with solid waves coming in, a hard rocky beach, and then a big storm on the horizon. It always reminds me of how calm it was before the storm
and then how much it rained once it arrived. I told Stephanie when we saw the cloud that I could see the rain coming down from it and sure enough once it arrived she claimed that it was the truth. All in all that was one of the more enjoyable moments on the trip.

Figure 19. This is DR-L’s photovoice image number 4 of the alvar on Kelley’s Island.

DR-L had never seen big water before. He was struck by the vastness of the water. He implied on several occasions that he found peace and a sense of calm by sitting and looking out at the lake, watching and listening to the waves, using his senses to learn about and understand that environment. For example, as DR-L cited earlier (Figure 18):

It is one of the most calming photos I think I took there because of how simple and clear it is. Water rolling over smooth rocks. If I listen to ocean waves, it's like I'm back there for that single warm day.
While describing his images, DR-L exclaimed, “That is the waves coming in. It is really peaceful.” He identified this experience as his fifth important experience on the field trip (Figure 20):

The sunset to the side and the waves rolling up on the side of the island is another calming photo that I enjoy looking at. There isn't much to say here. Simplicity and natural beauty win again. This photo also causes me to remember that night though. It was cold that entire day, but got warmer at night and I had a few good laughs at that beach taking photos and picking up rocks with Stephanie.

Figure 20. This is DR-L’s photovoice image number 4 of the shoreline on Gibraltar Island.

With the exception of the alvar and shoreline experiences, the setting provided DR-L the context for an experience with peers or learning as he described photographs:
“Everyone is covered with water from the rain and the waves are splashing really high before that,” “That is the waves coming in. It is really peaceful,” and “[this image is] the sunset that night, after we got done with the meeting, because the waves are coming in, I don’t know how to describe it” (DR-L, May 16, 2013, interview).

DR-L was the only student participant who commented regularly on the climatic conditions. “Probably being on the boat when it was storming wet and rainy, even though we were all cold and freezing and one of the girls had to use the restroom on the boat, it was pretty fun” (DR-L, May 14, 2013, interview). He acknowledged that it was cold and wet and miserable, although he also explained that he still enjoyed himself. In a separate interview, DR-L commented, “I was talking to a friend about how freezing cold it was and it was nasty back on the mainland” (DR-L, May 16, 2013, interview). Still, he wanted to return when the temperatures are warm, to experience the classes again:

I would definitely go [return during the summer time]. So long as I have mosquito repellent I would go. I think it is because I am a farmer, but I would rather sit in 102 degrees and sweat than be 50 degrees and chilly. Others say you can always put more layers on, but I feel uncomfortable when I wear a lot of clothes. I’d probably take everything again that I did that time because it would be warmer and I could pay attention more. It is hard, when Mr. G, he was giving his lesson when he was talking out in the morning and talking about the island. I was freezing so half the stuff went right over my head. (DR-L, May 14, 2013, interview)

His interest has been piqued, and he realized that there was so much more to experience than what he and his cohorts experienced on this cold, rainy April week.

**Tools.** DR-L directly and indirectly identified tools that maximized his and the other students’ experiences. Speaking about the science cruise aboard the research boat DR-L observed:
Mostly the tools we got to use, we got to see how clear the water is, the depth of the water, what direction the waves are going, how they use that to do whatever they have to do. I was the guy who collected the data, so everyone would do the tests and I would write everything down. (DR-L, May 14, 2013, interview)

DR-L spoke indirectly about the tools he used in the quarry, “At the rock quarry, we were breaking rocks together, we were looking at different stuff” (DR-L, May 14, 2013, interview). “Breaking the rocks in that quarry was pretty fun” (DR-L, May 16, 2013, interview). During the botany class, DR-L observed, “Oh, we were keying them out, and I think she went back and pressed some for her mom, but, I don’t care much about pressing flowers” (DR-L, May 14, 2013, interview). And concerning the ornithology class, DR-L said, “the bird one was pretty cool. I definitely liked that one the most” (DR-L, May 14, 2013, interview). Indirectly, DR-L acknowledged using tools such as rock hammers, goggles, identification keys, binoculars, and field guides, while passing on the opportunity to utilize the plant press.

Cultural lens.

Peers. Peer relationships defined whether DR-L’s experience would be positive or negative for him. The first notable experience DR-L named was the rough, rocky science cruise boat trip:

When I was on the boat, there was sort of like a companionship because everyone was huddled together to stay warm, even though it was really cold, it was still, like against the elements, you were having a ton of fun, and you are learning a lot, so it is a good feeling. I think everyone was working together equally. TK-H always wanted to do stuff and she was like asking me if I wanted to do anything else or sit down, because she was afraid I was getting cold, because my hands, while I was doing data collecting, when everybody else had their hands bundled up, and I think my hands were purple, but yeah, everyone was getting wet and cold and stuff and, even my girlfriend made it nice on the way back, I got to sleep and she gave me a head massage. (DR-L, May 14, 2013, interview)
In spite of the cold, miserable conditions on the boat, DR-L perceived the experience as positive because his peers were supportive and working together as a team. For DR, the participants onboard focused on the positive and buffered the inclement conditions.

In another instance, DR-L identified the importance of the volleyball game during the first day on the island:

[During] volleyball, everybody got to learn each other’s names and how you act, I think sports is the best way to see how people are really. Like how will act with one another. That was definitely one. And you get to show your crazy side, too, when you are playing volleyball with people you don’t know. (DR-L, May 14, 2013, interview)

Students want to be with their peers, not strangers. The icebreaker dissipated the barrier of strangers, creating an opportunity to bond with new peers. In spite of the icebreaker, DR-L did not enjoy being around students from the other schools. While commenting on his photographs, DR-L observed an image of students from another school climbing aboard the water taxi, and he said, “people going over.” He spoke of them as people, and not students. DR-L again revealed his feelings concerning students from the other schools during his cat dissection experience:

The only thing I really didn’t like was the dissecting with the cats because I felt like, our school wasn’t really, like we were being ostracized or something, because we tried helping out or doing something and we kind of being pushed away, it is whatever. So that is the only bad time I really had there. Everyone agreed that when they were about to cut open the ribs, I was, like OK, I will get the bone shears and I will do it if no one wants to do it. And I come up and one of the other school’s students took the hand shears and said I got it and just like did it and I was, OK, and I was holding open the cat and looking at the different parts of the stomach and everything to try to remember what I learned from bio 2 as far as anatomy goes, and they were, move your hands, and I was like, OK. So I just took my gloves off and left and that was the end of that. (DR-L, May 14, 2013, interview)
The problem surfaced when peers crippled DR’s experience. He lost interest, and left the activity. Peers can help motivate interest to a new level, or peers can negatively impact the interest so that the process is stopped and ceases to exist.

In spite of DR-L’s negative feelings concerning the students from the other schools, he showed compassion towards one student on the final day of the trip:

[We are playing] Putt Putt Golf, me, Stephanie, two others, and some kid by himself from another school. But after he was done, we decided we’d walk and talk or whatever, because he was alone. We walked with him all the way back and we decided to get a golf cart. (DR-L, May 14, 2013, interview)

While in the quarry, DR-L and other students were exploring the rocks. DR-L explained how they were talking about the rocks and rock types, a discussion any teacher would welcome in a classroom! “It was just conversation, until at the rock quarry, we were breaking rocks together, we were looking at different stuff. And talking about the rock types” (DR-L, May 14, 2013, interview). Although the conversation is not known, the students may have been helping each other reflect as they were experiencing the rock formations.

DR-L was smitten with a student who is not part of this study. DR-L chose a relaxing moment as one of his five significant photovoice experiences:

I like this photo (Figure 21) for obvious reasons, but it's more about the memory. I just remember taking photos and then looking up to see her cheesing for a photo. I have a lot of photos of her, but this one I like a little bit more than the others because of what she's doing. This photo reminds me of her and it reminds me of home, but home is where she is, so as long as she's with me then nothing is too miserable. Even a trip to Stone Lab in 30-degree weather.
Was this relationship distracting or augmenting, did it make a difference in DR-L’s experience at Stone Lab? This study cannot answer this question. He includes Stephanie in a great many of his responses. “I told Stephanie when we saw the cloud that I could see the rain coming down from it” (DR-L, May 14, 2013, photovoice). “I had a few good laughs at that beach taking photos and picking up rocks with Stephanie” (DR-L, May 14, 2013, photovoice). “I remember Stephanie brought some [rocks] home to put into a bowl” (DR-L, May 14, 2013, interview). His experiences during the activities and during his explorations on the islands were shared by Stephanie, thus there seems to be an emotional connection between the experience and DR, suggesting that there may be a memory or value to that experience.
**Family.** Derived from the pretrip interview, DR-L was comfortable talking about science with his family, and in particular, his dad:

My dad will talk about the recent news, what is coming out, or we will talk about new findings, especially if they cured someone with aids the other day, so we will talk about stuff like that, or medical stuff… My dad read stuff, he would come back, he worked in a water plant, so he had to know about chemicals and stuff. (DR-L, April 10, 2013, interview)

DR-L also thought about his family during the field trip. Talking about the ornithology class, DR-L said, “My dad likes to bird watch, so it was interesting to me” (DR-L, May 14, 2013, interview). DR-L explained that while on a rocky beach, “I brought some home to show my dad” (DR-L, May 14, 2013, interview). DR’s perception of his dad’s interests were important. DR-L placed value on his dad’s interests, which when confronted on the Stone Lab trip, DR-L saw as important or value-added experiences.

**Teachers.** DR-L also brought up the idea that the teacher’s passion makes a topic more interesting:

But to have every teacher who teaches something, when you look at them, you like, they get excited about, they have that twinkling in their eye, you know they like it. That makes it a little bit more fun. (DR-L, May 14, 2013, interview)

DR-L strongly argued that it is how a subject is taught that determines how much students will learn. He believed teachers should teach what they love and believe, as he described why the Stone Lab classes were interesting to him:

The way that people teach it. The people there when they taught stuff, they really, you could really tell that they liked it. They weren’t teaching because they had to, or because they were getting paid to. It was like they were teaching because they loved the subject material and they liked being there. It was something that was part of them. (DR-L, May 14, 2013, interview)
The teachers need to want to be there and enjoy being there. If the teachers are excited about what they are teaching, then the class would be more fun. Teachers need to be passionate about their subject.

DR-L spoke about his relationship with his teachers:

I like not necessarily tutoring, you don’t need to be tutored because your grades are not bad, but you just like going to ask the teachers more stuff, when you sit down with a teacher and you get to know them and you get to learn the subject more than what you are going to be taught in class. (DR-L, May 14, 2013, interview)

DR-L recognized the importance of a teacher or mentor, or anybody who can provide significant facts and ideas concerning the experience that helps the student reflect on the experience to make sense of what that experience means. DR-L also enjoyed his relationship with his teachers. Speaking of a teacher whom he assists during school, “Me and Mr. J would talk and make jokes and stuff” (DR-L, May 14, 2013, interview).

Transferability. DR-L explained that the informal setting allows teachers to teach subject matter that they enjoy, and that enjoyment is readily noticed by the students:

[At Stone Lab you] experience a little bit more (laughing) it is definitely more hands-on and the teachers seem to like it a lot more. But to have every teacher who teaches something, when you look at them, you like, they get excited about, they have that twinkling in their eye, you know they like it. That makes it a little bit more fun. It is definitely more hands-on. (DR-L, May 14, 2013, interview)

DR-L observed that the informal setting may have restrictions, but which are not a burden upon the students. The students may participate without fear of assessment or being judged, which opens up the creativity and innovation aspects of their minds:

So much is restrictive, at school you have an allotted time, [at Stone Lab] you have an allotted time too, but you are not packed down by work or you are thinking about other classes what you have to get done, there is no assignments,
so it makes it a little more like free roam, a little bit more hands-on. (DR-L, May 14, 2013, interview)

DR-L preferred to learn understanding, application, and relevance when learning a subject:

School helps me to understand more than anything. But going home and experiencing something, or when I look stuff up on the Internet, they do help out when I come back to school the next day, where I am applying something to a theme, or whatever it may be. (DR-L, May 14, 2013, interview)

He believed that school provides the knowledge base and out-of-school provides the application. DR-L does not enjoy formal education! When asked what activities he liked best at school, DR-L replied:

I like lunch, I like, I am kidding. The clubs, the sports, going after, not necessarily tutoring, you don't need to be tutored because your grades are not bad, but you just like going to ask the teachers more stuff. When you sit down with a teacher and you get to know them and you get to learn the subject more than what you are going to be taught in class. Or you are in a club of some sort and you are having a good time because you are doing something you like. Or like sports, if you like the sport, you are not being forced to play and those are the best moments. (DR-L, May 14, 2013, interview)

He is eager to learn and participate, but on his terms. He wants to learn without grades and without assessment.

DR-L explained that if Stone Lab style activities were to be used in a classroom, there would be many needs:

If you gave them the time, instead of just 45 minutes, if you gave them an hour and a half I think they would work. Especially if you had the equipment to do them. Of course you can't ride a boat around here, there is no water, but, there is that pond in the guy's yard over there. I think they would work if you had the equipment and the time. (DR-L, May 14, 2013, interview)

DR's believes that Stone Lab activities are transferable to a school classroom setting, but only to a point, and with many additional requirements, such as for more time
and proper equipment. The activities may lack context, such as the physical
environment, the water, and the boats. But substitutions might be used if the class could
use ponds and local environments.

Summary. To describe DR-L, he might be compared to the “All-American”
male, he is clean-cut, plays sports, enjoys listening to and playing music, is a good
student, and enjoys his peers. He likes helping his teachers when he is able. He has no
specific plans for his life other than to stay out of debt. He enjoys math, and sees math as
a focus for his future. He prefers a formula and one right answer format provided in math
and physics, rather than the necessity to understand systems and processes and no
formulas, as in life science. He enjoys playing computer games, but does not enjoy the
programming aspects of computers.

DR-L seemed to be bored to some extent with the Stone Lab classes. He
participated, but he was not as interested as he anticipated because there was so little
authentic material to study. He wanted to see the plankton that he collected, but there
was little, if anything in the container, and his comments reflected disappointment.

DR-L participated in each activity in a capacity that suited him. At Stone Lab,
DR-L was a recorder of data on the boat during a very rough, wet, cold trip on Lake Erie.
He enjoyed helping and being useful, recording data made him feel productive and
useful, much like he demonstrated in the classroom. He did not take on the job to be lazy,
because others offered to relieve him so he could warm up, but he continued recording
until the end of that boat trip. The boat experience was one that he would not have
chosen, but he still wanted to be a participant and found a comfortable job being the
recorder, which directly connected him to the activity while not doing the actual testing.
DR-L was lovestruck with his girlfriend who was also on the field trip. Although she may have been a distraction, DR-L actively participated in all the field trip activities.

**Case Study 5: LM**

**Contextual profile.** LM-L is a female high school sophomore athlete who enjoys math, art, ceramics and sports, and does not enjoy history or long reports. She plans to be an architect after going to college. LM-L prefers the physical sciences that are based on and often utilize mathematics over biology, which “is kind of boring.” However, LM-L stated, “I am outside a lot with my dad” learning about plants and landscaping. During summers she attended camp, where she “learned about plants and animals.” She recalled having fun creeking:

> It is fun. I wind up falling, always (laughing). I think it is fun to pick up a crawdad, but our creek is getting oily. Yeah, (pause, then in a sadder tone) I forget what they said is leaking into it, but our creek is going downhill. (LM-L, April 8, 2013, interview)

LM-L believes that the outdoor experiences are of minimal use to her, educationally:

> So much of what I do outside, outside is nature oriented, it only really helps when looking at nature related questions, like a couple of the biology questions or a couple of the questions on the whatever test we just took, OGT [Ohio Graduation Test], there are like two questions on there. (LM-L, April 8, 2013, interview)

She would “rather be doing math than looking at cells.”

LM-L participated in two science related activities at school. “Science club is always fun. Science fair is not fun” (LM-L, April 8, 2013, interview). She enjoys the science club experiments at the end of each meeting, especially when the teacher explodes a plastic bottle with dry ice or a peep in a vacuum bottle. She mostly enjoys the trips, “I have not missed a science club trip yet” (LM-L, April 8, 2013, interview). Concerning the impending Stone Laboratory trip, LM-L said, “I heard it is really fun, it is
something else to do with Science club” (LM-L, April 8, 2013, interview). When asked what she is expecting from the Stone Laboratory trip, LM-L replied, “I don’t remember much of what they told us. I know we will go see the glacial ridges, that would be cool. And being out on the water. And fish” (LM-L, April 8, 2013, interview).

LM-L talked about a previous, forgotten interest in ecology and balance of nature:

In middle school we talked about it, a little bit, mostly in 6th grade, we started recycling there, with that, at least in the middle school, I don’t know if the high school was doing it. So I did that for a while. And we do a group project on the cleanest cities but, after that we did not talk about it much, and so it just kind of slips your mind, because you are busy with everything else. (LM-L, April 8, 2013, interview)

LM-L only mentioned science fair after being prompted and acknowledged that she did not enjoy science fair. Last year she went to the State competition, but this year, in spite of receiving a superior, she could not attend. Interestingly, she chose a biological topic both years. She enjoys the exploration and experimentation, but does not enjoy researching data or writing papers.

LM-L is supported by her parents, especially in matters concerning school. She assumes friends will support her work in science club or science fair. She would not share much information concerning her friends, but LM-L did reveal that she talked about birds and ponds with her boyfriend, but noted that they never talked about chemistry, the course which she had been taking at the time of this study. In spite of her “dislike” and “boredom” of science, biology continually appears as a topic of discussion.

During classroom observations in her chemistry class from her front row seat, LM-L appeared fully concentrated on the teacher and lesson. Although she talked to peers before class, she did not talk to peers again except when asked for help to solve a
problem, and then LM-L responded quickly and helpfully. She began all work immediately, completing each assignment before the end of class. When her work was completed, LM-L appeared relaxed and friendly, smiling and talking quietly. From observations and through talking to her during the interviews, it is apparent that LM-L is a quiet, inwardly focused student who may talk openly with friends, but economizes her words when talking to adults.

**Cognitive/Affective lens.**

**Interest in science.** LM-L took only four digital images on Tuesday, the day of arrival - the swimming beach, a lily pad seed pod, a friend, and Mr. G who is fishing. During the posttrip interviews, LM-L did not discuss anything concerning her experiences of Tuesday’s events, activities. LM-L could not identify any noteworthy Stone Laboratory class experiences. She did explain that, “It all kind of adds up to the general idea” (LM-L, May 3, 2013, interview). The experiences gained from the five classes were a sum of all the classes. In spite of the fact that she could not identify any noteworthy experiences, LM-L did admit interest in the plant course:

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RESEARCHER - On the island itself at Stone Lab, Gibraltar Island, is there anything there that you found noteworthy?
LM - As in the classes?
RESEARCHER - The whole experience on Gibraltar.
LM - I don’t know. It all kind of adds up to the general idea.
RESEARCHER - So it is the sum of all the pieces.
LM - (nods)
RESEARCHER - How did you feel when you were on the island?
LM - (long pause) It was pretty cool, just finding out about different things, talk about the plants, the birds, the fish.
RESEARCHER - What did you like best of all the classes?
LM - (pause) I think I liked the plant one the best.
RESEARCHER - Why did you like the plants? (long pause) Was it the teacher or the subject?
LM - I think it was the stuff, I think it was pretty cool to be able to key through it and find the different plants just by the number of the leaves or the number of petals.
RESEARCHER - Was that your first plant experience?

Later, LM-L related that she was not inspired to take more science classes, but she does have a craving to get out into nature and look for new plants:

RESEARCHER – You really became interested in the plants.

LM-L selected Figure 22 as one of her five most important experiences and wrote in her photovoice caption:

This is the other thing that caught my interests while on the stone lab trip. These are???. They are interesting because they are so oddly shaped that they catch your eye. They are also one of the things we learned how to key out in class. It was interesting to be able to look at details everyone’s used to seeing but not thinking about and use them to find the exact name of the plant you’re looking at.
Figure 22. This is LM-L’s photovoice image number 1 of a stand of Dutchman’s breeches.

LM-L described her experience during the plankton lab as she described her gallery of digital photographs:

LM - LZ-L looking in a one ocular microscope. LK-H was actually doing, LZ-L was just pretending. We are looking at plankton. (pause)
RESEARCHER - I suspect when I get to LZ-L’s pictures, I will see the opposite of this picture? [He was taking a picture of her taking a picture of him].
LM - Yeah (laughing) (pause) he is pretending to read the sheet that says what the different plankton are.
RESEARCHER - He is pretending?
LM - Yes, he doesn’t really read like that, he rarely reads (laughing)
RESEARCHER - Was the identification sheet helpful?
LM - Yeah, I have a picture of the sheet next. Nope. Clock. The camera wasn’t focusing right, so I took a picture to get it to focus again. This is a focusing picture. That is actually a picture down the microscope. I thought it was cool, so I kept it. I had it for a second, and then I moved a little bit and it disappeared, and that is how it turned out. (pause) same thing (pause) there is the sheet (pause)
RESEARCHER - How many of the organisms did you see?
LM - I only found this one and one other one, I forget which one. I think it was one of the ones with all the branches off of it, so… (Pause) (LM-L, May 16, 2013, interview)

LM-L participated and interacted in class, but she does not add emotion or excitement to her description. LM-L talked about the fish dissection during the fish class:

RESEARCHER – Did your class dissect a fresh dead fish?
LM - We did both, we did the preserved one, I can’t think of the word, and we dissected a live fish he just killed.
RESEARCHER - Did you do the dissection?
LM - I didn’t specifically do it, but the other kids did it. There was a girl, there was a group from the other school with us who did it.
RESEARCHER - Did you not want to do it or did they just take it over?
LM - It was just where I was in line, and I was taking pictures anyways, so it didn’t really matter to me. (LM-L, May 16, 2013, interview)

Again, LM-L was attentive in the class, but did not seem to connect with the activity.

When asked what message or lesson resonated with her concerning the classes and other Gibraltar Island activities, LM-L responded:

Keeping balance in the lake and not pollution, polluting, anything like that. I guess that was more of a lecture part of that, but I mean testing water with Mrs. J showed how it affects it. I don’t remember [how the tests came out], but I do remember we had to test ours twice because I put way too much in there (laughing) that was, OK, half a bottle, that was OK too.[This is interesting because] just seeing how it [Lake Erie] affects everything because you want to be able to preserve everything for future use. It wouldn’t be very good if you polluted the entire lake and then gave it to the next generation, like here you go, clean it up. (LM-L, May 3, 2013, interview)

LM-L identified the glacial grooves as her foremost experience from the field trip.

She was able to picture the glacier atop this rock and she realized the profound thickness of the ice.

LM-L’s first described experience on Thursday was of the glacial grooves:

LM - I liked the glacial grooves. They were really cool. Just because you could see everything down underneath, you could see all the layers, it is millions of years old, so it is just weird that you can still see it today. It kind of makes you
think about all the weight that was going on and how much it has changed and how much things have grown even though they haven’t moved at all, or changed, other than water, I guess, but … (pause)

RESEARCHER - Who was with you while you were there. Did you have people with you, or were you alone?
LM - I was with Alan.

RESEARCHER - Did they have the same feelings that you had at the site?
LM - No, he was just running around. That is just what he does.

RESEARCHER - Did you read the signs, did you go through all the signs and all the lessons that they post around there?
LM - I read the first one. Then after that, we went to the (pause) walk. We were one of the last groups through. So we were more in a hurry then.

RESEARCHER - How did the place, the glacial grooves, make you feel? (pause)

She also included the glacial grooves with her photovoice (Figure 23), most important field trip experiences. She wrote in her caption:

This picture is of the glacier grooves. It was one of my favorite things from the trip. Two of the things I found myself interested on the trip were rocks and plants. This simply being a big rock that you can see all the layers in was really cool to see. Also just thinking that this was carved by an even bigger peice [sic] of ice is fascinating. On a deeper level, as I said in the interview, these grooves almost make you feel insignificant because of how large and old they are. No one could have stopped it either. Sadly, I was one of the last groups to get there so I did not get to read more information of it but it was still interesting.
Figure 23. This is LM-L’s photovoice image number 2 of the glacial grooves on Kelley’s Island.

Still looking at the digital photographs, LM-L spoke about the Thursday evening cat dissection, which she attended for only a short while:

I walked in just as they were cutting it open and stayed until after they had the kittens out of one of them. I just watched. I like watching, I don’t like doing them. (Pause) You can see the inside, and there is a kitten. (LM-L, May 16, 2013, interview)

Then she simply changed topics as she flipped to the next photograph, “There is a big pile of seashells, and they are all tiny (pause) purple ones, they look more purple in person” (LM-L, May 16, 2013, interview).

LM-L was not interested in everything that she saw or experienced. “We went to the beach, we looked for snakes, and animals. I’d seen both of them before, so I knew what they were, not exciting or anything” (LM-L, May 3, 2013, interview). But a stop at
the wildlife center captured LM-L’s interest. She selected Figure 24 as her fifth photovoice image, identifying it as one of her top five experiences of the field trip:

This is a picture I find both very interesting and very disgusting. We were at the nature center and these fish were hanging on the wall. The person giving the tour said the bottom fish is what they look like just before they die. The fish swim upstream to lay eggs then stop eating. They then turn a reddish brown color and some get hunches in their back. I just found this fact odd and interesting.

Figure 24. This is LM-L’s photovoice image number 5 of salmon at the wildlife museum.

At the conclusion of the digital photograph review of LM-L’s gallery of images, she panned through her images, describing her experiences of that afternoon, beginning with her comment about the fish at the wildlife museum:

LM - Yes. I liked how they showed the different stages of fish, like the younger fish, then the fish after that, I have that picture in there. And the flowers are
pretty. At home, not many are blooming at my house. (pause) Me and S. (laughing) (pause) there is a picture of the frog, he was not happy that we got close to take pictures (pause) I don’t know what those are, I have never seen them before [a robust purple spring flower] (pause) Antlers on top of the building [museum] (pause) there is the fish (pause) the ugly fish (pause) RESEARCHER - what are you showing there? [An image pebble with strong striations.]

LM - Lines in the rock, they were so worn down and smooth from being in the lake. (pause) We got [temporary] tattoos (pause) I don’t think the tattoo said what the fish is (pause) RESEARCHER - That would be the geode? [Multiple images of the crystal cave]
LM - it was really cool, that it was big enough for you to go down inside of it and see how big it was. (LM-L, May 16, 2013, interview)

LM-L’s interest focused on the change of form as the salmon matures, the lines and striations of a rock, of flowers, of an ugly fish, all described denoting the visual texture or quality. LM-L spoke again about the Crystal Cave:

I thought it was cool that they were like, oh, let’s dig a well and they found that. That is a pretty cool discovery to find. They were all formed the same structure, I think that is kind of, not weird, but it is interesting that it all forms the same way, is in the same shapes and angles. (LM-L, May 3, 2013, interview)

Again, her comments and interest keyed onto the shapes and angles of the crystals.

LM-L took a picture of Gibraltar Island (Figure 25) from the South Bass Island dock Friday morning shortly after disembarking from the boat that transported her and a dozen other students. She chose this image as one of her photovoice images, and wrote:

Last but not least, this is a picture of the island we stayed on though it may be hard to tell. While the island itself was interesting I think this picture is better at representing the whole trip. Over all the trip was a lot of fun. Not just because of friends but because I found myself more interested in the science parts than I expected. I expected to be more bored in a couple of the classes but I was surprised to find I liked most of them a lot. In conclusion I had a great a great time with friends and, yes, learning so I will definitely be back my senior year.
In spite of her apparent low key interest, LM-L explained that she was surprised to find the trip fun and interesting, stating she looked forward to attend the next trip in two years. LM-L believed that her interest had changed since the trip:

*I guess a little bit. I think I was surprised I was little more interested in the plants and the fish and the cat dissection than I thought I would be, because we looked at it more first hand, we got out and did it instead of looking at it in a text book. We go like, OK, this is this, and instead we actually did the fish, looked at a real fish, and a dead fish.* (LM-L, May 3, 2013, interview)

LM-L found herself to be more interested than she anticipated. The experiential aspect of the lessons made the plant and fish classes and cat dissection more interesting. She observed the dissections up to the point when the kittens were removed, at which time she left the lab for other activities. Although she was interested enough to watch the dissection to see the kittens, the interest did not carry over and she left.
**Prior interest and knowledge.** LM-L is an artist. Enjoying art and architecture, LM-L’s personal frame of reference was important as she assimilated the new experiences on the islands. This artistic lens notably helped her to perceive the points, lines and angles of the rocks, and colors of the sky and water. As she scanned through her digital images, LM-L looked at a picture of a rock pile in the quarry. “I thought it was just cool that they [two car-sized boulders] could balance off each other in such small contact points” (LM-L, May 16, 2013, interview). Another experience that interested LM-L was at the Crystal Cave, “It is interesting that it all forms the same way, is in the same shapes and angles” (LM-L, May 3, 2013, interview). LM-L’s only descriptive comment about the alvar came during the digital photograph interview. She described the lake while exploring the alvar, “The sky kind of changed while we were there. It was kind of blue and it went to gray as we were standing there. (Pause) Water splashing up, it reminds me of the ocean” (LM-L, May 16, 2013, interview). She commented about an image she took along the shoreline, “There is a big pile of seashells, and they are all tiny (pause) purple ones, they look more purple in person” (LM-L, May 3, 2013, interview). LM-L identified and described experiences with an artistic lens.

LM-L identified a developing interest in plants during and after the Stone Lab trip:

RESEARCHER - Was that your first plant experience?

During the pre-interview, LM-L discussed learning about plants with her father and at camp, suggesting that this is an area that she had already possessed knowledge, and perhaps forgotten interest.
LM-L revealed that she had recently studied ecological balance and recycling at school. She observed that it is easy to become busy with other commitments and forget what was important. She then spoke about creeking, but her statement was not lengthy. She commented on her enjoyment when creeking and looking for creatures, “I think it is fun to pick up a crawdad, but our creek is getting oily. Yeah, (pause, then in a sadder tone) I forget what they said is leaking into it, but our creek is going downhill” (LM-L, April 8, 2013, interview). The disappointment in her voice was apparent as she talked about the decline of the creek’s water quality. It did not lead to any reminiscing, but she was visibly saddened as she thought about how the creek had been polluted. Together, these may have connected to her sudden interest in the biological and chemical health of Lake Erie.

**Affective responses.** After the field trip, LM-L tried to explain her feelings concerning the trip, “As I said earlier, insignificant and significant at the same time. In what you do. Just how everything follows like a chain, one thing affects another” (LM-L, May 3, 2013, interview). When asked if anything specifically caused these feelings, she replied, “I don’t think specifically. It was just an add up all at once to get the big picture” (LM-L, May 3, 2013, interview). There was a sense of awe and wonder, and a feeling of insignificance as LM-L imagined the immensity of the glaciers. Those feeling will be associated with the memory of that site. LM-L connected the setting and emotion to develop a thoughtful understanding of the locale and what it means geologically and aesthetically.
In another statement, LM-L illustrated that she developed an understanding of Lake Erie’s ecology and how each person can make a difference to help the lake become balanced biologically and chemically:

="Keeping balance in the lake and not pollution, polluting, anything like that… just seeing how it [Lake Erie] affects everything because you want to be able to preserve everything for future use. It wouldn’t be very good if you polluted the entire lake and then gave it to the next generation, like here you go, clean it up. (LM-L, May 3, 2013, interview)

LM-L felt motivated and empowered to do what she can to communicate how all people are responsible for pollution involving Lake Erie. Does her sadness about the condition of her creek at home add relevance and motivate her to attack pollution in Lake Erie?

**Physical lens.**

**Setting.** Through photovoice, LM-L targeted the physical domain in three of her five images. In Figure 23 she spoke of the glacial grooves, which was a significant setting for her contemplations as previously discussed Figure 25 identified Gibraltar Island as the location where all the activities and learning took place. At the alvar, LM-L described the changing sky, “The sky kind of changed while we were there. It was kind of blue and it went to gray as we were standing there. Water splashing up, it reminds me of the ocean” (LM-L, May 16, 2013, interview).

**Tools.** LM-L identified a few tools throughout her comments. In her photovoice image, Figure 22, she spoke of the identification key, a tool used by biologists. She spoke about microscopes and identification keys during the plankton lab:

="LM - LZ-L looking in a one ocular microscope LK-H was actually doing. LZ-L was just pretending. WE are looking at plankton. (pause) RESEARCHER - I suspect when I get to LZ-L’s pictures, I will see the opposite of this picture? [He was taking a picture of her taking a picture of him]."
LM - Yeah (laughing) (pause) he is pretending to read the sheet that says what the different plankton are. (LM-L, May 16, 2013, interview)

**Cultural lens.**

**Peers.** LM-L found support through her parents and friends. Her parents were particularly involved concerning school. LM-L expected her friends to be supportive of her interests. In figure 25, LM-L implied the significance of her friends on the Stone Laboratory trip, “Over all the trip was a lot of fun. Not just because of friends but because I found myself more interested in the science parts than I expected” (LM-L, May 3, 2013, interview).

**Teachers.** After storing their suitcases and belongings, the students hiked to Perry’s Monument, where at the base of the steps, the teachers gave a talk about the Battle of Lake Erie. LM-L chose this photovoice image (Figure 26) to highlight the experience of the teachers’ presentation:

> This is Perry’s monument. I took this picture while still standing on stone labs island. Perry’s monument was interesting because of the history behind it. Typically I don’t find war very interesting. Because Mrs. K explained a little more of the peoples story it interested me. It also had some strange facts with it. I probably was a little interested in it since it was in Ohio so it related to me [sic].

The teacher was able to draw students into her historical account of the Battle of Lake Erie by making the history relevant to the students. She placed the site of the battle directly behind her, and she talked about the personalities of the people involved in the battle, using terms in today’s language that originated during the War of 1812.
Transferability. As LM-L thought about her experiences at Stone Laboratory, she compared and contrasted learning at Stone Lab versus learning at school:

Everything is much more hands-on and that is what makes it a lot more interesting. It is easier to understand exactly what you are looking at. It is a lot easier to look at a real fish and say this is this fin and this fin than to look at an illustrated picture in a textbook. Hands-on, it makes everything more interesting. I think it is just easier to understand if you can actually see it and apply it to what you are actually looking at or holding, having something right in front of you and looking at it hands-on is more effective than looking at a textbook or a board, or a lecture. (LM-L, May 3, 2013, interview)

LM-L was savvy enough to realize that learning must be balanced and recognized the need for lectures. “You can’t expect to walk out into the field and be like, OK, so I know everything out here already, so let’s go back. You have to understand a little bit already. And then go out and look at it” (LM-L, May 3, 2013, interview).

LM-L talked about what kinds of experiences should always be part of a school
I think the hands-on thing should be, because when we do do, like the frog dissection last year, or zoology classes doing their dissections, personally that was my best part of the exam, I didn’t miss anything on that part, I think it is just easier to understand if you can actually see it and apply it to what you are actually looking at or holding, instead of like in math, you can’t like, you can practice some situations which does make more sense, like rolling a ball down a hill and looking at the velocity but if you, I don’t know, if you have, having something right in front of you and looking at it hands-on is more effective than looking at a textbook or a board, or a lecture. (LM-L, May 3, 2013, interview)

When asked for her opinion of how well Stone Lab activities and lessons might be transferred and presented in her classroom, LM-L responded:

Just because there would be a larger group here, it would be the same setting as we would do normally, I feel it is a different experience up there, it is easier to get the impact to something you see on a day to day basis. (LM-L, May 3, 2013, interview)

Summary. LM-L is a female sophomore athlete who prefers art and math in school, and plans to be an architect. She has little interest in the biological sciences, preferring the physical sciences that are based on and often utilize mathematics. LM-L enjoys and looks forward to the science club meetings, in particular the activities conducted at the end of each meeting. She also participates in all the science club trips. LM-L went on the Stone Lab trip because it sounded fun, and because it was a science club trip.

LM-L only mentioned science fair after being prompted and acknowledged that she did not enjoy science fair. Last year she went to the State competition, but this year, in spite of receiving a superior, she could not attend. Interestingly, she chose a biological topic both years. She enjoys the exploration and experimentation, but does not enjoy researching data or writing papers.
LM-L is supported by her parents, especially in matters concerning school. She assumes friends will support her work in science club or science fair. She did not share much information concerning her friends, but LM-L did say that she talked about birds and ponds with her boyfriend, but noted that they never talked about chemistry, the course which she had been taking at the time of this study. In spite of her “dislike” and “boredom” of science, biology continually appears as a topic of discussion.

Away from school, LM-L learned about plants by working with her Dad while landscaping, and about plants and animals during Girl Scout Camp. She has no hobbies, but does enjoy watching forensic shows on television. LM-L enjoyed playing in creeks and catching crawdads, and spoke with sadness that the creek by her home has become polluted. She related that she sees no relevance of knowledge about nature except for when it helps to answer questions on standardized tests.

LM-L went to Stone Lab with prior experience of working with plants and present interest creating artwork. She discovered, or rediscovered, an interest in plants after attending the plant course. It is interesting that before the trip, she discussed her prior knowledge and experience with plants when she assisted her father in the landscaping business, but she did not acknowledge any prior interest after the field trip. However, that prior knowledge may have provided the connections that made the plant class relevant. Her present interest in art provided unique lens in which she would experience the Stone Lab activities. While discussing the crystal cave, she talked about the shape and angles of the crystals. She talked about the depth and grandeur of the glacial grooves. Some of her photographs and descriptions also focused on lines, angles and shapes, suggesting that her artistic frame of mind guided her thinking and observations. The prior
knowledge and interests provided a foundation onto which new knowledge and interests could be constructed.

She connected to things she considered relevant, such as with the plants and art work. Another example is the Lake Erie ecology, which LM-L discussed as important. Using her knowledge of recycling from school, LM-L recognized a connection to Lake Erie pollution problems, to the effects of pollution, and for a personal solution to help abate Lake Erie’s pollution issue.

LM-L acknowledged that hands-on activities made her interested in topics and subjects that she previously held no interest. She suggested that hands-on activities provide a path to understanding and learning that is not available from textbooks or lectures. She would like to see more hands-on opportunities in school, but recognized that the number of students in a class would be a hindrance to success.

Case Study 6: LZ

Contextual profile. LZ-L is a male senior high school student who enjoys soccer, band, reading, writing, math, and art. He enjoys English because he can read and write. In math he can find the right answer. He plans to study psychology in college. “I want to explore forensic psychology, which looks at people’s minds and stuff, and you have to learn how the brain works” (LZ-L, April 9, 2013, interview). LZ-L rated his interest in science a 3 on a 0-5 scale. He does not enjoy biology. However he stated:

It is easier for me to learn formulas. I loved chemistry, with the math and stuff, I liked that. I don’t know why I have never been into how the body works. I like how the bones form, but not just this atom goes with this atom, it bores me so much. (LZ-L, April 9, 2013, interview)
When asked what activities he did enjoy involving science, LZ-L responded, “Science
club! I like to see different things all the time. I love to go on the Columbus Zoo
overnight trip. I get to see, you get to interact with different kind of people, you get to
learn stuff you don’t learn at school.” He joined science club because he liked the
teacher-advisors:

I like how they teach and it made me want to join science club more, and my
sister was in science club and she loved it and she always talked about it, so she
was a big factor too. I had multiple friends who were in it, so I was like, why not?
(LZ-L, April 9, 2013, interview)

When prompted, he talked about science fair. He did well, but he was not
enthusiastic about his project. Unlike talking about science fair, when LZ-L spoke about
science club, there was more interest and excitement in his speech. Twice he stated that
he prefers hands-on lessons. He also believed that teachers and others who are excited
about something, make learning more enjoyable. He believes that activities build a
foundation for learning and help one determine what is going to happen next. What was
learned in school is just the beginning, more can be learned outside of school.

LZ-L spoke about interest. If he picked up a magazine and saw an article that
interested him, then he would read it a couple times and remember it. He admitted that
unless it was something he was really interested in, he would not follow up on the article.

When the topic of the outdoors was opened, LZ-L became excited, talking about
playing outside. He preferred to be alone when outside. He recognized that he learned
how to read the weather without ever being taught.

LZ-L was observed during his biology class. He sat in the front center. When the
teacher gave instructions or provided notes for the students, LZ-L was focused on the
teacher and board. If he spoke to a peer, it was concerning the information or an activity. Near the end of each class, LZ-L would rest his chin on his hand, and begin to appear tired. During lab activities, LZ-L read procedures and directed group members.

**Cultural/ Affective lens.**

**Interest in science.** When asked for the most notable experience while at Stone Laboratory on Gibraltar Island, LZ-L did not identify any class activities, instead he provided a curt compellation of events, making this field trip sound more like a vacation trip:

LZ - I was down by the water a lot, I was helping some people find some sea glass. And I got chased by a goose. That was awful. Actually, I know we weren’t supposed to, but I went off on one of those little cliffs, that hung over the water. I went over with WM-H. That was fun. It was really cool. And I went over to the bar and I found a rusted flashlight, I found that entertaining, this sucker was really nasty, it was really cool.

RESEARCHER - What did you find interesting in your exploring?

LZ - I found lots of different plants and found some prickle plants that cut me. That was awful. I found some fish carcasses, like I found one that was completely picked apart, it was just bone. And I wanted to touch it, but I have a thing with dead stuff, I can look at it, I just can’t touch it. I really wanted to pick it up, but…(Pause)

RESEARCHER - So what was interesting? Why was it interesting?

LZ - I don’t know, it was, you see this stuff, because you can’t explore next to the sea, well, it is not a sea, it is like a giant lake, and I found all kinds of interesting stuff, just random, I found a cinder block that washed up, so I don’t know where, but it is a cool cinder block that I found entertaining. And a couple bricks and a flashlight. I was really trying to figure out why there was a cinder block, I was honestly trying to figure out why you would drop a cinder block in the water. (LZ-L, May 9, 2013, interview)

In spite of the lackadaisical review of his images, moments of interfacing with nature are apparent.

LZ-L did eventually identify Stone Lab classes that he found interesting:

I liked your bird class, because I learned all kinds of different birds, naming the random ones, I liked Mrs. G’s plant class, because I just like plants. I like, I was
able to key them out better, but I have no clue which plant was which, but it was nice to do for a little bit. Besides those two classes, there weren’t any that I really liked. I liked Mrs. K’s class because we got to test water oxygen levels, I think it was, so that was kind of cool.

RESEARCHER - You liked the chemistry part of it?
LZ - yeah, chemistry I like it a lot better. (LZ-L, May 9, 2013, interview)

He liked physical science activities, and he enjoyed the nature based classes where nothing died to provide the students an experiential activity. He was more willing to talk about the water chemistry activities. When asked why he felt the topic of water chemistry was important, LZ-L replied:

Because the littlest thing can change, like habitat for animals and make it do a lot of damage. I think it was actually normal up there, so nothing was dying. But I think a couple years ago there was like a big problem with the oxygen levels, and a lot of fish and watersnakes, killed them off. (LZ-L, May 9, 2013, interview)

Although this study does not examine learning, it is significant that LZ-L understood the concept of chemical balance of lake water without a full understanding the actual biological effects. Having fun and learning from an activity does not mean that the concepts will be correctly applied, nor does it mean that an interesting and fun activity will trigger, develop, or reinforce a student’s interest:

RESEARCHER - Were you interested in chemistry before?
LZ - Yes (nodding)
RESEARCHER - So did this bolster your interest, was there no difference?
LZ - No
RESEARCHER - Have you thought about the chemistry since?
LZ - No
RESEARCHER - have you thought about the ornithology or plants?
LZ - I’d see a random bird fly by and I’d think, I used to know what that was. (Laughing) (LZ-L, May 9, 2013, interview)

LZ-L was bored with the classes and the class activities. During the final interview in which LZ-L discussed all his photographs, he had taken an image of students in a class and then an image of a paper:
RESEARCHER - Everybody looks so tired, cold and wet. (Pause) Why did you take that one of the paper?
LZ - To be honest, I think I was really bored and I completely checked out of the class, I just started taking pictures of pretty much anything. (LZ-L, May 16, 2013, interview)

Even when LZ-L admitted an activity was fun, he still revealed shadows of boredom:

Researcher - What did you think of the plankton lab?
LZ - It was fun, I liked it. I found a, what was it, it looked like a little shrimp, what was it called, I actually took a picture of the board so I might know what it was called. (Pause) ceiling, that light was having a seizure so it was really bothering me. (LZ-L, May 16, 2013, interview)

LZ-L commented through his photovoice image of the rocky shoreline and caption (Figure 27), “We were talking about the Lake Erie Water Snake” (LZ-L, May 16, 2013, interview). Lake Erie watersnakes are an important topic taught at Stone Lab, a topic not a chosen for this year’s field trip. LZ-L searched for and hoped to take photographs of watersnakes, but was disappointed that he failed, although in fact he did get one image of one without knowing. LZ-L’s attempt to take pictures of watersnakes the first day on Gibraltar Island and the photovoice comment suggest that LZ-L may have had interest in island herpetology, had it been taught this year during the Stone Lab classes.
At Stone Lab, LZ-L gained experiences and perhaps passively learned from each of the classes and activities. Explaining how he was playing in the quarry with his friends, he related a moment when he looked in a vernal pool and saw tadpoles and bugs, which seemed like a vivid memory for him, yet it seemed to have no relevance or value to him:

> It was something that looked so blah, can actually have different organisms just, it is just where they live, I never think about it until I saw, I started looking through the water and there was like tadpoles and just random bugs everywhere. I knew there was a lot, I only picked up one rock and there was a thousand bugs, it was a lot of bugs crawling down, scurrying everywhere. (LZ-L, May 9, 2013, interview)

When asked if he made any science related observations at the quarry, LZ-L answered:

*Figure 27. This is LZ-L’s photovoice image number 4 of Kelley’s Island State Park.*
We went through the woods and I found all kinds of bugs and I almost got attacked by a chipmunk. That was awful. I love animals, but I scare them, sometimes. And it ends badly. And we had, instead of taking the easy route, we decided to climb straight up and (laughing) it was all wet and I started sliding down the hill, so I was grabbing onto moss, and that wasn’t very smart idea, but I thought, I lived. (LZ-L, May 9, 2013, interview)

LZ-L seemed to want to explore and have experiences without incorporating any focused learning.

LZ-L discussed images that he had taken during the Thursday evening guest speaker session. When asked if he enjoyed the speakers, LZ-L replied:

Yeah, they were fun. They were interesting, I liked them. I think one of them was really boring, but I can’t remember which one it was. I liked Mr. TG’s, Mr. G’s son, I liked his, it was interesting [pause] [panning through photographs] she was like ready to pass out, so she just lay on the floor [pause] guys in [laughing] WM-H makes all these weird faces sometimes and she doesn’t realize it, so I just sit and take pictures of her. [Pause] She kept saying this real annoying catch phrase it was like truth, daddio. So every time she said it I’d take the camera and flash her in the face with it. She always stops, so …and I think that is Michael from another school, he is almost a complete foot taller than her. (LZ-L, May 16, 2013, interview)

It is interesting to observe how dry the initial response is, and then LZ-L segues back into talking about friends, using more descriptive terminology.

**Affective response.** LZ-L was excited when he arrived on the island, looking for snakes along the walkways. As he spoke about his exploration, he indicated disappointment that he was not able to locate any snakes. But while looking at and talking about his photographs, he located a snake hidden in the grass that he did not see in real time. He was both joyful and excited that he was successful in his search after all.

LZ-L explained that the most peaceful moment was during the final bonfire, when he and his friends were the only ones present, and it was quiet and relaxing:
When we were down at the bonfire, literally there was no one else, it was me, J. A. and TK-H, A, LK-H, and I caught a few others, and we were all down there just chilling out because no one else was down there and it was just really nice. We never actually got peace and quiet, and those other schools sort of scared us, because they had the, they were interesting. They just, they never understood our sense of humor. (LZ-L, May 9, 2013, interview)

During the interviews, LZ-L did not display many emergent responses to situations. However, through photovoice, LZ-L related setting-induced affective responses. Associated with the bonfire, LZ-L wrote about his rising moon photograph (Figure 28):

I love the night because everything is calm and relaxing. It was the first or second day and a bonfire was being put together, and I saw how the moonlight just reflected so perfectly and needed a picture.

Figure 28. This is LZ-L’s photovoice image number 2 of a rising full moon over Perry’s Monument.
LZ-L indicated sadness in Figure 29 because he is leaving the island for the last time. “This (Figure 29) was another picture of when we were leaving and I felt sad and wanted to get some really good pictures because I won't ever be coming back.”

In the post trip interview he also indicated sadness for the same reason. A few weeks after taking this photograph, LZ-L was to graduate from high school. Could he have been lamenting the loss of his friends and high school years? His statement of sadness may be deeper than it first seems. If this was the case, this frame of mind would have affected how LZ-L viewed, acted, and participated on the field trip.

Figure 29. This is LZ-L’s photovoice image number 3 of Gibraltar Island.

In Figure 27, LZ-L again is looking at the open water, this time finding warmth,
another physical sensation absent over the past two days. LZ-L photovoice caption read:

I never had been on this part of the island before I liked how warm it felt next to the water, and I found it funny that I could see a nuclear power plant in the distances.

His comment about the nuclear power plant suggests that it somehow connects to his value system.

In figure 30, LZ-L chose as one of his most important experiences to be the ride home on the ferry back to the mainland, “This picture made me feel calm and this was the day that we were leaving Stone Lab and heading home.” LZ-L described a feeling of calmness, which might be a play on words, since the lake was extremely rough the previous two days. If the comment is serious, LZ-L is looking at the vastness and serenity of the open water.

LZ-L demonstrated negative some situational responses. He did not enjoy dissections, and had no desire to participate. “The cat lab was a definite no for me. Ew!” (LZ-L, May 9, 2013, interview). Concerning the fish dissection during the fish class, LZ-L responded, “I still felt bad. I didn’t help with the dissection” (LZ-L, May 9, 2013, interview).
LZ-L talked about boredom. “This atom goes with this atom, it bores me so much” (LZ-L, April 9, 2013, interview). LZ-L was not engaged with the botany lesson, in spite of the setting and in spite of the immersive activity, “To be honest, I think I was really bored and I completely checked out of the class, I just started taking pictures of pretty much anything” (LZ-L, May 16, 2013, interview). A trigger to interest in the topic was not connected. LZ-L also identified his school classroom as a source of boredom, “After 20 minutes, I am out of it, I just don’t pay attention…I like being able to… move around, so you are not sitting in one place, drool is coming out of your mouth” (LZ-L, May 9, 2013, interview).
At the glacial grooves locality, LZ-L was more concentrated on his peers, the setting did not appear to engage his sense of interest:

It was me and Jennifer. We went through the glacial grooves, and we were just screwing around and it was a lot of fun, we were like, we trying to count how many grooves we could find. I don’t know, Jennifer was trying to do it, I was kind of bored with it, and Alan and Bobby, he had a giant batman thing on, I just started laughing nonstop. (LZ-L, May 9, 2013, interview)

Physical lens.

Setting. LZ-L’s first selected photovoice image (Figure 31) is of a statue that he observed during the Kelley’s Island hike from the ferry dock to the quarry entrance, “I was mildly disturbed by this wood craving. It was, what I thought, a mutated cat eating a fish... Not really sure why someone would want that in their yard.” LZ-L was drawn to the quirkiness of the carving and judged its worthiness. The carving connected to his value system in some way.
LZ-L showed minimal connection to the varied setting during the trip. His statements, no matter whether directed to Stone Laboratory, Kelley’s Island or South Bass Island, featured interaction with his peers. While discussing his trip photographs, LZ-L did not focus on the setting:

[Images taken at night at the bonfire]
LZ - I was trying to get an outside picture of WM-H. (pause) J just crawled under a rock to go to sleep. WM-H and Allison. (Pause) this is during the bonfire. (Pause) it was me and J and those two and I think and LK-H and TK-H were down there. That was WM-H and Allison. that were down there with us. There weren’t too many other people. (Pause) Oh, that is S. I think, from a different school, and then we went to the dining hall to play cards. That game got really violent, like it escalated very quickly.” (LZ-L, May 16, 2013, interview)
LZ-L described the calmness of the moment in his photovoice image (Figure 28) of a beautiful image of the rising moon over Perry’s Monument, taken the final evening. It had rained with high winds for two days, and suddenly the skies cleared and the students had a nice, although chilly, evening. During one of LZ-L’s posttrip interviews, the rising moon was again discussed. While describing his trip photographs, LZ-L came upon a different image of the rising moon:

RESEARCHER - a beautiful moonrise. Can you close your eyes and recall the sound of the waves?
LZ - yeah - they did not want to wake up. (Pause) We are all pretty close, because there are not many of us. (LZ-L, May 16, 2013, interview)

LZ-L did not seem to acknowledge the restful nocturnal setting during this interview, in direct contrast to LZ-L’s photovoice comment, “I love the night because everything is calm and relaxing. It was the first or second day and a bonfire was being put together, and I saw how the moonlight just reflected so perfectly and needed a picture.”

Setting was important in LZ-L’s photovoice images, Figures, 27, 28, 28, and 30. All four photos include Lake Erie, with Figure 30 consisting entirely of Lake Erie. Figure 29 is a photo of Gibraltar Island, surrounded by water, figure 27 looks out over Lake Erie from a beach, and figure 28 of the rising moon. Although he never said it words, data suggests the lake setting was important to LZ.

Tools. LZ-L only briefly mentioned tools:

I liked your bird class, because I learned all kinds of different birds, naming the random ones, I liked Mrs. G’s plant class, because I just like plants. I like, I was able to key them out better, but I have no clue which plant was which, but it was nice to do for a little bit. Besides those two classes, there weren’t any that I really liked. I liked Mrs. K’s, because we got to test water oxygen levels, I think it was, so that was kind of cool. (LZ-L, May 9, 2013, interview)
LZ-L identified the plant identification key, but also implied chemical test kits and binoculars.

**Cultural lens.**

**Peers.** When asked to talk about a notable experience on Kelley’s Island, LZ-L responded with this comment, cited earlier in affective responses:

It was me and Jennifer. We went through the glacial grooves, and we were just screwing around and it was a lot of fun, we were like, we trying to count how many grooves we could find. I don’t know, Jennifer was trying to do it, I was kind of bored with it, and Alan and Bobby, he had a giant batman thing on, I just started laughing nonstop. (LZ-L, May 9, 2013, interview)

Similarly, while viewing all the photographs he had taken, LZ-L commented on the glacial groove images:

LZ - Yeah, they were being dummies. (Pause) I think that was an accident one, it happens, I like that picture. I like looking at all the grooves and stuff (pause) I took that because I saw the Batman costume. (LZ-L, May 16, 2013, interview)

For LZ, the experiences were about the people, his peers and friends. When given freedom to experience the trip in a manner he preferred, LZ-L chose to focus on his peers and friends, people he was comfortable with. The setting and activities appear to have been secondary:

Researcher - When you were at the quarry, can you describe an experience, something you were doing in the quarry?
LZ - With me and Jennifer, there is this joke that she is a Hobbit. Whenever we find someplace really small she hides in it. (Laughing) So I was taking pictures and there was, it was a lot of fun, it was five or six giant holes and then she almost got stuck in one of them, and I told her, I am not helping you, even if I have to drill you out. And it did end well when she got out, but it was quite funny (Laughing). (LZ-L, May 9, 2013, interview)

It is significant that peers along with inspirational teachers talked LZ-L into joining the science club, where he met new friends:
Oh, yes. Mr. J and Mrs. K, I like how they teach and it made me want to join science club more, and my sister was in science club and she loved it and she always talked about it, so she was a big factor too. I had multiple friends who were in it, so I was like, why not? (LZ-L, April 9, 2013, interview)

In science club, LZ-L’s focus was on the peers, not on the science. Still, he called himself a “nerd” and a “freak”, suggesting that he viewed his involvement in science as stepping outside the school norms. During the science fair, he partnered with a friend and conducted the project at home. Contrary to his pretrip interview that suggested he had a minor interest in science, LZ-L’s Stone Lab field trip experience appeared to be focused on interactions with peers.

Stone Lab was about the people on the island, and he was relaxed with his peers who attended. LZ-L talked about deep sadness on the final day of the Stone Lab field trip, when it was time to leave the island:

LZ - It was really sad we were leaving.
RESEARCHER You were sad you were leaving? Why?
LZ - Cause it is my last year, the last time I will be up there. So I was like, eh. A little sadness.
RESEARCHER - What are you going to miss about it?
LZ - I think just going up and having all my friends, for a week straight. (LZ-L, May 16, 2013, interview)

He was sad because he had been with his friends for a full week, and the week was over.

Also recorded during the photograph review, this final example illustrates LZ-L’s minimal connection to the physical experience:

[Images taken at night at the bonfire]
LZ - I was trying to get an outside picture of WM-H. (pause) Jennifer just crawled under a rock to go to sleep. WM-H and Allison. (Pause) This is during the bonfire. (Pause) It was me and Jennifer and those two and I think and LK-H and TK-H were down there. That was WM-H and Allison. that were down there with us. There weren’t too many other people. (Pause) Oh, that is Lauren I think, from a different school, and then we went to the dining hall to play cards. That game got really violent, like it escalated very quickly.”
RESEARCHER - a beautiful moonrise. Can you close your eyes and recall the sound of the waves?
LZ - I yeah - they did not want to wake up. (Pause) We are all pretty close, because there are not many of us. (LZ-L, May 16, 2013, interview)

The Stone Laboratory field trip was about the people. LZ-L was relaxed with his peers who attended:

RESEARCHER - Can you describe how Stone Lab made you feel?
LZ - I felt really relaxed up there. I have friends that I actually like spending time with, instead of people, you would be walking in a hallway and it is like, get out of the way. So it was nice, and being outside all the time instead of being cooped up all the time, which is nice to be outside. (LZ-L, May 9, 2013, interview)

Family. LZ-L’s sister who enjoys science, and his mother who is a nurse supported LZ-L and attached value to science concepts through their interests, “If I see something interesting I would tell her about it, and she tells me if she sees something cool, she will tell me about it. My mom is a nurse too, so she tells me about medications” (LZ-L, April 9, 2013, interview). LZ-L’s mother was also involved with his science fair project to a sufficient level that she provided “memorable” commentary while she supported the project and effort. LZ-L recognized his sister three times in the data, suggesting she was an important influence on his interest in science.

Teachers. LZ-L talked about an experience along the state park beach:

LS - When I went down to the beach, we went, I am not sure what it was. What is the structure, stone things,
RESEARCHER - Break walls?
LZ - what were those?
RESEARCHER - There is a boat ramp area there, so the rocks slow the waves down.
LZ - That makes sense. Well, I went to this other thing, and I was talking to J. this is really like how a horror movie starts, and I am walking out and A., a really tall kid, literally with his hand, grabbed my goggles, ripped them off my head, I like freaked out and ran for my life, and I see WM-H just laughing hysterically at me. I went to this other thing, and I was talking to J. this is really like how a
horror movie starts, and I am walking out and A., a really tall kid, literally with his hand, grabbed my goggles, ripped them off my head, I like freaked out and ran for my life, and I see WM-H just laughing hysterically at me. (LZ-L, May 9, 2013, interview)

LZ-L did not know what a break wall is. He needed a mentor or tutor to help him make sense of the experience.

LZ-L’s science teachers provided a great deal of influence because he liked the way they taught and they were enthusiastic concerning their activities. The science teachers, with additional motivation from his sister and friends, influenced LZ-L to participate in science club in spite of his not enjoying science classes. In general, LZ-L believed teachers had the power to make the class good or bad through passion and enjoyment of teaching:

LZ - The teacher needs to love their subject, not, I have had teachers who, not Mr. J or Mrs. K because they love their subjects, I had a teacher back in middle school, I am pretty sure she hated all of us. But, and if you asked questions, she would rip your head off. I feel like the teacher should know what they are talking about and actually love what they are teaching.

RESEARCHER - Does that affect the students?
LZ - I feel like it does, because I have heard students complain about, we had a middle school teacher, I don’t know if she is still there or not, but they say they loved science before her class, and now they absolutely hate it. Some of them left, they really, really hate it.

RESEARCHER - So when you have a teacher who really likes it, someone who is really passionate about their teaching, how does that help the students.
LZ - If they are actually passionate about it, it gives them more of, they are always happy, and it gives better vibes off them, and I am like, hey, this isn’t god awful. This guy has been doing this for like 20 years, I may as well try, because, one of the math teachers, I liked math, but he loves it, and he jumped on a desk one day to get our attention, and it just, his class always makes me laugh, because he lets us talk and screw off and we can ask him the weirdest questions and he would, like, answer. It was just fun. (LZ-L, May 9, 2013, interview)

To sum up this conversation, the teacher has the power to make the class good or bad, to create enthusiasm and interest, or boredom and disinterest. Teachers who teach
what they love will reach more students, and forcing teachers to teach something they do not enjoy might be counter-productive.

**Transferability.** When asked to compare Stone Laboratory experiences to regular school classroom experiences, LZ-L answered:

> We actually, we were taken outside instead of being cooped up in a single room for 45 minutes. After 20 minutes, I am out of it, I just don’t pay attention. And they treated it more like a college class. They didn’t say you have to learn this exactly, it was, you could interrupt and ask what that is and they would answer. They didn’t tell you to shut up and keep going. You could explore, the teacher would say, find something cool, bring it back, I like that kind of teaching. I like being able to move around, so you are not sitting in one place, drool is coming out of your mouth. (LZ-L, May 9, 2013, interview)

It is interesting that LZ-L believes college classes are different from high school classes. He liked the independence, not sitting in a classroom the entire time. His view of a traditional classroom lesson reveals boredom and lack of interest in the class material. When asked how he would feel if his traditional school classes were taught like the Stone Laboratory classes, LZ-L responded:

> If we did what we did up at Stone Lab, up here I would absolutely have loved that. If we did that with almost all of our classes, that would have been amazing. Math would have been interesting to do it with, but, if we had to just sit down and do it in class, I would probably not take it. (LZ-L, May 9, 2013, interview)

The idea of an experiential, hands-on class truly interested him. During the pretrip interview, LZ-L revealed his preference for hands-on experiences:

> I like being a lot more hands-on with chemistry. I was a lot better with chemistry than with bio 2, it is not because the teaching, with chemistry I knew, I had to balance stuff, and I could get hands-on a lot better, with biology there are multiple things that can happen, and I couldn’t, I just don’t understand those that much. (LZ-L, May 9, 2013, interview)

This suggests that he prefers being able to come up with the right answer. He sees chemistry as experiential versus biology which is more lecture and abstract.
**Summary.** LZ-L is a senior male student, who prefers English and math over science courses. He enjoys sports, band, art, reading and writing, so he is a well-rounded student. He plans to get a PhD in psychology, and may want to teach in a high school. He understands that science will help him “explore” forensic psychology, and to “learn” how the brain works.

LZ-L preferred physical science. He liked to have a solid yes or no answer, nothing abstract. Math was comforting to him. He enjoyed science club because “you get to learn stuff you don’t learn at school.” When prompted, he talked about science fair. He did well, but he was not enthusiastic about his project. LZ-L did not plan to join science club. He identified the two Stone Lab trip teachers as a motivator to join science club, as well as being motivated by his sister and friends. Unlike science fair, when LZ-L spoke about science club, he revealed more interest and excitement in his speech. Twice he stated that he prefers hands-on lessons. He also believed that teachers and others who are excited about something, make learning more enjoyable. He believed that activities build a foundation for learning and help one determine what is going to happen next.

What was learned in school is just the beginning, more can be learned outside of school.

On the Stone Lab trip, LZ-L participated in the activities, but through his interview statements it seemed like each activity was focused on the peers whom he was with at the time. During the post-trip interview, it was necessary to continue pulling the conversation back to the Stone Lab activities and experience, because LZ-L would relate each question to a cultural definition. Multiple times this researcher redirected the questions and comments back to the Stone Lab experiences, and LZ-L responded with a very short, non-descriptive comment and then go back to talk about friends in more
descriptive and emotional color. He admitted no real attachment to the sciences, but at Stone Lab, he enjoyed the fun aspects of the trip, absorbing science along the way. But he also admitted that he enjoyed the activities and experiences more than he had expected. The biology did not interest him, but the chemistry did stimulate some interest. He enjoyed the plant and bird classes, but not to the extent that he could name any birds or plants.

LZ-L attended Stone Lab field trip to have fun with peers, and he did. LZ-L was very socially oriented; experiences were primarily social/cultural. He participated in all the activities, although he may not have paid attention to the concepts being explained or illustrated. LZ-L’s peers may have helped him to experience the activities, although LZ-L may have distracted them from experiencing those activities from the fullest.

The pretrip interview suggested that LZ-L had some interest in science and the outdoors. LZ-L’s concentration on peer interactions during the Stone Laboratory trip was unexpected by this researcher. It should be acknowledged that LZ-L was a senior, and would be graduating in just a few weeks. It may be that he academically shut down, being the end of his high school career, explaining his view of this trip as a fun field trip, rather than an immersive science experience.

**Cross Case Analysis**

The cross case analysis shall consist of seven sections that examine focal points that longitudinally intersected all the participants’ experiences. The seven sections are 1) Prior experience; 2) Affective responses; 3) Interest development; 4) Setting; 5) Peers; 6) Teachers; and 7) Changes in view of science.
Prior experience. The significance of prior experience was implied through the number of times it appeared with each participant throughout this analysis. Looking at comments that specifically discussed the prior knowledge, six concepts were identified: 1) Playing outdoors; 2) Personal experiences and interests; 3) Family, community experiences; 4) Formal school education; 5) Previous Stone Lab experience; and 6) Peer previous experiences.

Playing outdoors. Stone Lab by definition requires students to participate in activities and explore the outdoors, a theme common among all the participants involved playing outdoors, both as they were growing up and recently. Four of the participants discussed memories of playing in creeks. WM-H spoke about riding 4-wheelers in the creek and stopping to “catch crawdads and we play with the sand” (WM-H, April10, 2013, interview). WM-H connected her past creek experiences with her experience on the alvar at Kelley’s Island, stating, “I thought that was really cool and it reminded me that out by my mom’s house in the creek, we have this (garbled)…” (WM-H, May 14, 2013, interview). TK-H explained that she has a creek flowing through her backyard and “I go creeking sometimes but not often enough” (TK-H, April 8, 2013, interview). LK-H described growing up with a forest behind her home, and having a creek. “The creek was really fun, that was sort of scientific too, finding little crawdads, trying to catch minnows, seeing the little life forms in the creek” (LK-H, April 9, 2013, interview). She also recalled visiting her grandfather’s home which included 180 acres of land including creeks where “we try to find turtles on the way down.” LM-L recalled a creek near her home, “I think it is fun to pick up crawdads” (LM-L, April 8, 2013, interview).

LZ-L did not discuss creeks but did say:
I love being outdoors, getting fresh air, just, I like to look at, if I find little animals, I like to look at them. I look for birds, I am that kind of nerd (laughing). You find really amazing stuff outside if you look hard enough. I was outside literally for 10 to 12 hours a day, just straight. I was by myself. I would just play. I would go home when it was pitch black out. (LZ-L, April 9, 2013, interview)

In other examples of outdoors being discussed throughout the interviews, WM-H talked about a black squirrel she observed on the final day of the trip on South Bass Island. “I have never seen a black squirrel in my entire life. It was all black. It was cool looking” (WM-H, May 14, 2013, interview). She observed squirrels in her past, but perceived that this particular individual squirrel was black, contrary to all her previous experiences, which inspired WM-H to develop interest or curiosity. Without prior experience with squirrels, WM-H would never have recognized the uniqueness of this black-furred mammal.

DR-L preferred to be outdoors playing sports, but did mention living “on a farm, and I definitely like to be outside, playing with sticks, beating each other up, I have brothers…” (DR-L, April 10, 2013, interview). This was his only comment concerning outdoor activities prior to Stone Lab.

**Personal experiences and interests.** Participants with previous interests may have had a unique lens to certain Stone Lab field trip experiences. This is most evident with LM, whose primary interests involved art and architecture. Her field trip observations and perceptions repeatedly integrated her art interests into the experience. About Kelley’s Island, LM-L commented: “Lines in the rock, they were so worn down and smooth from being in the lake,” “I thought it was just cool that [boulders] could balance off each other in such small contact points,” and “It is interesting that [the crystal cave] all forms the same way, is in the same shapes and angles” (LM-L, May 16, 2013,
She noticed the points, lines and angles of the rocks. Her personal frame of reference was important as she assimilated the new experiences in the quarry. Unlike the other participants, LM-L also described her experiences using colors. She described the alvar, “The sky kind of changed while we were there. It was kind of blue and it went to gray as we were standing there. (Pause) Water splashing up, it reminds me of the ocean.” She described what she saw on the beach, “There is a big pile of seashells, and they are all tiny (pause) purple ones, they look more purple in person” (LM-L, May 16, 2013, interview).

WM-H had experienced the glacial grooves during family visits to Kelley’s Island, but did not focus on geological landmark. “I have been there before and I have been to the grooves, but I never really paid attention, they were just like a tourist attraction, but now I was actually looking at them, and reading the signs and learning about them” (WM-H, May 2, 2013, interview). Did the past experience connect WM-H to the site during the Stone Lab field trip?

TK-H attended a field trip the year before, where she learned about and explored botany:

[Last year] we went to the Hocking Hills and I like the trees, especially that grow around water, so the Indians would make campsites around it so there had to be water somewhere in order for them to be there. Or just the medical uses for all the different flowers, the limbs, and barks, and how you can eat termites with, weird things. So I like the usefulness of plants, rather than just keying random plants. (TK-H, May 9, 2013, interview)

TK-H developed an interest in plants, which was at a higher level than what was offered at Stone Lab. She wanted something more. That is when she discovered the aberrant flower on which she focused all her attention.
LK-H attended a summer science program for middle school girls hosted by a university, which magnified her interest in science. “I thought it was going to be boring lecture, but we did a dissection, we made robots one time, and it was just really cool” (LK-H, April 9, 2013, interview). Since then, LK-H has felt comfortable being interested in science. LK-H admitted that she had always been interested in anatomy and physiology. The cat and fish dissections were of great interest for her. She explained, “I am really excited about this dissection in biology, because you can see pictures and you can write notes, but you actually get to touch something and take it apart and look at it, that is more meaningful to me. You have to feel the experience, not just watch it” (LK-H, May 9, 2013, interview). LK-H saw the dissections as more than an activity, “I don’t know why, but it is kind of moving, because when you see those tiny little kittens, it is, it strikes you how similar they are to - how babies are” (LK-H, May 9, 2013, interview).

LZ’L’s academic interests were math and physical science, and he did not like killing things. By definition, the Stone Laboratory field trip would not meet LZ-L’s interests. However, during the pretrip interview, LZ-L did appear excited when he began to talk about playing outside when he was younger. He spoke about how from simply being outside all the time, he learned to read and predict the weather. His past experiences provided some connections to the environment at Stone Lab. He commented that he liked the ornithology and botany classes, and then identified the water quality lab experience as enjoyable:

I liked your bird class, because I learned all kinds of different birds, naming the random ones. I liked Mrs. G’s plant class, because I just like plants. I was able to key them out better, but I have no clue which plant was which, but it was nice to do for a little bit. Besides those two classes, there weren’t any that I really liked. I liked [Mrs. K’s water chemistry lab] because we got to test water oxygen levels,
I think it was, so that was kind of cool. I, yeah, chemistry I like it a lot better. (LZ-L, May 9, 2013, interview)

He liked the physical science classes, and he enjoyed the nature based classes, where nothing died to create a student experience.

Similarly, LM-L talked about her summer time experiences during the pre-trip interview, “Looking at things outside, I am outside a lot with my dad, he used to be a landscaper, so he used to teach me about plants, or I’d go to camp during summers and would learn about edible plants, and animals out there” (LM-L, April 8, 2013, interview).

After the Stone Lab field trip, LM, who admitted she did not enjoy life science, was asked which class she liked best, and she replied, “I think I liked the plant one the best. I think it was the stuff, I think it was pretty cool to be able to key through it and find the different plants just by the number of the leaves or the number of petals” (LM-L, May 3, 2013, interview). Throughout the post-trip interviews, LM-L never identified a previous interest or knowledge in plants, suggesting that she did not connect her new interest in plants to her previous experiences while landscaping.

**Family experiences.** Students acquired some topic relevance through their family connections. If a parent considered something interesting, the student may not share that interest, but knowledge of that interest still has value. WM-H talked about the relevance of the fish class, “I thought it was really interesting, in learning about it for me, I go fishing a lot, so I was paying attention because I was, oh, that is how my dad knows all that stuff” (WM-H, May 2, 2013, interview). While panning through all her digital images from the field trip, TK-H pointed out images of cannons that ornamented the city park and commented, “All the guns. My dad was in the military, so whenever there is big
guns you have to get pictures because he will tell you all about them, and I am, how do you know these things?” (TK-H, May 16, 2013, interview).

LK-H identified her family as important to her interest in science:

My parents, and my grandpa, had a big influence on me, he is the one who has the farm, to see his relation to the animals, it is kind of how I was inspired to get into loving animals and all the stuff. When I was little I actually wanted to become a vet, and then we had to put my dog down, and I said I will never do that, I could never do that. So… my parents, my grandparents (pause)…Whenever I have an assignment in bio that I think is interesting I will discuss it with my brothers, but it is cool to introduce them to things, and to see what their feelings are about it. (LK-H, April 9, 2013, interview)

LK-H recognized her source of interest in the bird class, “My grandpa is really interested in birds, so why does it appeal to him, why is he interested in that?” (LK-H, May 9, 2013, interview).

In a similar comment, DR-L explained, “My dad has talked about bird watching before, so I knew a little bit about that. I did not know we were doing that, but as soon as I heard, I was wow, that won’t be too bad” (DR-L, May 14, 2013, interview).

Family support of learning science may have also added a sense of importance to student science interest, before and after the field trip. DR-L related before the trip:

We talk about science and politics and that kind of stuff all the time. In the morning especially, my dad will talk about the recent news, what is coming out, or we will talk about new foundings [sic], especially if they cured someone with aids the other day, so we will talk about stuff like that, or medical stuff, I guess you could count that as science, yeah, stuff like that. Or new technology, if you call that science. (DR-L, April 10, 2013, interview)

After the trip, DR-L talked about the stones he collected along the shoreline, “I have never seen rocks that smooth before unless they were in a store. I brought some home to show my dad.”
LZ-L explained that he discussed science with his younger sister. “If I see something interesting I would tell her about it, and she tells me if she sees something cool, she will tell me about it. My mom is a nurse too, so she tells me about medications” (LZ-L, April 9, 2013, interview).

**School education.** Traditional, formal science education occurs in the school classroom and if taught effectively, provides students a foundation of prior knowledge and experience with a topic. Only LM-L spoke about how previous classroom topics tied into her experiences:

In middle school we talked about [ecology and ecological balance], a little bit, mostly in 6th grade, we started recycling there, with that, at least in the middle school, I don’t know if the high school was doing it. So I did that for a while. And we do a group project on the cleanest cities but, after that we did not talk about it much, and so it just kind of slips your mind, because you are busy with everything else. (LM-L, April 8, 2013, interview)

LM-L revealed her previous experience in the topic of ecological balance. Her last observation is interesting, because it may be true of many school activities, and even non-school activities.

**Previous Stone Lab experiences.** Three of the six participants attended the Stone Lab field trip two years before this trip. LZ-L did not provide any comparative comments. LK-H attended the Stone Laboratory field trip two years ago as a freshman. She tried to provide perspective to why she is returning to Stone Lab, “I like [that] the focus is all on learning, it is fun learning, and I like the location because I love Lake Erie” (LK-H, April 9, 2013, interview). LK-H saw the experience as purposeful learning. “It is all applicable, it really helps, it is real science, not just here, take notes on this, you will
never actually use it in life - this is an actual career, this is actually happening every day” (LK-H, April 9, 2013, interview).

TK-H and LK-H used their previous experience to enhance their second visit. TK-H observed, “We [TK-H and LK-H] were the only two who wore our boots, because we brought them in our bags, and we had tennis shoes on the rest of the time, but we switched because we knew it was going to be muddy” (TK-H, May 9, 2013, interview).

LK-H said, “I really enjoyed the old quarry. I don’t know what it is, I remember it from freshman year, that is like a big thing that I loved doing. Just putting on muck boots and wading through all those pools of water, finding little creatures was really cool” (LK-H, May 9, 2013, interview).

When asked to compare this Stone Laboratory field trip with the trip she went on two years ago, TK-H explained:

Most of it was the same as 2 years ago, but it was also completely different, I think it was my attitude about it, this time I am going to have fun, it is my last time, I am a junior, the first time as a freshman, I didn’t know anything, I didn’t know anyone, there were a few kids from ROHS I knew, and the one friend that I met. (TK-H, May 9, 2013, interview)

**Peer previous experiences.** Students who had no previous experience at Stone Lab may have had friends who did attend the trip two years ago. WM-H was the only participant who commented on relying on those who had been there before to show her the important places. Her friends were in essence mentors, guiding WM-H to what they considered important experiences, providing WM-H with essential quality experiences in a minimal amount of time, “She was telling me stories about her past experience at Stone Lab, and I was so happy to be able to be a part of her experience this year” (WM-H, photovoice). In another interview WM-H related, “She had already been there, so she was
showing me the cool places on Gibraltar” (WM-H, May 14, 2013, interview). WM-H described one of those places:

We had some down time and I hadn’t been on Alligator Bar yet, and everyone else had, so I was, I will go with you guys and we ended up, it was the first time it had stopped raining the whole time we had been there, and there just happened to be a rainbow right behind Perry’s Monument, and it was really clear, you could see all the different colors. (WM-H, May 14, 2013, interview)

Affective responses. The significance of affective responses is evident throughout the interview and photovoice data. This study was not designed to examine emotion, however a brief look at the prominent affective responses to settings or situations may provide insight to how students experienced the field station field trip. Among the six participants, 39 different affective responses were identified. Fun, like, and happy constituted a majority of the responses. This section will examine two common responses from the data that were related to the research questions.

Awe and wonder. Awe and wonder are a feeling of amazement, admiration, or surprise. LZ-L explained that awe and wonder are nearby and ready for discovery, “You find really amazing stuff outside if you look hard enough” (LZ-L, April 9, 2013, interview). Each of the participants revealed a moment when they saw something that amazed them.

WM-H described one powerful moment:

I went out on Alligator Bar and saw this beautiful rainbow behind Perry’s Monument. I was amazed because I hardly ever see them and when I do, they’re really faint or small. This one is clear and pretty big, which really excited me. (WM-H, May 9, 2013, photovoice)

The rainbow left a strong memory with WM-H, a moment that she designated as one of her most important moments on the field trip. WM-H was also drawn to the sunset,
commenting during two different interviews, “And it was at sunset, that is where I got that really cool sunset picture, too. That was amazing” (WM-H, May 14, 2013, interview). She observed that she enjoyed just looking out over Lake Erie at the horizon, “I still think it is amazing. You don’t get to see that all the time” (LK-H, May 14, 2013, interview). In another instance, WM-H commented about a small snake that her peers found. Although she was reluctant to even go near the snake, they convinced her to hold a snake for the first time. A week after her snake experience, WM-H declared, “I love snakes. I think they are so cool. And they are cute and cuddly” (WM-H, photovoice). When she held the snake, she developed a new understanding and her affective response changed from fear to wonder.

TK-H identified a moment on the Jet Express boat that was momentary and singular. She noticed a rainbow effect caused by her glasses:

I had clip-on to my regular glasses, and looking through them, I said oh, that is a pretty formation. As soon as I said that I kind of realized that I was probably the only person who could see it, because it was undoubtedly my sunglasses, so we passed around my sunglasses and all of us were oh, that is trippy, that is cool, whatever, and I put it over the camera lens and took the picture so I could prove, and then the next picture is just naturally, So this is what everybody else was seeing. I was clearly seeing pretty rainbow formations. (TK-H, May 16, 2013, interview)

That awe and wonder led to a moment of discovery as she learned the mechanism of the effect, and she wanted to share that feeling with her friends. In a separate, longer term period of awe and wonder, TK-H explained how extended time on rocking boats produced sensations lasting days after the field trip:

The water, how it, that was a really windy, choppy day. I love the, even the next week, you lay in bed, and you feel, I’m moving, the boat, it was worse the first time around, but this year it wasn’t quite so, so rocky. (TK-H, May 9, 2013, interview)
The alvar affected LK-H in a subtle manner, “The alvar is really neat, I think. Allison and I explored and we were, I don’t know, it is so neat to be standing on the edge of the water and looking out and seeing the horizon and the entire lake” (LK-H, May 16, 2013, interview). LK-H described the awe and wonder of the alvar in greater detail:

I kind of felt like I was on top of the world because it was like, you could stand on the edge of it and, the water’s not too far away, but you can still, you are still above it, you can still see so far away when you are up there. And I think it was really cool, because you could see the sky in the horizon and that is when it was going to start raining and you could see exactly where it was raining, on Put-In-Bay, you could see the rain coming down over there, and it was travelling towards you, to have that scope, was really cool, I think. (LK-H, May 9, 2013, interview)

The highly descriptive language suggested the alvar experience was quite meaningful. LK-H was also moved as she observed the glacial grooves, “The whole length of the glacial grooves. I think it is so cool how small the people look compared to it” (LK-H, May 9, 2013, interview). Literally, LK-H looked at the size of the exposed glacial grooves, but figuratively she is looking at how inconsequential people seem when standing next to something created by mile high glaciers and time.

DR-L expressed his wonder as he watched the storms move across the lake while he sat on the alvar:

We sat there and watched it, and then there was a big storm off in the distance, so we came in and it went from dry and slightly warm to just pouring down rain, that was kind of a, that was a neat thing. (DR-L, photovoice)

DR-L discussed the memory of the moment he looked out over the lake, “And just the vastness. It looks like the sea” (DR-L, May 16, 2013, interview). DR-L also observed how the constant water action created the topography upon the rocks of the alvar, “The way the water moved, the way you could see the water had been going in the same
pattern for like, a hundred years, it dug a circular shape into the rocks” (DR-L, May 16, 2013, interview). Trying to explain the experience, DR-L commented, “Sometimes it made you feel warm inside, like even though it was cold, it just felt like, something was really neat about it, like it was different, you can’t really explain it, but it was different” (DR-L, May 14, 2013, interview).

The glacial grooves provided moments of awe and wonder to two participants. LM-L was especially moved by the glacial grooves:

LM – I like the glacial grooves. They were really cool. Just because you could see everything down underneath, you could see all the layers, it is millions of years old, so it is just weird that you can still see it today

RESEARCHER - Are you able to describe your feelings?

There is a sense of emotion and a feeling of insignificance as LM-L imagined the immensity of the glaciers. There is an emotional attachment to that site, that memory, and those concepts.

LZ-L revealed little interest or attachment to the setting, focusing on his interaction with peers. While explaining his digital images, LZ-L commented, “Glacial grooves. Yeah, they were being dummies. (Pause). I like that picture. I like looking at all the grooves and stuff (pause) I took that because I saw the batman costume” (LZ-L, May 16, 2013, interview). This suggests that LZ-L did not connect to the setting, but was strongly connected to peers and interaction with peers. However, LZ-L did not select his photovoice images or write his captions until after his graduation and celebration, roughly six weeks after the field trip. LZ-L’s photovoice images and captions suggested he did experience moments of awe and wonder. About his sitting beside the bonfire on the final night and observed the rising full moon, he wrote, “I love the night because
everything is calm and relaxing. I saw how the moonlight just reflected so perfectly and needed a picture” (LZ-L, photovoice).

**Boredom.** Not all participants described positive affective responses. It is noteworthy that the three participants who made comments about being bored were the three students who were least interested in science. DR-L spoke about his feelings after the plankton lab failed to collect specimens to examine, “I did not get anything. After that, I was really bored” (DR-L, May 16, 2013, interview).

LM-L admittedly was not much of a science person and expected the classes to be boring. “I expected to find some of it interesting and some of it not. But I think I found more of it interesting than I expected” (LM-L, May 3, 2013, interview). Concerning the teacher presentation about the Battle of Lake Erie, she explained, “I liked parts of it [Mrs. K’s talk]. Others I found more boring, I liked the part where she told us the different words we use because of it, and more about today’s morals, but war does not interest me” (LM-L, May 3, 2013, interview).

LZ-L commented about boredom throughout the interviews. Concerning the glacial grooves, he stated, “We were just screwing around and it was a lot of fun, we were like, we trying to count how many grooves we could find. I don’t know, J. was trying to do it, I was kind of bored with it” (LZ-L, May 9, 2013, interview). Concerning the botany class LZ-L admitted, “To be honest, I think I was really bored and I completely checked out of the class, I just started taking pictures of pretty much anything. (Pause) yeah, he loves Batman...” (LZ-L, May 16, 2013, interview). LZ-L was not always engaged with the lesson in spite of the setting and in spite of the immersive activity.
LZ-L described his boredom in his school classroom in a similar manner, “After 20 minutes, I am out of it, I just don’t pay attention…I like to kind of move around, so you are not sitting in one place, drool is coming out of your mouth” (LZ-L, May 9, 2013, interview).

**Other significant affective responses.** Disgust appeared during the fish dissections. WM-H described, “She was holding it, with the intestines hanging on her fingers, and she was laughing. And I was, I don’t like this” (WM-H, May 3, 2013, interview). WM-H admitted that, “I think I would have liked the dissection if I had a different group.” WM-H was clearly upset over this situation. Also, LZ-L did not like killing anything, and voiced disgust when dissections were discussed, “You don’t have to kill, I don’t like killing, I like dissecting some stuff, but I like, love animals, so I feel really bad if I have to dissect an animal. So the cat lab was a definite no for me. Ew” (LZ-L, May 9, 2013, interview).

Sadness was brought up multiple times by different participants, but the sadness generally was related to social connections at the end of the field trip. For example, LZ-L commented about his feelings at the end of the trip:

LZ - It was really sad we were leaving.
RESEARCHER - You were sad you were leaving? Why?
LZ - Cause it is my last year, the last time I will be up there. So I was like, eh. A little sadness. (LZ-L, May 16, 2013, interview)

TK-H spoke of sadness when she and LK-H explored the quarry wetlands for frogs and found a dead frog. “It was dead. It was just sitting there, dead. That is kind of sad” (TK-H, May 9, 2013, interview). In a different conversation, TK-H described her feelings about the conclusion of the Stone Lab Trip, “We are not going to be in a group
having fun stuff for a week again. And that is really what was sad and kind of depressing” (TK-H, May 9, 2013, interview). WM-H voiced sadness when she was discussing her gallery of photographs, and came to the final image of the group photo, taken moments before all the students loaded onto the buses to head home, “here we are, now I will never forget any of you” (WM-H, May 14, 2013, interview).

**Interest development.** Participants who attended the Stone Lab field trip were very likely to develop some level of interest during the experience (Malinowski and Fortner, 2011). In Hidi and Renninger’s (2006) four-phase model of interest development, the pathway to interest development was described through a person’s extrinsically motivated interest or situational interest, and intrinsically motivated interest or individual interest. This section will examine through the participants’ comments how interest was triggered and developed. The concepts explored were: 1) Triggered interest; 2) Interest development; 3) Examples of situational interest; 4) Examples of individual interest; and 5) Interest influenced future lifeplans.

**Triggered interest.** Interest is triggered by environmental or textual objects or features such as unexpected or surprising information, and is usually externally maintained. All of the participants exhibited triggered interest. Of interest in this study, what level of interest was generated, and was there a causal relationship between the trigger and the level of interest generated.

WM-H talked about the surprises and unexpected activities during her trip to Stone Lab:

Going to Stone Lab, I didn’t know what to expect in the first place. So everything was, you turn around and there was something new. And you are, oh, I didn’t know that was going to happen. OK (laughing) It was not that I was not
expecting it in a bad way, it was, I didn’t know we were going to be doing a cat dissection, I didn’t know we were going to Kelley’s and actually go into a quarry. When they said rock pile, I wasn’t picturing (laughing) a rock pile, a rock pile. (WM-H, May 2, 2013, interview)

WM-H also described moments of discovery as she experienced the island. The rocks were “cool to me, they were all spotty and patchy, but they were still, it looks rough, but when you touch it, it is smooth, that was weird” (WM-H, May 14, 2013, interview). “When I first stepped onto [the beach], I didn’t expect it to be gravel, it was weird, I am used to sandy beaches, like even on Kelley’s [Island], it is sand. It was weird” (WM-H, May 14, 2013, interview). The newness of the setting grabbed her interest and her curiosity motivated her to explore.

WM-H talked about a picture she had taken of an odd structure she found on the beach on the first day:

WM-H - That is a little thing we found, I don’t know what it is. But it was cool. RESEARCHER - Do you want to know what it is? It is a grinding plate from a fish from in their throat. WM-H - Oh, that’s nice. (WM-H, May 14, 2013, interview)

The moment she found the structure, WM-H’s interest was triggered. Her curiosity and sense of exploration wanted an explanation. With no teachers around at that moment to answer her curiosity, WM-H’s quickly triggered interest, just as quickly extinguished.

TK-H attended the Stone Lab field trip two years ago, it was therefore likely that during this second trip experience she would experience fewer surprises and unexpected experiences. Still, she described triggered interest concerning this trip:

Just being able to explore that and see all the different formations nature has made around it, was pretty cool. And then you get to see all the plants and animals,
mostly plants, all the way back there and have different teachers point out to you, that is this, and it does this. That’s kind of cool. (TK-H, May 9, 2013, interview)

One aspect that was new to TK-H was the program at Perry’s Monument. Since the facility was closed due to the federal sequester, the teachers presented their own version of the history of the Battle of Lake Erie:

I liked Mrs. K.’s rendition of [the Battle of Lake Erie and the reason for constructing] Perry’s Monument, because two years ago we had the same speech, but it was [performed by The National Park Service who operate the memorial], then we had to sit through the movie, and all that stuff, but this time she kind of went straight forward and she did an awesome job. (TK-H, May 9, 2013, interview)

Asked how the Perry’s Monument experience affected her, TK-H answered, “Almost more interested than I usually am because I am not a history person, whatsoever, so to hear it and actually and enjoy it and actually learn something was kind of different for me” (TK-H, May 9, 2013, interview). TK-H suggested that even history can be interesting when it is taught in an experiential way. Her interest was triggered through the unusual and unexpected lesson.

This was also LK-H’s second trip to Stone Lab. LK-H presented an example of a trigger that did not proceed past situational interest. Throughout the interviews, LK-H did not provide any comments or descriptions of her experiences from the first day of the field trip, with the exception of her discussion of the digital images that she took during the trip. Although LK-H took several digital images the first day, her descriptive comments suggested a lack of personal connection to the activities depicted in her photos:

…Eagles nest, (pause) geese, (pause) TK-H took the camera, obviously I didn’t know, that was on the way to South Bass. Allison put on her sunglasses and it had already broken, but she put them on, (pause) water snake (pause) I like that
picture of WM-H because she looks like an old man, (pause) a little heron, (pause) just trying to get a nice shot of the [eagle] nest, (pause) it was still warm, that was from South Bass, I was trying to take a picture of Gibraltar. Mr. J, (pause) dining hall. (LK-H, May 16, 2013, interview)

LK-H experienced the travel and the activities, but it seems little from the first day triggered interest that intensified or lingered until the posttrip interview. Did her prior experience diminish the moments of surprises and discovery? The reason for her apparent interest development can only be conjectured.

DR-L talked about many things that triggered his interest:

Walking around, on South Bass, whatever, we were looking at the giant geode, playing Putt Putt, going down to the one beach and looking at the, looking for snakes, whatever. The smooth rocks a lot because I have never seen rocks that smooth before unless they were in a store. I remember S brought some home to put into a bowl for her family. I brought some home to show my Dad. S. brought a whole handful. Watching the sun set when it was, when the waves were coming in. (DR-L, May 14, 2013, interview)

DR-L recognized the wide range of things that caught his attention, but the only experience that he expanded the description was that of the rocks which intrigued him because of their smooth, worn texture.

This was LM-L’s first trip to Stone Lab. LM-L also experienced all the same Tuesday activities as the other participants, yet she exhibited little interest, in spite of the new environment and island activities. On the day of arrival she took only four digital images on Tuesday - the swimming beach, a lily pad seed pod, a friend, and Mr. G who was fishing. During the posttrip interviews, LM-L did not discuss anything concerning her experiences of Tuesday’s events, activities:

RESEARCHER - On the island itself at Stone Lab, Gibraltar Island, is there anything there that you found noteworthy?
LM - As in the classes?
RESEARCHER - The whole experience on Gibraltar.
LM - I don’t know. It all kind of adds up to the general idea.
RESEARCHER - So it is the sum of all the pieces.
LM - (nods)

But LM-L’s interest was triggered during the plant class:

RESEARCHER - What did you like best of all the classes?
LM - (pause) I think I liked the plant one the best.
RESEARCHER - Why did you like the plants? (long pause) Was it the teacher or the subject?
LM - I think it was the stuff, I think it was pretty cool to be able to key through it and find the different plants just by the number of the leaves or the number of petals.
RESEARCHER - Was that your first plant experience?
LM - Yeah.

Later, LM-L related that she was not inspired to take more science classes, but she did crave to get out into nature and look for new plants:

RESEARCHER – “You really became interested in the plants.”

LM-L wrote in her photovoice caption (Figure 22) a moment that triggered her interest:

[sic] This is the other thing that caught my interest while on the Stone Lab trip. These are (Pause). They are interesting because they are so oddly shaped that they catch your eye. They are also one of the things we learned how to key out in class. It was interesting to be able to look at details everyone’s used to seeing but not thinking about and use them to find the exact name of the plant you’re looking at. (LM-L, photovoice)

With LM-L’s “new found” interest in botany, new aspects of plant science also began to interest her.

LZ-L identified many things that triggered his interest on the first day:

RESEARCHER - What did you find interesting in your exploring?
LZ - I found lots of different plants and found some prickle plants that cut me. That was awful. I found some fish carcasses, like I found one that was completely picked apart, it was just bone. And I wanted to touch it, but I have a
thing with dead stuff, I can look at it, I just can’t touch it. I really wanted to pick it up, but…(Pause)

RESEARCHER - So what was interesting? Why was it interesting?
LZ - I don’t know, it was, you see this stuff, because you can’t explore next to the sea, well, it is not a sea, it is like a giant lake, and I found all kinds of interesting stuff, just random, I found a cinder block that washed up, so I don’t know where, but it is a cool cinder block that I found entertaining. And a couple bricks and a flashlight. I was really trying to figure out why there was a cinder block, I was honestly trying to figure out why you would drop a cinder block in the water. (LZ-L, May 9, 2013, interview)

In spite of the lackadaisical review of his experiences, moments of interfacing with nature were apparent.

Stone Lab did not seem to trigger interest in LZ-L as it had other participants.

During the final interview in which LZ-L discussed all his photographs, he had taken an image of students in a class and then an image of a paper:

RESEARCHER - Everybody looks so tired, cold and wet. (Pause) Why did you take that one of the paper?
LZ - To be honest, I think I was really bored and I completely checked out of the class, I just started taking pictures of pretty much anything. (LZ-L, May 16, 2013, interview)

Even when LZ-L admitted an activity was fun, he still revealed shadows of boredom:

Researcher - What did you think of the plankton lab?
LZ - It was fun, I liked it. I found a, what was it, it looked like a little shrimp, what was it called, I actually took a picture of the board so I might know what it was called. (Pause) ceiling, that light was having a seizure so it was really bothering me. (LZ-L, May 16, 2013, interview)

Through LZ-L’s unfocused comments, it does not seem that much interest was triggered.

**Developing interest.** Developing interest has been triggered and then grows in breadth and depth, first motivated extrinsically, and then intrinsically. This section examines the participants’ statements that exhibit developing interest.
WM-H explained what she found interesting about the rock quarry:

(Long pause) I don’t know, it was just, really, interesting, like there was a giant rock pile. And no one really thinks about it, but when you go up and look at it and go explore it, there is really cool stuff. And it is not just cool stuff to look at, it is stuff you can take with you and tell people about. That is pretty interesting.
(WM-H, May 2, 2013, interview)

WM-H had never seen rock piles, and this opportunity enabled her to explore and discover something she had never seen, or even imagined.

The following is a long statement given while describing her photograph gallery, but it illustrates the components of a rich experience that developed WM-H’s interest during this visit at the alvar:

That is the alvar. It was cool. This is the water on the alvar, the little places where things can grow, and that is the picture I used for photovoice (Figure 7), that was like a black algae, it was weird and squishy, and I didn’t like it. It felt, I couldn’t get the feeling off my hands, it made me uncomfortable. That is a little pool. It was like a stream almost, it went down and cut through the rock and I, yeah, it was cool looking. That was, we were starting to get closer to the edge, and I didn’t want to go very far, so that was where I stopped (laughing). I was trying to get a picture of the algae going down in it, it was slimy and weird, I like this, it wasn’t like the black stuff, the black stuff was oily, and that was just slimy, so it was OK. (Laughing) I am a texture person. This is looking back across. This is another picture where it got carved out and it was , it wasn’t like a pool, it was like a stream and it was pretty deep, not deep, but deep for the alvar. More of the slimy moss. I got my foot stuck in that. I really like it because you are looking out on the horizon and you can see where the water meets the sky and the water meets the alvar, it gives you a good viewpoint. That was just water. More rocks. This is like a little bench. This is another thing of water, I saw something swimming in it, and so I was trying to get a picture of it and then it darted away and I don’t know where it went. I really like this picture because, it is not waves, it is actual layers of rocks, and the water over it, and you can see the layers. I thought that was really cool and it reminded me that out by my mom’s house in the creek, we have this (garbled by background noise). And we climbed around on this, around and down to that and jumped down there so we could get over there. (Laughing) it was terrifying, actually. And that was a pool of the green stuff and it was nasty looking. And that is Alan and me and I am yelling at him at the time, don’t get close to the water, you are going to fall and hurt yourself, but he kept going. And that was a rock that was like a perfect square. Not perfect, but like a 90 degree angle there, a 90 degree angle there, why? This is a
picture of where we were, it wasn’t like, it was one big pool on these rocks, and it was red, and I realized after I took the picture that this was all red and it was just red, but it was interesting. (WM-H, May 14, 2013, interview)

This account, defined by the long series of photographs she had taken, shows WM-H’s experience to be full of emotion, curiosity, adventure, discovery, and interest; friends and peers are included; she explored with her senses, presenting tactile descriptions of the different algae on the rocks; and she compared what she was seeing to her prior experience at her mom’s creek.

A reversal of interest was seen as WM-H described her interest in the Stone Lab classes:

I really liked the fish lab and I liked learning about the different parts of the fish and we talked about plankton and phytoplankton and zooplankton, and I liked looking under the microscopes, that was really cool. I think I would have liked the dissection if I had a different group. There was this girl, and she was like ripping it apart with her hands and digging in there. She took out the beating heart with her hand, and she was holding it, with the intestines hanging on her fingers, and she was laughing, and I was, I don’t like this. (WM-H, May 2, 2013, interview)

WM-H’s description of the dissection illustrated digressing interest. She was excited and it appeared that the fish and plankton activities were interesting her, however it took one insensitive peer to curtail WM-H’s interest in the fish dissection.

During the plant class, TK-H found a plant with a flower aberration and was intrigued to why it should exist. While discussing her photograph gallery during the final interview, TK-H explained:

TK-H - This is the Dutchman’s breeches, the six versus five, there are supposed to be five, but I kept counting six, so I was trying to get evidence that I had six and I don’t think any of them really show you six. RESEARCHER - Were you interested in plants before this trip? TK-H - Enough, like we went to the Hocking Hills and I like the trees, especially that grow around water, so the Indians would make campsites around it so there
had to be water somewhere in order for them to be there. Or just the medical uses for all the different flowers, the limbs, and barks, and how you can eat termites with, weird things. So I like the usefulness of plants, rather than just keying random plants. (TK-H, May 16, 2013, interview)

TK-H was interested in plants and was quite curious why the flower did not key out as expected. Her curiosity may have stemmed from her admitted preference of working with plants rather than simple identification with no application.

During the visit at the wildlife center, TK-H observed and commented on one exhibit that connected to her sense of touch:

I like the petting wall poster thing, that you can touch all the different animals furs that you never get to do, it is not a random porcupine that you go and play with up close, no, that sounds like a bad idea, to be able to get up close and personal with the wall, is nice, different textures, and also I want this kind of animal as a pet. It is soft and it is a mountain lion (laughing) never mind. (TK-H, May 16, 2013, interview)

The exhibit was interesting to TK-H because it was a tactile exhibit, meant to be touched and felt.

LK-H identified a notable experience concerning the botany class, suggestive of a new interest in botany:

Mrs. G … showed us flowers that we could find anywhere, like in our backyard … we just passed by those little wild flowers and don’t think about what are they called, what family are they in … but when we actually went on the walk and she was showing us all the plants outside, that was when people were actually paying attention. Having that little wake up, you don’t think about plants often enough. She told us about the invasive species too, which, that is drilled into us so many times at Stone Lab. (LK-H, May 16, 2013, interview)

LK-H’s interest in plants was triggered and developed as she became aware of the flowers around her that, until then, were unseen. LK-H was amazed and interested how she had never noticed the intricacy and construction of plants and flowers. It required somebody to point out those everyday things by providing awareness and value.
LK-H was already interested in anatomy and physiology and was excited to participate in the cat dissection. Her interest developed as she related the cat dissection experience to a much anticipated fetal pig dissection that was about to commence in her school biology class:

I am really excited about this dissection in biology because you can see pictures and you can write notes, but you actually get to touch something and take it apart and look at it, that is more meaningful to me. You have to feel the experience, not just watch it. (LK-H, May 9, 2013, interview)

LK-H’s interest was developing because she was anxious for the experiential aspects of the dissection, to avoid the traditional classroom drudgery that decreased LK-H’s interest.

In the new setting of open water and islands, DR-L wanted to explore. He had a sense and need for discovery of the unknown. “I felt adventurous. It was definitely different and foreign. I had never been to anything like that before. I thought it was kind of cool” (DR-L, May 14, 2013, interview).

DR-L was intrinsically motivated to learn about this new environment. Once he was taking part in the assigned classes, DR-L admitted he felt some interest and some motivation to participate:

When I saw the minerals they had out in that one room, the bird room. They had that copper they found there on the island, stuff like that, and I wanted to learn a little bit more about anatomy and I wanted to know a little bit more about botany. (DR-L, May 14, 2013, interview).

His interest fed upon an exhibit that inspired him to want to know more, knowing he would have the opportunity to personally explore those topics.

DR-L talked about the one class that he enjoyed:

The bird one was pretty cool. I definitely liked that one the most, because I feel I learned the most out of it. And plus my dad likes to bird watch, so it was interesting to me…My dad has talked about bird watching before, so I knew a
little bit about that. I did not know we were doing that, but as soon as I heard, I was wow, that won’t be too bad. (DR-L, May 14, 2013, interview)

In spite of the bird watching hike occurring in a cold rain, some birds were observed in the bushes and trees. DR-L observed, “You are walking around all day and you take them for granted, but if you stop for a second and look around, you can see tons of different species, that I didn’t even know existed” (DR-L, May 14, 2013, interview). DR’s interest was captured by the connection of birds to his dad, and his interest developed from that connection.

DR-L demonstrated an interest that decreased when he discussed the botany class. “It would be cooler if it was like, what you could do with the different flowers or plants or stuff like that. I know some flowers you can make soaps out of, or they tell you where water is” (DR-L, May 14, 2013, interview). For whatever reason, DR-L did not find botany interesting, as related during the final interview. After the researcher asked a question about the plant class, DR-L curtly answered the questions and changed the subject:

    DR - She is looking at a flower. I was getting Allison. (laughing)
    RESEARCHER - What did your class do with the flowers?
    DR - Oh, we were keying them out, and I think she went back and pressed some for her mom, but, I don’t care much about pressing flowers. [Back to looking at photographs] That is more botany class. That is just, I think that is out the window. (Pause) The clock. I was waiting for the class to be over. (DR-L, May 16, 2013, interview)

DR-L stated earlier that he was looking forward to the botany class, his interest was triggered, but the class failed to connect with DR-L and the interest faded. Another example of a decrease of interest occurred during the plankton lab. DR-L wanted to see the plankton and searched for them under the microscope, however none were evident.
He quickly lost interest when he realized his water specimen was void of any organisms. “I thought [the plankton lab] would be more fun if, my samples contained something because I looked through two of them and I did not get anything. After that, I was really bored” (DR-L, May 16, 2013, interview).

DR-L explained that teachers made the different that helps students develop interest in a class:

The way that people teach it. The people there when they taught stuff, they really, you could really tell that they liked it. They weren’t teaching because they had to, or because they were getting paid to. It was like they were teaching because they loved the subject material and they liked being there. It was something that was part of them. (DR-L, May 14, 2013, interview)

LM-L seemed to develop stronger interest as she discussed her visit at the glacial grooves, which she identified as her foremost experience from the field trip. She was able to mentally picture the glacier atop this rock and realized the profound thickness of the ice:

LM - I liked the glacial grooves. They were really cool. Just because you could see everything down underneath, you could see all the layers, it is millions of years old, so it is just weird that you can still see it today. It kind of makes you think about all the weight that was going on and how much it has changed and how much things have grown even though they haven’t moved at all, or changed, other than water, I guess, but … (pause)
RESEARCHER - How did the place, the glacial grooves, make you feel? (pause) Are you able to describe your feelings?

She also chose the glacial grooves to be one of her photovoice images (Figure 23), and wrote in the caption:

This picture is of the glacier grooves. It was one of my favorite things from the trip. Two of the things I found myself interested on the trip were rocks and plants. This simply being a big rock that you can see all the layers in was really cool to see. Also just thinking that this was carved by an even bigger peice [sic] of ice is fascinating. On a deeper level, as I said in the interview, these grooves almost make you feel insignificant because of how large and old they are. No one could
have stopped it either. Sadly, I was one of the last groups to get there so I did not get to read more information of it but it was still interesting.

LM-L’s interest seemed to develop as she thought about and reflected on the implications of her glacial groove experience.

LZ-L identified three Stone Lab classes that he found interesting:

LZ - I liked your bird class, because I learned all kinds of different birds, naming the random ones. I liked Mrs. G’s plant class, because I just like plants. I like, I was able to key them out better, but I have no clue which plant was which, but it was nice to do for a little bit. Besides those two classes, there weren’t any that I really liked. I liked Mrs. K’s class because we got to test water oxygen levels, I think it was, so that was kind of cool.

RESEARCHER - You liked the chemistry part of it?
LZ - Yeah, chemistry I like it a lot better. (LZ-L, May 9, 2013, interview)

His interest, if evaluated through his comments, was pretty shallow concerning the birds and plants, but his interest in the chemistries appeared to be stronger. He spoke about the conditions of the lake and the implications for animal life in the lake, suggesting LZ-L’s interest concerning the lake water chemistry had developed in spite of his stated disinterest:

RESEARCHER - Were you interested in chemistry before?
LZ - Yes (nodding)
RESEARCHER - So did this bolster your interest, was there no difference?
LZ - No
RESEARCHER - Have you thought about the chemistry since?
LZ - No
RESEARCHER - Have you thought about the ornithology or plants?
LZ - I’d see a random bird fly by and I’d think, I used to know what that was. (Laughing) (LZ-L, May 9, 2013, interview)

Situational interest. Not all participants provided evidence of situational or individual interest, however the illustrations that are available provide tangible examples of the two levels of interest. WM-H provided many significant comments concerning her
interest through her comments and observations as she experienced the Stone Lab classes and activities. One example was WM-H’s Science Cruise experience:

It was just really windy and cold and we went out like to the, out, we went out of the bay to go get the fish, and the waves were really strong at one point, (laughing and excitedly), and it tipped sideways, and I was, Oh my God, I am going to die, but no, it was OK. We got back OK. We checked the temperature of the air and the water and then we also did, what was it called, it was a test to see how far in the water you could see, and we obviously couldn’t see very much because the wind was messing everything up. But it was pretty interesting, it was a few simple tests, but it was cool. It was. It was a really cool experience, I don’t think for any specific reason. I just liked being out on the water, seeing that side of this, we weren’t in a lab, we weren’t on the island, we were out in a boat (laughing) out in the waves. So it was cool. (WM-H, May 2, 2013, interview)

WM-H’s interest engagement was greater than the fear elicited from the rough water.

Her interest was situational because it was triggered by the boat trip, externally motivated by her cohort being aboard as assigned by the teacher, and excited to learn about how the lake scientists obtained their specimens and data.

TK-H found the macroinvertebrate class to be interesting, resulting in situational interest:

I liked the macroinvertebrate walk on Alligator Bar. We saw several [species of animals] that I had not seen before, we found a water beetle that is actually kind of rare and we don’t usually find it, and we found it, and we were kind of excited about that, (laughing) really geeky things, that was pretty cool. (TK-H, May 9, 2013, interview)

TK-H’s interest was triggered by the animals that she had not seen before. She did not indicate any self-motivated efforts to continue the experience or to research the creatures that she found, rather she just asked the teacher. The experience was orchestrated as a class and was extrinsically motivational for TK-H and her cohorts. Her description continued:
TK-H - I was just picking up rocks and looking at the bottom of it and saying, oh look, there is a thing. Mr. J, what is this? Cause we really don’t know, we aren’t going to take our papers out there with the list of what’s there, because it is not waterproof. Just the learning experience and digging under rocks and leaves and sticks and (laughing)…

RESEARCHER - Have you done that before?
TK-H - I have. Well, I go creeking sometimes but not often enough. But enough to, oh, there’s a bug, but I never know what it is, so it is nice to have the teacher there who can say oh yeah, that is um a lalalala (laughing). They just give out random names and I am like OK, I am pretty sure you just made that up, but OK, we got this. (TK-H, May 9, 2013, interview)

LM-L’s interest was not triggered in everything that she saw or experienced. “We went to the beach, we looked for snakes, and animals. I’d seen both of them before, so I knew what they were, not exciting or anything” (LM-L, May 3, 2013, interview). But a stop at the wildlife center captured LM-L’s interest. She selected Figure 24 as her fifth photovoice image, identifying it as one of her top five experiences of the field trip:

This is a picture I find both very interesting and very disgusting. We were at the nature center and these fish were hanging on the wall. The person giving the tour said the bottom fish is what they look like just before they die. The fish swim upstream to lay eggs then stop eating. They then turn a reddish brown color and some get hunches in their back. I just found this fact odd and interesting.

LM-L developed situational interest when she learned about the salmon’s life cycle. She was participating with a class, but her interest was triggered, and it developed into an extrinsically motivated interest that held her interest as long as they were in the museum. LM-L did not explore salmon further, and did nothing more with her interest, illustrating how the situational interest dissipated after the extrinsic motivator was removed.

At the conclusion of the digital photograph review of LM-L’s gallery of images, she panned through her images, describing her experiences of that afternoon, beginning with her comment about the fish at the wildlife museum:
The lack of supportive motivation to continue with that interest may decrease or extinguish that interest, as can be seen in DR’s statement:

I think [Stone Lab] offered some good things, but it is not things that are so important that they need to be taught at school. I think they are things that are important and we need to know, but it is definitely not something that is required because if you grow up and you, unless you are an important scientist, you are not going to need to know the birds or whatever, but…yeah (DR-L, May 14, 2013, interview)

DR-L experienced and was engaged with the activities, but the experiences were not meaningful enough for him to participate beyond a superficial way. He had fun, but found little to become excited or motivated enough to explore any of the sciences.

**Individual interest.** In one of the most poignant comments made by any participant in this study, WM-H tried to describe the Stone Lab trip. She was keenly connected to the science that she has experienced on the island. The final comments illustrated her intrinsically motivated interest:

It was really intense, I just felt, very curious, but also, (pause), I don’t know how to explain it. Amazed. Because I had never been put into a situation where you were like in depth, going into all this stuff, it was like, it wasn’t in a classroom, like you were there learning, and it wasn’t like learning, you were exploring, you were doing all this stuff, I was like this is awesome. It was also very exhausting, you are doing so much and even though it was like, I was cold and wet and muddy, through all of that, it was just wonderful, it was great, and I just remember, not when I was at Stone Lab, but after, when I came home, I just missed it so much, it kind of hurt a little bit. I just want to be back at Stone Lab. For one more day. (WM-H, May 2, 2013, interview)

WM-H was intrinsically motivated. She was curious. She was excited, she wanted to continue exploring and discovering. She was at an individual interest level.

Another illustration of individual interest is how WM-H continually observed trees growing out the side of cliffs and was curious how they survived because there is no dirt there. “And these are some really cool tree roots. And a little tiny bush. That is going
to be a tree growing out of nothing one day” (WM-H, May 14, 2013, interview). “More cool tree roots that are growing out of nothing. It just amazes me, I don’t know why that happens, but I like it” (WM-H, May 14, 2013, interview). WM-H was curious and wanted to know why, and continued to explore for an answer, intrinsically motivated to discover.

TK-H identified a variety of interests in the following statement, suggesting she was fully involved with the experience. TK-H illustrates intrinsic motivation powered by individual interest:

LK-H and I are just splashing through [puddles], and racing past them, and we get back there, and all we wanted to do was find a frog, we just wanted to find one frog. But instead we found all the salamander babies and the spider and we eventually found what we thought was going to be a nice frog. It was dead. It was just sitting there, dead. That is kind of sad. And so LK-H switched over to wanting to find tadpoles, and all we could find were the salamanders, so we kept on searching and we had to go into this back area that was almost too deep, it hit the top of our boots, and had it splashed at all it would have been in our boots… And then being able, since we have gone previously, seeing them before, we would show others and teach others, hey, this is a salamander, this is a tadpole, see the difference? And, because everybody else was saying, “oh it’s tadpoles,” and no, that is not it, they have little legs popping out of, they are salamanders, so, that was fun. (TK-H, May 16, 2013, interview)

Another aspect of individual interest was the desire to teach others. TK-H exemplified this in the previous statement and in the following statement:

I always kind of learn not only by doing but also by teaching others so when I teach anybody else anything, I definitely know more about it. So they ask questions, and I never thought of that, so I go and do my own research, and doing things like that helps me learn, solidifies it in your brain. (TK-H, May 9, 2013, interview).

TK-H later talked about helping other students during the cat dissection:

We were able to help the other kids who were asking questions about what to do and what things were. It was great to help others, because I learn by teaching. We also got two different kinds of kittens out of this particular momma; one had six
fingers on each front paw and the other was small. After a closer look at the smaller kitten we determined that it would have most likely been a still born, based on its size and the fact that its skull had not formed over its brain. (TK-H, May 16, 2013, interview)

TK-H continued to be intrinsically motivated to experience and explore and learn about science, but she was frustrated by her inability to get outdoors due to commitments. Her interest did not decrease, but remained strong and created a strong desire to follow her interests:

I just want to be outside. I had a rather large paper I had to write before the Tuesday, we got back that weekend and it was due that Tuesday. I had a six page paper that was due, in a college course that I hadn’t started yet, which is bad. I just wanted to be outside. I have a creek that runs through my backyard too, so I just wanted to go out there and have fun and I couldn’t because I had to be inside at the computer writing my paper, so it, I just want to go outside. I want to learn things, which when you are outside you kind of have to, whether it is because, oh, that’s a bird, that is a pretty bird, I want to learn about that bird, or this piece of grass looks different, what is it? Things like that. I love the outdoors. (WM-H, May 9, 2013, interview)

LM-L’s interest in art and architecture helped LM-L focus on those aspects of the field trip. She spoke about the Crystal Cave:

I thought it was cool that they were like, oh, let’s dig a well and they found that. That is a pretty cool discovery to find. They were all formed the same structure, I think that is kind of, not weird, but it is interesting that it all forms the same way, is in the same shapes and angles. (LM-L, May 3, 2013, interview)

LM-L’s comments suggested that her prior interest was nurtured as she perceived the lines and angles of the crystals in the cave.

Interest influenced future lifeplans. WM-H described how her interest in science intensified since the Stone Lab trip. “I want to be outside again, I want to go exploring (laughing)” She also stated:

It made me sure of what I want to do, to go into a science career. I realized there is so much that I wanted to learn and do and I wanted to be the one who was
figuring things out and telling people about it, so when we were exploring and learning I was like, I really want to be, not necessarily outside, but I want to be the one exploring and learning all the time. That is just what I want to do with my life. (WM-H, May 2, 2013, interview)

TK-H acknowledged that her interest in science changed “a little bit” since the Stone Laboratory trip. During the posttrip interview, in an extended discourse about her summer internship with the county extension office and how everybody in the office attended Stone Lab at some point in their career, TK-H reconsidered her future plans to include teaching in a similar environment:

I was wearing a Stone Lab T-shirt at the time but everybody else knew what it was, so it was obvious that they had been there because they were telling me about, oh I took this class and it was really hard and it the summer of 1973 or whatever it was they were doing and it just drew me in, I wouldn’t mind and am looking into, I am still doing my sign language, because I love that, but it drew me in, what else can I do at the extension office. (WM-H, May 9, 2013, interview)

TK-H’s recent Stone Laboratory experience has caused her to reconsider her future career.

After the trip, LK-H tried to explain the effect Stone Laboratory experience had upon her interest in science:

It has gotten me more excited for college, honestly, because it was being there, learning things I actually want to learn that I am happy to sit and listen to. It makes me feel let down at school, because I wish this was over already so I could get into the classes I want to take, so it has made me more excited to go to college. (WM-H, May 9, 2013, interview)

The Stone Lab experiences helped feed LK-H’s intrinsic motivation, strengthening her interest in life science. “It has strengthened, enriched it [career path], “I want to go into medicine and it has encouraged that path.”

Setting. The Stone Laboratory and island settings provided the objective and venue location of the field trip, each participant comment in some way was connected to
setting. This section could identify most of the data collected, but will examine comments that specifically discussed the setting. Three concepts were identified: 1) Setting was the location where the field trip occurred simply facilitating the events and activities; 2) The setting created an affective response, and; 3) The setting captured the interest of the participant.

*Island setting facilitated class or activity.* Most participants did not directly comment that the island setting was important to their experience, but rather inferentially acknowledged the Stone Laboratory and island settings. WM-H recognized that:

> When you are on the island, you don’t really have a choice, you chose to be there, but once you get there you can’t help but be sucked in, but here at school it is, in a classroom setting you can choose to go off with your friends and just be stupid or you can choose to enjoy the experience and the island is definitely a big part of why I enjoyed it, you are on a little island and you can go explore your interests, but I don’t think we can recreate that in a classroom, but doing the same kind of things would still be beneficial and would still have kind of the same appeal. (WM-H, May 2, 2013, interview)

TK-H also could not identify any specific memorable settings at Stone Lab, but concluded, “I love campfires, so that whole area, with the new benches and stuff was pretty cool this year. And then, back on the other side, where the waves splash constantly” (TK-H, May 9, 2013, interview).

LK-H recognized that the Stone Lab setting created a mystique or ambiance that could not be recreated in the classroom. “It has been there so long and so many students have come there, and have had life changing experiences and learned so much. I like that it has that feeling of age and that feeling of knowledge in it” (LK-H, May 9, 2013, interview).
DR-L did not talk about or relate the setting to the classes or his experiences. LM-L could not identify any specific feature of Stone Lab that she found memorable. “It all kind of adds up to the general idea” (LM-L, May 3, 2013, interview). She did not immediately point out anything special about the Stone Lab trip, but thought that the Stone Lab experience was noteworthy by the sum of the pieces. When asked about the entire field trip experience, she similarly answered, “I don’t know, I think it will be, the entire thing wadded up together into one experience” (LM-L, May 3, 2013, interview). No one thing stood out in her mind, but the entire coalesced experience was integral.

LZ-L seemed not to feel that ambiance:

To be honest, I think I was really bored and I completely checked out of the class...We went through the glacial grooves, and we were just screwing around and it was a lot of fun...I was kind of bored with it. (LZ-L, May 16, 2013, interview)

However, LZ-L presented four photovoice images and captions that focused on the setting suggesting that setting was more important to LZ-L than his words indicated.

**Setting and affective responses.** Participants discussed setting related affective responses that ranged from awe and wonder to peacefulness. WM-H tried to put into words how she felt. She was excited about seeing the rainbow. “I was amazed because I hardly ever see them and when I do, they’re really faint or small. This one is clear and pretty big, which really excited me” (WM-H, photovoice). She watched the sun set below the horizon of the lake, “That was amazing.” Experiencing the climactic moments outside thrilled WM-H, which seemed to inspire her and keep her wanting to experience more:

It was also very exhausting, you are doing so much and even though it was like, I was cold and wet and muddy, through all of that, it was just wonderful, it was
great, and I just remember, not when I was at Stone Lab, but after, when I came home, I just missed it so much, it kind of hurt a little bit. I just want to be back at Stone Lab. (WM-H, May 2, 2013, interview)

TK-H tended to talk about her experiences on the trip with excitement and enthusiasm. She was excited to be back at Stone Lab and reveled in everything she did and everywhere she went. She evoked a bit more emotion when she described the same sunset that WM-H spoke of:

I always kind of, God’s masterpiece that I am never able to paint or do anything with, and I finally made one 8th grade year with oil pastels and turpentine, but it is still not as good as that. (TK-H, May 16, 2013, interview)

The setting added to her already high level of excitement. The campfire setting helped TK-H to calm down at night, “it is fun to just hang around and be quiet because I am exhausted at that point and I just want to go to sleep” (TK-H, May 16, 2013, interview).

LK-H did not display obvious affective reaction. Her excitement and enthusiasm for her second trip to Stone Lab was evident, but contained. She made one observation concerning the setting which revealed her sense of awe and wonder while she was at the alvar:

I kind of felt like I was on top of the world because it was like, you could stand on the edge of it and, the water’s not too far away, but you can still, you are still above it, you can still see so far away when you are up there. And I think it was really cool, because you could see the sky in the horizon and that is when it was going to start raining and you could see exactly where it was raining, on Put-In-Bay, you could see the rain coming down over there, and it was travelling towards you, to have that scope, was really cool. (LK-H, May 9, 2013, interview)

LK-H tried to describe a feeling that was over and above her normal level of enthusiasm.

LM-L revealed a connection to a specific locality, the glacial grooves as she pondered the significance of the formation:
It was one of my favorite things from the trip. Two of the things I found myself interested on the trip were rocks and plants. This simply being a big rock that you can see all the layers in was really cool to see. Also just thinking that this was carved by an even bigger piece [sic] of ice is fascinating. On a deeper level, as I said in the interview, these grooves almost make you feel insignificant because of how large and old they are. No one could have stopped it either.

(WM-H, photovoice)

DR-L described the significance of the Gibraltar Island shoreline setting by describing, “How soothing it is. It is one of the most calming photos I think I took there because of how simple and clear it is. Water rolling over smooth rocks. If I listen to ocean waves, it's [like] I'm back there for that single warm day” (DR-L, photovoice).

DR-L shared an observation describing the alvar setting on Kelley’s Island:

This photo (Figure 19) strikes my eye because of all of the contrast. You have a big green lake with solid waves coming in, a hard rocky beach, and then a big storm on the horizon. It always reminds me of how calm it was before the storm and then how much it rained once it arrived…All in all that was one of the more enjoyable moments on the trip. (DR-L, photovoice)

LZ-L’s view of the significance of setting was conflicted. Throughout the interviews, setting appeared to be inconsequential. In this passage, LZ-L shows little connection to the physical experience, focusing instead on connections with his peers:

LZ - A beautiful moonrise.
RESEARCHER - Can you close your eyes and recall the sound of the waves?
LZ - Yeah - they did not want to wake up. (Pause) We are all pretty close, because there are not many of us. (LZ-L, May 16, 2013, interview)

Throughout the interviews, LZ-L focused on activities and connections with his peers. However, LZ-L’s photovoice activity was not completed until June, a month after the interviews. All of LZ-L’s images and accompanying captions focused on the importance of setting. “This picture made me feel calm and this was the day that we were leaving Stone Lab and heading home” (LZ-L, photovoice). “I never had been on this part
of the island before I liked how warm it felt next to the water, and I found it funny that I could see a nuclear power plant in the distances. We were talking about the Lake Erie Water Snake” (LZ-L, photovoice). “This was another picture of when we were leaving and I felt sad and wanted to get some really good pictures because I won't ever be coming back” (LZ-L, photovoice). “I love the night because everything is calm and relaxing. It was the first or second day and a bonfire was being put together, and I saw how the moonlight just reflected so perfectly and needed a picture” (LZ-L, photovoice). When removed from the social environment, LZ-L revealed that he was cognizant of the setting and that he was learning, in spite of his apparent lack of focus.

**Setting and interest.** The setting captured the interest of some participants. WM-H was highly interested in science prior to the trip, and was engaged throughout the week. WM-H’s interest was stimulated as she observed segments of the setting. The rocks were “cool to me, they were all spotty and patchy, but they were still, it looks rough, but when you touch it, it is smooth, that was weird” (WM-H, May 14, 2013, interview). “When I first stepped onto [the beach], I didn’t expect it to be gravel, it was weird, I am used to sandy beaches, like even on Kelley’s [Island], it is sand. It was weird” (WM-H, May 14, 2013, interview). WM-H was intrigued how trees grew out of the rock. “More cool tree roots that are growing out of nothing. It just amazes me, I don’t know why that happens, but I like it” (WM-H, May 14, 2013, interview). Her curiosity grew as the week progressed, her interest and inquisitiveness guiding her perceptions of the islands’ rocky settings, until she discovered thin soil underneath some rocks on Kelley’s Island:
This is a huge [rock] we were able to break off to see if there are fossils under there...and there was just soil under there. It was weird, just soil, no fossils or anything, looking at it, we saw all the roots and were, oh, that is how they probably grow out of nothing. (WM-H, May 14, 2013, interview).

WM-H’s interest related to setting did also take in the big picture. On the BioLab science cruise, she observed:

It was a really cool experience, I don’t think for any specific reason. I just liked being out on the water, seeing that side of this, we weren’t in a lab, we weren’t on the island, we were out in a boat (laughing) out in the waves. So it was cool. (WM-H, May 2, 2013, interview)

Similarly, she commented about her alvar experience:

I learned that this was one of very few of this kind of ecosystems. I was really interested in it, and took this picture right as I got off of the path and onto the alvar. At first, it just looked like a sparse limestone cliff, but in reality, there is a lot of interesting life here. (WM-H, May 14, 2013, interview)

TK-H did not focus on the setting as she described her experiences, thus linking setting to interest is difficult. There are two instances where setting was important concerning TK-H’s interest:

I liked the macroinvertebrate walk on Alligator Bar. We saw several [species of animals] that I had not seen before, we found a water beetle that is actually kind of rare and we don’t usually find it, and we found it, and we were kind of excited about that, (laughing) really geeky things, that was pretty cool. (TK-H, May 9, 2013, interview)

TK-H also talked about the wildlife center touchable exhibit of the animal fur:

I like the petting wall poster thing, that you can touch all the different animals’ furs that you never get to do, it is not a random porcupine that you go and play with up close, no, that sounds like a bad idea, to be able to get up close and personal with the wall, is nice, different textures, and also I want this kind of animal as a pet. It is soft and it is a mountain lion (laughing) never mind. (TK-H, May 16, 2013, interview)

The exhibit stimulated interest by allowing TK-H to utilize her sense of touch along with vision.
LK-H recognized that being out of the classroom and in the field took learning to a new and different level, opening her mind. She expected to see some relevance since the field trip experiences were being taught in the field:

[Stone Lab] made me eager for new experiences, so if someone said hey, do you want to go do this, to me now, I would be eh, not really, but at Stone Lab, it’s like, just those experiences and you have only a limited time to experience them, so I guess I wanted to jump onto every experience I could. (LK-H, May 9, 2013, interview)

The wetlands on Kelley’s Island interested LK-H, “Finding out what inhabits those little pools of water, because everyone has those little puddles of water, and they have tadpoles and stuff” (LK-H, May 16, 2013, interview). She had been to Stone Lab once before, and she was able to focus on the smaller settings instead of the expansive open water or abandoned quarry views.

LM-L was connected to the setting through her artistic interests. “The sky kind of changed while we were there. It was kind of blue and it went to gray as we were standing there. Water splashing up, it reminds me of the ocean” (LM-L, May 16, 2013, interview). This poetic way describing the setting offers a sense that LM-L connected to the place at that time. LM-L also found the crystal cave interesting, “it was really cool, that it was big enough for you to go down inside of it and see how big it was” (LM-L, May 16, 2013, interview). She was fascinated by the crystalline walls and contours of the cave setting. LM-L’s prior interest in art and architecture steered her to gravitate to certain settings that she already found interesting.

LM-L found the glacial grooves interesting and noteworthy:

This picture is of the glacier grooves. It was one of my favorite things from the trip. Two of the things I found myself interested on the trip were rocks and plants. This simply being a big rock that you can see all the layers in was really cool to
see. Also just thinking that this was carved by an even bigger piece [sic] of ice is fascinating. (LM-L, photovoice)

The setting provided stimulus for her imagination to take her back in time, to see the glacier in place.

DR-L had never seen open water, thus every setting he experienced was new to him. He wanted to explore the new settings. “I felt adventurous. It was definitely different and foreign. I had never been to anything like that before. I thought it was kind of cool” (DR-L, May 14, 2013, interview). He identified one specific setting as interesting, “When I saw the minerals they had out in that one room, the bird room. They had that copper they found there on the island, stuff like that” (DR-L, May 14, 2013, interview). DR-L talked about Gibraltar, Kelley’s, and South Bass Islands, but he did not specifically identify any particular interest in the settings. For example, DR-L described the setting of crashing waves upon the rocky shore. Because he had never experienced big water before this trip, the uniqueness of the setting, although unspoken, created interest. He explained, “Everyone is covered with water from the rain and the waves are splashing really high before that. Then they were coming down to get pictures” (DR-L, May 16, 2013, interview).

LZ-L was interested in exploring the setting. In this statement, he identified three different settings that inspired his interest:

I was down by the water a lot, I was helping some people find some sea glass…I know we weren’t supposed to, but I went off on one of those little cliffs, that hung over the water…And I went over to the bar and I found a rusted flashlight…you see this stuff, because you can’t explore next to the sea, well, it is not a sea, it is like a giant lake, and I found all kinds of interesting stuff. (LZ-L, May 9, 2013, interview)
LZ-L’s relationship with the settings encountered during the field trip seemed to link to exploration. He noticed the settings he walked through, as indicated in his description of the quarry wetlands:

It was something that looked so blah, can actually have different organisms just, it is just where they live. I never think about it until I saw, I started looking through the water and there was like tadpoles and just random bugs everywhere. I knew there was a lot, I only picked up one rock and there was a thousand bugs, it was a lot of bugs crawling down, scurrying everywhere. (LZ-L, May 9, 2013, interview)

When asked if he made any science related observations at the quarry, LZ-L answered:

We went through the woods and I found all kinds of bugs and I almost got attacked by a chipmunk. That was awful. I love animals, but I scare them, sometimes. And it ends badly. And we had, instead of taking the easy route, we decided to climb straight up and (laughing) it was all wet and I started sliding down the hill, so I was grabbing onto moss, and that wasn’t very smart idea, but I thought, I lived. (LZ-L, May 9, 2013, interview)

LZ-L’s description of the setting provides more of an image of the environment than any other participant’s description. LZ-L was having fun and fulfilling his interests in exploring and discovery, and was not necessarily focused on the traditional activities such as rock and fossil hunting.

**Peers.** Peers played a significant role in the participants’ experiences through different ways. Although all the participants commented about their interactions with peers, each participant appeared to have unique interactions and relationships with peers. Looking at comments that specifically discussed the significance of peers, three concepts were identified: 1) Fear of unknown peers; 2) Peers enhanced an experience; 3) Peers impaired an experience.
Discomfort or fear of unknown peers. There was an uncertainty or “fear” factor when the participants were placed in a situation with new, unknown peers. LK-H voiced her fears about a science camp she once attended:

I was thinking, oh my gosh, I don’t know what the other people are going to be like, I was going to seem so nerdy to them, it was a science camp, so everyone kind of was, made friends, because we were all feeling nerdy. (LK-H, April 9, 2013, interview)

In spite of her excitement about science, LK-H was self-conscious about being a middle school girl who liked science. The program sounded fun to her, and she was sufficiently courageous to go in spite of her concerns about how others would think of her. When she discovered that all the girls had the same interests and fears as she did, she began to make friends and was able to openly enjoy the science activities. On the Stone Lab trip, LK-H did not acknowledge any discomfort with her peers, with the exception of her comment about her second floor housing in the Barney Cottage, where her peers on the first floor complained about the noise created by walking on the creaky floors.

WM-H documented the impromptu volleyball game as an important first experience on the island, “It wasn’t just playing volleyball, it was, I got to meet [another schools’] kids and got to spend time with the [the other attending schools’] kids we brought along, it was a good experience for building relationships and friendships” (WM-H, May 2, 2013, interview). WM-H wanted to build casual relationships with students from other schools to create a friendly learning environment. TK-H also spoke about the volleyball game, “Volleyball is pretty much the initiation ceremony onto the island; or at least it has been the past two years. This is when everybody meets everybody and we try to memorize names” (TK-H, photovoice).
DR-L talked about the first few hours on Gibraltar Island:

Volleyball, everybody got to learn each other’s names and how you act, I think sports is the best way to see how people are really. Like how will act with one another. That was definitely one. And you get to show your crazy side, too, when you are playing volleyball with people you don’t know. (DR-L, May 14, 2013, interview)

In the shown situations, the participants were hesitant to insert themselves into a new, unknown situation with unknown peers, yet tried to remedy the situation by getting to know the students from the other schools. And in all three situations, the participants acknowledged the association of new peers was a positive experience.

**Peers enhance an experience.** Peers were directly or indirectly involved in a large amount of the interview data. Identification of specific peer connections that exemplified enhancement of an experience was problematic because most connections were blended or casual relationships. To avoid misinterpretation, data reinforced by the participants’ own words were chosen to illustrate how their experiences were enhanced through interaction with their peers.

WM-H recognized the value her friends added to her Stone Lab experience, “The three of them and me, just made it a really great experience, and I don’t think I would have had the great experience without all of them there” (WM-H, May 2, 2013, interview). WM-H also enjoyed moments of being alone to explore, but acknowledged that there were benefits to exploring with friends, “When you are with other people, they find things, and then you find things, and we can all share all the things together” (WM-H, May 2, 2013, interview). After the trip, WM-H and a friend talked all the time about the Stone Lab trip, “Going back and talking to my friends, oh, do you remember this? But yeah, do you remember this?” (WM-H, May 2, 2013, interview). WM-H’s friends
made the trip seem special. The social interactions added depth and reflection to the experience.

TK-H described her reluctance to go on the Stone Lab field trip from two years ago:

I went two years ago. I didn’t want to go, my friends were like, you are going to be stuck at school by yourself, so I did go, and I loved everything about it...the atmosphere in general was really nice, and bonding with the friends I already had, and making new friends from other schools was pretty cool. (TK-H, photovoice)

Before her first Stone Lab field trip, TK-H did not have much interest in science. She did not want to go on the trip. Yet her friends encouraged her to attend, and it has changed her life. How many students might also discover an interest in science, or any subject, if only they would be encouraged to experience new experiences in areas they believe are not interesting?

TK-H viewed her peers as fellow learners, and wanted to share her discoveries with those who would listen. On the boat, she made the discovery that her sunglasses created a rainbow in the mist, and her peers’ reactions were perplexing to her since they could not see the rainbow, and once she figured out the phenomenon, she wanted them to experience and understand the phenomenon:

My glasses, I had clip on to my regular glasses, and looking through them, I said oh, that is a pretty formation. As soon as I said that I kind of realized that I was probably the only person who could see it, because it was undoubtedly my sunglasses, so we passed around my sunglasses and all of us were oh, that is trippy, that is cool, whatever, and I put it over the camera lens and took the picture so I could prove, and then the next picture is just naturally, So this is what everybody else was seeing. I was clearly seeing pretty rainbow formations. (TK-H, May 16, 2013)

At the quarry, TK-H wanted her peers to understand that the animals they were calling tadpoles, were actually salamander larvae:
We would show others and teach others, hey, this is a salamander, this is a tadpole, see the difference? And, because everybody else was saying, “Oh it’s tadpoles,” and no, that is not it, they have little legs popping out of, they are salamanders. (TK-H, May 16, 2013, interview)

LK-H perceived her friends as part of her experiences. For example, on the Jet Express, LK-H talked about riding on the open, top deck as the boat sped to Kelley’s Island, “We were up on the top deck and we were playing around, the wind was blowing so hard, but just acting goofy with my friends was really fun” (LK-H, May 9, 2013, interview). After the trip, LK-H encouraged underclassmen at her school to attend the next Stone Laboratory trip:

I have been trying to encourage other people to get involved and I think I have actually succeeded, with a couple, so yeah, I think it has changed my view a little bit because I get to spread the ideas, I already love science, but spreading my love of science now. (LK-H, May 9, 2013)

DR-L described the cold, wet, rough boat ride as tolerable because his peers bonded and worked together. “There was sort of like a companionship because everyone was huddled together to stay warm, even though it was really cold, you were having a ton of fun, and you are learning a lot” (DR-L, May 14, 2013, interview). He was the only student to acknowledge comfort from peers while on the boat. In a different setting, DR-L spoke of working in the quarry with his friends, talking about random topics, “It was just conversation, until at the rock quarry, we were breaking rocks together, we were looking at different stuff. And talking about the rock types” (TK-H, May 14, 2013, interview). Although the conversation is not known, the students may have been helping each other reflect as they were experiencing the rock formations.
LM-L spoke very little about her peers in any of her interviews. In one photovoice image, LM-L acknowledged that friends may have played a positive part in some indeterminate way during her Stone Lab experience:

> Overall the trip was a lot of fun. Not just because of friends but because I found myself more interested in the science parts than I expected. I expected to be more bored in a couple of the classes but I was surprised to find I liked most of them a lot. In conclusion I had a great time with friends and, yes, learning so I will definitely be back my senior year. (LM-L, photovoice)

LM-L later explained that she did not discuss the Stone Lab trip with any of her friends.

LZ-L’s experience was defined by interconnections with peers:

> I felt really relaxed up there. I have friends that I actually like spending time with, instead of people, you would be walking in a hallway and it is like, get out of the way. So it was nice, and being outside all the time instead of being cooped up all the time, which is nice to be outside. (LZ-L, May 9, 2013, interview)

LZ-L’s explained that back at school, he tried to talk about the Stone Lab trip, but:

> Most people look at me like I am crazy because half the stuff I talk about they are like I don’t know what you are talking about. And so I talk to the people who are well interested about it. Everybody else looks at me like I am crazy because I made a joke. (LZ-L, May 9, 2013, interview)

LZ-L’s final post-trip interview comment summed up the priority he placed upon his interactions with friends:

> LZ - It was really sad we were leaving.
> RESEARCHER - You were sad you were leaving? Why?
> LZ - Cause it is my last year, the last time I will be up there. So I was like, eh. A little sadness.
> RESEARCHER - What are you going to miss about it?
> LZ - I think just going up and having all my friends, for a week straight. (LZ-L, May 16, 2013, interview)

**Peers impair an experience.** Two particular incidents involving the dissections created a negative experience for three of the participants. During the fish dissection, a
student from another school ripped a fish apart and pulled out the beating heart and as WM-H described, “She was holding it, with the intestines hanging on her fingers, and she was laughing. And I was, I don’t like this” (WM-H, May 2, 2013, interview). WM-H admitted that, “I think I would have liked the dissection if I had a different group.” Clearly the peer’s actions affected the amount of learning during WM-H’s dissection experience. LM-L briefly mentioned the same event, “There was a girl, there was a group from the other school with us who did it… It didn’t really matter to me” (LM-L, May 3, 2013, interview).

During the cat dissection TK-H did not enjoy the large number of students who attended, because there were only two cats. “Everyone else just wanted to see the babies and then they left. Once they left, we were, oh we can actually learn something” (TK-H, May 9, 2013, interview). Her patience allowed her to have a positive experience after the negative moments. DR-L lost his patience and departed from the activity while the initial crowd was in attendance. “I felt like our school wasn’t really, we were being ostracized or something, because we tried helping out or doing something and we were kind of being pushed away” (DR-L, May 14, 2013, interview). He explained that his frustration mounted, and finally he just gave up, “So I just took my gloves off and left and that was the end of that. I did not stay for the rest of it.” Clearly, the negative impact to DR-L and WM-H resulted in anger and disgust, a lost opportunity for a new experience, and an unpleasant memory concerning dissection activities.

**Teachers.** The teachers’ interactions added value to the participants’ experiences and provided positive dividends that carried over into the regular classroom. Looking at comments that specifically discussed teacher involvement, three concepts are identified:
1) Teachers’ impact on participant interest; 2) Teachers introducing values to students; and 3) Teachers seen in a new perspective.

**Teacher impact on interest.** Teachers play a significant role in how students respond to a class or activity. The participants identified four areas in which teachers affected the students’ interest at Stone Lab: 1) Passion; 2) Freedom; 3) Pedagogy; and 4) Encouragement.

**Passion.** All participants identified characteristics of teachers and their teaching that made an activity or class interesting. DR-L perhaps summed up all the participants’ comments when asked what it was about an activity that grabbed his interest:

> The way that people teach it. The people there when they taught stuff, you could really tell that they liked it. They weren’t teaching because they had to, or because they were getting paid to. It was like they were teaching because they loved the subject material and they liked being there. It was something that was part of them… when you look at them, you like, they get excited about, they have that twinkling in their eye, you know they like it. That makes it a little bit more fun.

(DR-L, May 14, 2013, interview)

The teachers on the Stone Lab field trip knew and understood the field station, and were excited to share the place and experiences with their students. The passion and excitement was tangible and infectious. The students perceived this excitement, and were interested to see what made the teachers so excited. LZ, who does not enjoy life science, reinforced the significance of teacher enthusiasm at Stone Lab:

> They are actually passionate about it, it give them more of, they are always happy, and it gives better vibes off them, and I am like, hey, this isn’t god awful. This guy has been doing this for like 20 years, I may as well try…It was just fun.

(LZ-L, May 9, 2013, interview)

The teacher has the power to make the class good or bad. The teachers make or break the class with their enthusiasm. Teachers who teach what they love will reach more students.
Forcing teachers to teach something they do not enjoy might be counter-productive. LZ-L talked about a teacher in middle school:

I had a teacher back in middle school, I am pretty sure she hated all of us. But, and if you asked questions, she would rip your head off. I feel like the teacher should know what they are talking about and actually love what they are teaching. (LZ-L, April 9, 2013, interview)

Freedom. On the Stone Lab field trip, the teachers provided the students unexpected freedom. WM-H explained:

[I was surprised by] the amount of freedom and trust in the students. The teachers obviously were around, but they weren’t breathing down your neck. It was like they were there if you had a question, and they would come and make sure you weren’t drowning and stuff like that, but you were allowed to go off by yourself and with your friends and they trusted us not to do bad things. (WM-H, May 2, 2013, interview)

An example of how the freedom enabled and fostered exploration was provided by WM-H:

At first I was in a big group and then me and A broke off and he went down and at first, I’m not sure we are supposed to be here, but then he went down there and Mr. J. watched and didn’t say anything. And I was like, OK I will go down here too. And then everyone followed us, K and A came down too and we were looking all around together and that was interesting. (WM-H, May 2, 2013, interview)

Without naming the teachers, LK-H described how freedom enabled her to explore:

I was kind of on my own, at that point, my friends didn’t have boots on, so I went off to my own area and was searching for little creatures independently. Striking out on my own was different because all the other activities, I was with my friends all the time, but I was on my own. (LK-H, May 9, 2013, interview)

LZ-L recognized this freedom in the Stone Lab classes, “They didn’t say you have to learn this exactly, it was, you could interrupt and ask what is that and they would answer. They didn’t tell you to shut up and keep going” (LZ-L, May 9, 2013, interview). He
enjoyed the ability to interact with the lessons, and to devote his energy to his own interests:

You could explore, the teacher would say, find something cool, bring it back, I like that kind of teaching. I like being able to move around, so you are not sitting in one place, drool is coming out of your mouth. (LZ-L, May 9, 2013, interview)

DR-L provided similar comments about the program structure of the Stone Lab field trip:

It is definitely more hands-on, so much is restrictive at school, you have an allotted time, but you are not packed down by work or you are thinking about other classes what you have to get done, there is no assignments, so it makes it a little more like free roam, a little bit more hands-on. (DR-L, May 14, 2013, interview)

The sense of freedom or independence enabled the students to relax and enjoy learning at their own speed, in their own way, without fear of judgment or assessment.

Pedagogy. Each teacher on the Stone Lab field trip taught four sessions of one subject. Participants described the significance of how the teachers made the classes or activities more interesting. LM-L explained that the teacher in the botany activity made her favorite activity interesting, “They knew what they were already talking about and they’d done it before so their experience, they would do a good job explaining and getting the main points across, and helping us to understand what is going on” (LM-L, May 3, 2013, interview).

DR-L tried to identify what the teachers did at Stone Lab that made the classes more interesting:

The way that people teach it. The people there when they taught stuff, they really, you could really tell that they liked it. They weren’t teaching because they had to, or because they were getting paid to. It was like they were teaching because they loved the subject material and they liked being there. It was something that was part of them. (DR-L, May 14, 2013, interview)
The lesson about the Battle of Lake Erie was presented on the steps of the memorial, while the students looked out over the lake where the battle took place. The teacher drew the students into the story by talking about the people’s personalities and made the history relevant to the students, using the students’ imaginations through their observation of the lake, utilization of terminology of that age that has carried over to today’s vocabulary, and description of people involved in the battle as real people the students could identify with. LM-L said, “Typically I don’t find war very interesting. Because Mrs. K explained a little more of the peoples’ story it interested me. It also had some strange facts with it. I probably was a little interested in it since it was in Ohio so it related to me” (LM-L, May 3, 2013, interview).

LK-H and DR-L recognized the importance of the teachers to cause students to become aware of things that had always been present, but unseen. LK-H recognized that the teacher “showed us flowers that we could find anywhere, like in our backyard … we just passed by those little wild flowers and don’t think about what are they called” (LK-H, May 9, 2013, interview). DR-L similarly began to see birds where he had not seen birds previously, “You are walking around all day and you take them for granted, but if you stop for a second and look around, you can see tons of different species, that I didn’t even know existed” (DR-L, May 14, 2013, interview).

While describing the cat dissection, TK-H portrayed the teachers as encouragers and guides, allowing the students to explore the specimens. When it was discovered that two kittens had birth defects, the teachers encouraged the remaining participants to explore and try to understand the birth defects. That encouragement led to increased
confidence, courage to explore, and pride to be the ones doing the work. “Mr. J. had me dissect the stillborn, which was kind of cool, because we could see where the lip of where the skull was” (TK-H, May 16, 2013, interview). LK-H recognized a different teacher during the dissections:

Mr. G is a really great teacher too, so having him as an instructor was a really cool bonus, he reminds me of my grandpa, so his patience with the people who were just trying to cut into the cat, he was like, let’s take this slow, so that was kind of cool. (LK-H, May 9, 2013, interview)

LZ-L provided an illustration of what occurs when a teacher or mentor is not available to explain what the student perceives:

LZ - When I went down to the beach, we went, I am not sure what it was. What is the structure, stone things (long pause) what were those?
RESEARCHER - There is a boat ramp area there, so the rocks slow the waves down
LZ - That makes sense. (LZ-L, May 9, 2013, interview)

LZ-L did not know what the structure was, or the purpose of the structure, so he could not assimilate all the observations concerning that experience. Another participant had a similar situation. WM-H found an object along the beach. She was curious and photographed it because she did not know what it was. Soon after, she forgot about the structure until she reviewed her digital photographs after the trip. She commented:

WM-H - That is a little thing we found, I don’t know what it is. But it was cool.
RESEARCHER - Do you want to know what it is? It is a grinding plate from a fish, in their throat.
WM-H - Oh, that’s nice. (Pause) That is a seagull…. (WM-H, May 14, 2013, interview)

Although she was curious when she located the structure, and she acknowledged that it “was cool” during the interview, WM-H lost the inquisitive interest because there was no teacher or mentor around to tell her immediately what she found. With that knowledge
she may have been able to connect that knowledge during the fish class, when the teacher spoke about that species of fish. Teachers who are in the background, but are able to answer questions and provide relevancy to students’ finds will enable students to build connections to past and future learning opportunities.

Encouragement. Teacher encouragement was implied throughout the participant interviews. These specific comments illustrate the value of teacher encouragement. LK-H said, “Having a mentor, someone to look up to in the field of science helps” provide a dream, a goal, and a purpose for learning” (LK-H, May 9, 2013, interview). LZ-L explained why he joined science club when he did not enjoy science, “Oh, yes. Mr. J and Mrs. K, I like how they teach and it made me want to join science club” (LZ-L, April 9, 2013, interview). WM-H spoke of the same two teachers:

I have never taken a class with Mr. J. But obviously I am in his room all the time, he has really helped, and I can talk to him about things and he encourages me about Stone Lab, because I wasn’t going to go, I was like I am not gonna, I can’t pay for that, but he was like no, we can pay for this. And then Mrs. K is just like, she is just goofy, I love her so much, it is really helpful that with her around will lighten my mood and make me feel better. (WM-H, May 2, 2013, interview)

TK-H described the importance of her teachers’ encouragement for her to learn:

Teachers are always there in the background, like the man behind the curtain. If you truly show interest or show that you are not doing so well but they know you can do well, they are great, they are there, they are my counselors half the time. (TK-H, May 9, 2013, interview)

TK-H does not see the teachers as the generators of her interest in science, but as mentors, as guides, as counselors. The teachers help her develop her interest.

WM-H commented about teachers in the agriculture program she joined in eighth grade:
When I joined FFA, Mrs. J. was really helpful and really supportive and encouraged me to try things that I never had done before, like I probably wouldn’t have done science fair if I hadn’t done public speaking, and I wouldn’t have done if I didn’t have different context, different experiences. (WM-H, April 10, 2013, interview)

Her teachers encouraged her to develop new skills and to try new activities, which have led to a strong interest in science, and towards a career in science.

DR-L enjoyed sitting and talking with the teachers to learn who they are as people, as well as to enter conversations about science and non-science topics of interest, “When you sit down with a teacher and you get to know them and you get to learn the subject more than what you are going to be taught in class” (DR-L, May 14, 2013, interview).

**Teachers teaching values to students.** The participants discussed experiences that concerned teachers who introduced a new value system to the students. WM-H exemplified while describing her digital images how one of the teachers defined a definitive ecological priority. “This was the emerald ash borer Mr. G was showing us, what happens to the trees, so I took a picture of that, I thought it was important” (WM-H, May 14, 2013, interview). She thought it was important because the teacher provided evidence that it was important. The teacher pointed out something that the students might have missed, gave it meaning by explaining what is being seen, and then provided value to the concept. In a similar way, WM-H had visited the glacial grooves previously, and saw no value or interest in them, but it required a teacher to provide value to the setting before WM-H saw value in the setting:

We go fishing up on Kelley’s Island, so I have been there before and I have been to the grooves, but I never really paid attention, they were just like a tourist
attraction, but now I was actually looking at them, and reading the signs and learning about them, it was really cool. (WM-H, May 2, 2013, interview)

Students voluntarily participated in a non-science activity on the final day involving the maze. TK-H observed, “At one point half of us went out the entrance, and Mr. J made us go back in and find the exit” (TK-H, May 16, 2013, interview). The teacher refused to allow the students to quit and take the easy way out. He set up a value expectation that students should finish what they start.

In the botany lab, the teacher instilled a sense of value by showing students plants preserved, from 70 years ago. LK-H explained, “She just pulled out the pressed flowers from the cabinet and it was really cool because she said there were some from even back to the 1940s in that cabinet, so that was really neat” (LK-H, May 16, 2013, interview). The teacher was excited to work with specimens that were important enough to be preserved for 60 or more years, and the students felt and absorbed that excitement and respect.

LK-H also talked about the significance of the botany teacher’s discussion about invasive plants, “She told us about the invasive species too, which, that is drilled into us so many times at Stone Lab” (LK-H, May 16, 2013, interview). As each botany class walked around the island, students saw the teacher identifying and pulling invasive plants from the ground, placing them in garbage bags. During the exploration hikes on Kelley’s and South Bass Islands, LK-H and other students were observed identifying and pulling invasive plants from the ground and dumping the pulled plants in garbage receptacles.

**Teachers seen in new perspective.** Students generally only see their teachers in the classroom setting, and only get to see that classroom teacher persona. Away from the
classroom on the Stone Lab field trip, the teachers behaved differently than the students were accustomed, especially with the teachers’ families also in attendance. The participants only made a few observations of this phenomenon. TK-H took a photograph of one teacher and the teacher’s family (who also attended the field trip but did not participate in the classes), “I have the whole G family in there. 3 generations. That is kind of adorable” (TK-H, May 16, 2013, interview).

One teacher seemed to draw the majority of comments. Mr. J’s firm classroom management style markedly contrasted with his excitement and enthusiasm in the field. LK-H commented, “I was playing around with the camera and Mr. J stuck his face, so there you go” (LK-H, May 16, 2013, interview). WM-H made another observation, “And Mr. J holding a frog. He kissed the frog. He didn’t turn into a prince, so my whole childhood was ruined, thanks Mr. J, yeah, and then we passed the frog around” (WM-H, May 14, 2013, interview). This teacher revealed a candid characteristic that students have not seen in the classroom. Rather than just yell for the students to meet where he was at, Mr. J had an effective, unique, and memorable method of assembling his students, described by TK-H, “He is caw cawing because that was his call for all of us to get ready to go down to the quarry” (TK-H, May 16, 2013, interview).

The teachers also surprised the students by being receptive to casual discussion about their lives, the world, and general conversation fodder. DR-L explained, “Me and Mr. J would talk and make jokes and stuff. We just would sit there and talk about how it is” (DR-L, May 14, 2013, interview).

**Changes in View of Science.** Participants attended the Stone Lab field trip and experienced the classes and activities. How did their interest in science compare change
from before to after the trip? This section will focus on each participant’s view of science before, and then after the field trip.

**WM-H.** Prior to the Stone Lab trip, WM-H was asked how she related to science. She responded:

I love it. I like, I’m a really, really curious person, so with science you can, I don’t know how to explain it, you can go in and figure things out, I am not sure if there is a how or why and even if there is not a how or why, that means there is something new to be discovered, it is not like English or social studies where it has already happened. (WM-H, April 10, 2013, interview)

After the trip, WM-H commented:

Because I had never been put into a situation where you were like in depth, going into all this stuff, it was like, it wasn’t in a classroom, like you were there learning, and it wasn’t like learning, you were exploring, you were doing all this stuff, I was like this is awesome. It was also very exhausting, you are doing so much and even though it was like, I was cold and wet and muddy, through all of that, it was just wonderful, it was great, and I just remember, not when I was at Stone Lab, but after, when I came home, I just missed it so much, it kind of hurt a little bit. I just want to be back at Stone Lab. For one more day. (WM-H, May 2, 2013, interview)

WM-H wanted the experiences to continue. She was already interested in science, but her view of science was maintained and possibly strengthened.

**TK-H.** Prior to the Stone Lab trip, TK-H was asked how she related to science. She responded:

TK-H - I feel happy, but almost intimidated. There is so much of it, there is no possible way to know it all. Science itself doesn’t know it all. I think that really draws me into it. The almost mystery surrounding it. I have always loved mystery books. Especially - Science itself is the mystery.

RESEARCHER - Is that why you like Egyptian history?

TK-H - (Deep breath and excited response) Yes! I can just delve into it and learn a lot. (TK-H, April 8, 2013, interview)

After the trip, TK-H commented:
And with that meeting everybody who was, they still knew each other, they were asking about Stone Lab about people I had never met before. I heard you went to Stone Lab, I was what is this, everybody, I was wearing a Stone Lab T-shirt at the time but everybody else knew what it was, so it was obvious that they had been there because they were telling me about, oh I took this class and it was really hard and it the summer of 1973 or whatever it was they were doing and it just drew me in, I wouldn’t mind and am looking into, I am still doing my sign language, because I love that, but it drew me in, what else can I do at the extension office. (TK-H, May 9, 2013, interview)

She has reconsidered her career path which was unclear and focused on ASL, and now wants to include science in her life. She recognized that the social connections to Stone Lab are important to other people, and the connections remain strong long after attending Stone Lab. And she recognized that Stone Lab is a common denominator for many people who are working in the biological, agricultural, soil and water fields.

**LK-H.** Prior to the Stone Lab trip, LK-H was asked how she related to science. She responded:

I really enjoy science. I wish we could do more with anatomy and health, but I am happy with biology this year. I guess I really enjoy actually psychology and genetics, but once we get farther into them, I kind of, it goes over my head. (LK-H, April 9, 2013, interview)

Even though LK-H had a strong interest in science before attending the field trip. After the trip, LK-H commented:

I have always been interested in anatomy and physiology and also, horticulture and ornithology, those are things that I hadn’t really shown an interest in before, but I would say now at least I am thinking about those things. Taking in anything I was taught at Stone Lab, really helped open my mind to those things. (LK-H, May 9, 2013, interview)

LK-H developed new interests of topics not taught in public school. LK-H did explain how the trip affected her interest in science, “It (the trip) has strengthened, enriched it
[career path]…I want to go into medicine and it has encouraged that path” (LK-H, May 9, 2013, interview).

**DR-L.** Prior to the Stone Lab trip, DR-L was asked how he related to science. He responded, “I like using it as something entertaining and fun… it would be more for the entertainment as opposed for what I would use for my job” (DR-L, April 10, 2013, interview).

After the trip, DR-L commented:

I remember a little bit about the sciences that intrigued me a little bit. When I saw the minerals they had out in that one room, the bird room. They had that copper they found there on the island, stuff like that, and I wanted to learn a little bit more about anatomy and I wanted to know a little bit more about botany. But I haven’t, I have been too busy. (DR-L, May 14, 2013, interview)

DR-L viewed science as a source of entertainment, and after the trip he did not indicate any change in attitude.

**LM-L.** Prior to the Stone Lab trip, LM-L was asked how she related to science. She responded. “The experimenting part is interesting, but writing the papers and going through all the research is not fun” (LM-L, April 8, 2013, interview). She also stated:

Because so much of what I do outside, outside is nature oriented, it only really helps when looking at nature related questions, like a couple of the biology questions or a couple of the questions on the whatever test we just took, ACT, there are like two questions on there. OGT, that is the test I took. (LM-L, May 3, 2013, interview)

After the field trip, LM-L stated:

I expected to be a little more bored in the classes, just because I am not really much of a science person. I expected to find some of it interesting and some of it not. But I think I found more of it interesting than I expected…I think I was surprised I was little more interested in the plants and the fish and the cat dissection than I thought I would be… We looked at it more first hand, we got out and did it instead of looking at it in a text book. We go like, OK, this is this, and instead we actually did the fish, looked at a real fish, and a dead fish.
LM-L commented on whether she felt more compelled to explore science on her own:

Maybe a little bit, if I go somewhere, to find out a little more about the area. What is around there that we won’t necessarily see here? At Hilton Head, South Carolina, maybe like, obviously the plants are different down there, because it is a completely different climate, so maybe look a little bit closer at the plants down there, how different they all are from ones up here that we see every day. It is entirely different down there, I guess, but up here, so look at the animals too.

(RESEARCHER: You really became interested in the plants.] I know. That’s cool. (LM-L, May 3, 2013, interview)

After the trip, LM-L realized a new interest in botany and possibly field biology.

**LZ-L.** Prior to the Stone Lab trip, DR-L was asked how he related to science. He responded:

I like English and math much more than I like science. I am a lot more accelerated in those two. I don’t know why I like English so much, you get to read, you get to write. And math is more of a, you do it this way, you get the right answer. It is a lot easier for me to learn formulas. (LZ-L, April 9, 2013, interview)

After the trip, LZ-L commented, “everything out there was really cool to do, but I just do not like science.” He explained:

I liked your bird class, because I learned all kinds of different birds, naming the random ones, I liked Mrs. G’s plant class, because I just like plants. I like, I was able to key them out better, but I have no clue which plant was which, but it was nice to do for a little bit. Besides those two classes, there weren’t any that I really liked. I liked Mrs. K’s because we got to test water oxygen levels, I think it was, so that was kind of cool. Yeah, chemistry I like it a lot better. (LZ-L, May 9, 2013, interview)

Asked to explain how his interest in chemistry changed, LZ-L replied: “No”, and if he had thought about the trip’s chemistry experience since the trip, and he replied, “No.”

**Summary**

This chapter presented the analysis of data from this study of the nature of high school students’ experiences in an immersive four-day field experience at Stone
Laboratory. Stone Lab is a dynamic learning environment that triggered many unique experiences among the participants of this study. The additional field excursions to Kelley’s Island and South Bass Island provided the participants the freedom to explore and discover new settings. Chapter five will discuss the data that was just presented.
Chapter 5: Discussion and Recommendations

Summary of Research

Decreasing student interest in science is a topic of concern as the baby boomer generation begins to leave the workforce and fewer students are enrolling STEM and medical programs in college. Students, especially those with little interest in science, are not acquiring the scientific literacy required to contribute to society as knowledgeable decision makers who will be responsible for civic, cultural, environmental, and economic dimensions of society (National Center for Education Statistics, 2011). NRC (2009) recommended including informal science programs into students’ lives to stimulate science specific interests. Non-school activities include 4H, summer camp, hobby related groups, and family excursions. School related activities include science club, science fair and field trips. In this study, a group of students from a rural high school attended an optional four-day long science immersive field trip to a biological field station located on an island in Lake Erie.

The intent of this study was to understand the experiences from the students’ perspectives, to understand what stimulated their interest and what they considered important. Research has shown that students’ attitude, knowledge, and interest toward science increases after attending a field trip to a biological field station (Ebenezer, & Zoller; 1993; Hudak, 2003; Kisiel, 2006b; Malinowski & Fortner, 2011; Mawdsley, 1999; Michie, 1998; Nadelson & Jordan, 2012; Scarce, 1997; Scribner-MacLean & Kennedy, 2007; Zandstra, 2012). There is an absence of research concerning the mechanism or how students acquire that interest (DeMarie, 2001; Falk, 2001; Falk & Dierking, 2000).
Theoretical Perspective

The theoretical framework of this multiple case study integrated three unique models to illustrate how a student processes an experience into interest and learning. Kolb’s experiential learning model (1983) combined with Hidi and Renninger’s four-phase interest model (2006) to illustrate the process of experience turning into learning or interest. The NRC Ecological Framework (2009) supplemented the model through the addition of the three lenses that define an experience. The three combined models interacted to help explain how a student processes an experience into interest, learning, or nothing at all. Through this new, innovative, integrated model, the findings from the data will provide a clearer view of the nature of, or the essence of an experience.

Research Questions and Results

The purpose of this case study was to describe how high school students experience an immersive four-day field experience at Stone Laboratory, leading to the development of interest in science. The specific research questions will be followed by a brief overview answer. The results will be discussed in depth in the next section.

Question 1. What was the nature of high school students’ experiences in an immersive four-day experience at Stone Laboratory?

Each experience was highly individualized and unique, defined by the student’s level of interest entering the field trip, the student’s goal for the field trip, and relevance derived from the student’s prior knowledge or prior interest, including the funds of knowledge that harbor values of which the student may or may not be aware.

Question 2. How did high school students experience the various activities at Stone Laboratory?
Students exhibited the most interest during an experience that incorporated all three ecological lenses - cognitive/affective, physical, and cultural. Students also showed higher interest in experiences that stimulated the senses, a proportional relationship that suggests that the more sense driven the experience may be, the more memorable and interesting the experience will be.

Question 3. How did high school students experience the physical and social resources at Stone Laboratory?

A unique setting inspired the students to explore and discover, and led to an affective response, such as awe and wonder. A familiar or unstimulating setting simply became the venue where the experiences occurred, placing priority onto the experience. The social resources, primarily peers and teachers, enhanced the experience through comfort of camaraderie, casual interaction, and discussion that provided reflection. Peers were catalysts to an experience that increased awareness, interest, enjoyment of the activity, and they added their prior interest and knowledge to their cohort. Teachers empowered the students to explore, and needed to be available to guide discussions or make students aware of an aspect of the experience.

Question 4. What aspects of students’ experiences at the Stone Laboratory led to the development of interest in science?

As more ecological lenses were incorporated into an activity, it seemed that student interest grew stronger. Students reported various aspects which developed or increased their interests: Exploration, discovery, curiosity, freedom, level of science interest before the trip, prior experience, prior interests, presence of friends, support of teachers, unique setting, and new experiences.
Discussion

Stone Lab is a unique field trip destination. Before students ever sat in the facility classroom, they had already endured a lengthy bus ride to the ferry dock, a half hour ride on a ferry across open water, and a long walk or bus ride to the administrative complex where they boarded a large research vessel that carried them to the actual six acre island facility. The experience began the moment the students left their school, and continued until they arrived back home four days later.

For some students, this trip was a repeat from two years prior. But for most, this was their first visit to Stone Lab. This was the first time some students had ever left their home county. Their experiences challenged their secondary source knowledge about the Great Lakes and the glacial plains of northern Ohio. The primary experiences acquired during the field trip provided rich, powerful lessons defined through all five senses. The students’ experiences were guided, promoted, and nurtured through personal curiosity, friends, peers, mentors, and teachers. In reference to science education, the payoff for these experiences was interest. No matter whether the students were highly interested or minimally interested in science, the immersive science environment with authentic, hands-on activities engaged students and triggered interest, even if only for a moment. Learning requires interest. A short-lived triggered interest will allow a student to develop a connection to a concept that may be built upon at a later time (Hidi & Renninger, 2006).

To understand what is meant by a developing connection, it may be useful to metaphorically consider tinker toys, those sticks and attachments that children play with to construct any figure their imagination might contrive. There are many sticks and many
connectors all free-floating in a box. Some connectors have only two slots, some have more available openings. The more openings there are on a connection piece, the more adaptable and the more useful that connector will be for future, yet unimagined additions to the structure. In this metaphor, the sticks represent the knowledge, but the knowledge is useless without the connectors. Simple connectors are useful only to attach two pieces of knowledge, with no flexibility. However, connectors with many potential attachment points will be highly flexible and will accommodate many different types of present and future knowledge. Interest development constructs those valuable connection points where past, present, and future knowledge may attach.

The following sections will consist of the four research questions. Each will be discussed individually.

**Question 1.** What was the nature of high school students’ experiences in an immersive four-day experience at Stone Laboratory?

There were six participant students, and there were six unique natures of experience. In spite of experiencing the exact same classes and planned activities at the exact same time, each participant acquired a personally distinctive experience during the four day field trip. To answer this question, a brief description of each student’s overarching nature of experience will lead to a general discussion of the nature of experience.

The nature of WM-H’s experience was defined by the freedom to explore and learn on her own terms. She wanted to participate in all the activities and experience everything she was able. She was tired of sitting in a classroom and wanted to mentally stretch out and discover things that interested her. She was surprised at the freedom the teachers provided to the students, and she used that freedom to explore and discover to
the fullest extent she was able. The nature of WM-H’s experience was defined in part by a peer who had attended Stone Lab two years ago. The peer, in essence a mentor, helped WM-H make sense of the novel setting and helped WM-H focus on specific experiences. WM-H’s experiences were directly tied to the friend’s previous experiences. Not all of WM-H’s experiences yielded positive results. The incident with the fish dissection adversely affected WM-H’s interest in that activity and any experiences that she might have gained.

The nature of TK-H’s experience can be defined by excitement, joy, exploration, discovery, and companionship. She came to Stone Laboratory with a strategy developed from her previous experience at Stone Lab two years earlier, when she had little interest in science. Since that first visit, TK-H’s interest in science blossomed, so that she cannot get enough science in her life. Her science classroom experiences did not meet her needs for experiential, hands-on learning. For each activity, she wanted to be given enough information to get started, and then she wanted to explore and discover on her own terms. TK-H exhibited joy and excitement during each activity of the trip. The nature of TK-H’s experience can be described as joyful exploration and discovery.

The essence of LK-H’s experience focused on exploration and discovery. This was her second field trip to Stone Lab. LK-H remembered her previous trip to Stone Lab, particularly the wetlands, and on this trip brought boots so that she could freely explore the wetlands without fear of getting wet. She was bored with the same activities from last time, but was excited to experience the wind, explore the quarry, and share serious and fun experiences with her friends.
Stone Lab was important to DR-L as an awakening about the enormity of the world, and the power of nature over humans. He accepted the cold and misery, and was quite adamant that he would enjoy returning, but only when it was warm and might be enjoyed at a more comfortable level, and when there was sufficient biota to observe and study. He wanted to be wowed. He was seeking awe and wonder. He wanted the experience to be amazing, and he was not happy participating on a field trip where conditions and lessons were not optimal. DR’s experience was also directly intertwined to his girlfriend, who accompanied him through all the activities.

The essence of LM-L’s experience was discovery, awareness, awe, and wonder through hands-on experiences connected to prior knowledge and interests, and supported by friends and teachers, resulting in new or renewed interests and a deeper appreciation of nature. LM-L was among the youngest of participants on the trip and attended without many expectations. The hands-on nature of the trip was important to LM. She discovered an interest in plants generated from hands-on activities and possibly nurtured through prior experience with plants. She was awed by the glacial formations as she pondered the sheer size, mass and energy produced by the glaciers to carve bedrock. Her artistic interests provided an important lens which brought awareness to LM, through the recognition of lines, patterns, designs, angles, and formations, which extended into her mathematical predilections.

LZ-L’s experience was defined by his peers. LZ-L was not interested in the science, and the free, open experience allowed him to focus on his priority, interacting with peers.
Perhaps the most illustrative description of the nature of LZ-L’s experience is best left to LZ-L’s own words:

LZ - It was really sad we were leaving.
Researcher - You were sad you were leaving? Why?
LZ - Cause it is my last year, the last time I will be up there. So I was like, eh. A little sadness.
Researcher - What are you going to miss about it?
LZ - I think just going up and having all my friends for a week straight.

LZ-L had spent four days in a highly immersive science environment, explored three islands and participated in numerous activities. But he was sad that the week of being with his friends was over. His experiences with the activities, explorations, and discoveries would still be added to his knowledge base and be available for future connections, however LZ-L appeared to have developed minimal new interests concerning science on this field trip.

Each student had a uniquely personal experience during the four day immersive field trip. Four overarching themes can be seen when examining each participant’s nature of experience and from the data provided in chapter four: 1) Freedom to explore and discover; 2) The desire to experience a new environment on one’s own; 3) The importance of prior knowledge; and 4) The importance of friends and peers during the activities. Each student attended the Stone Lab field trip with his or her own priorities, and those priorities defined how each experience would progress.

The ecological framework model (NRC, 2009) illustrated that informal science learning can be viewed through cognitive/affective, physical, and cultural lenses. The four overarching themes incorporate all three lenses. The freedom to explore and discover is cognitive/affective, because the students are driven by curiosity and are struck
by an affective response of amazement, or awe and wonder. Experiencing new environments may be physical and cognitive/affective because the unique settings inspire the students to explore and discover. Prior knowledge is highly cognitive/affective, and may be cultural when the funds of knowledge are included. Friends and peers are from the cultural lens, which may stimulate affective responses that are part of the cognitive/affective lens. A rich informal learning experience will incorporate all three lenses. The compilation of the participants’ natures of experience suggests that the Stone Lab field trip offered a rich, informal learning experience.

**Question 2.** How did high school students experience the various activities at Stone Laboratory?

All six students participated in the same cohort group that rotated from class to class. They heard the exact same words, saw the exact same demonstrations, and participated in the same hands-on activities. They also participated in the same activities on the other islands. In spite of experiencing the very same concepts, facts, and activities, each participant saw, heard, felt, and perceived the experiences differently. Some participants found the botany class to be boring, yet others said it was one of the best classes on the trip. Some thought the “BioLab” science cruise was exhilarating as well as interesting, and others did not. Dieleman and Huisingh (2006) identified this very situation while exploring a cohort of students who were playing an environmental computer game. Each participating student performed the exact same activity, however acquired a unique set of experiences that a reflection or debriefing session would explain, clarify, place into context, and potentially reveal how the lesson may be used in the student’s personal and professional life. The students heard their peers’ experiences and
realized that although they played the same game, each finished with different lessons and perceptions.

Among the six ROHS participants, there was little agreement concerning the most interesting activities. Through their interviews, the participants presented variables that may explain the differences, such as the amount of sleep obtained the night before, who they were sitting with, where they were sitting, their emotional state, and of concern in this study, level of interest.

Students attended the Stone Lab field trip activities with different initial levels of interest. The three students with high science interest were anxious to begin, explore, and discover. The three less interested students were excited to begin, but did not have the intensity of the more interested participants. The less interested students attended the assigned classes and activities, listened to the brief introductory talks, and joined in the activities. Sometimes an activity was enjoyed, sometimes the students treated the activity as they would have done in their school science classroom or lab and in a few cases, the students tried the activity, did not enjoy it and tuned out for the remainder of the activity.

Looking at student experiences, LK-H, who was highly interested in biology, thrived on the authentic, hands-on activities at Stone Lab. She personally related to many experiences in which she had prior knowledge and experience, with the wind, water, cats, plants, birds, and microscopy. She was visibly excited talking about what she saw, what she did, and what she felt. She was motivated to explore and discover, alone when she was able. It is important to also recognize that LK-H was highly frustrated and bored in her school science classroom because it was: Too slow for her preferred learning pace; Lecture-based; Non-experiential; and Overburdened by unmotivated peers.
In contrast, LM-L entered the activities with only hope to have fun, but unexpectedly gained interest in plants, fish, and ecology. She was surprised that she became interested in these subjects and attributed the interest to the hands-on activities and experiences. She did not see the connection between the classes and her past experiences, especially with plants. Her previous experiences with landscaping provided an unseen but present set of available connections that provided significant relevance to her experiences in the plant class.

Prior experiences or funds of knowledge elevated student interactions during a class or activity. Each student has his or her own private fund of knowledge that provided a potential link between the student and a lesson or experience (Gonzalez et al., 1995; Street, 2005). As another example, parents and grandparents enjoyed bird watching and maintained backyard bird feeders. The children and grandchildren observed the interaction, but may not have become involved. But when the children as students attended an experiential ornithology class, their level of interest was beyond simply triggered, there was an intrinsic motivational factor compelling them to participate, to understand, and to learn. There was an inherent relevant priority that was connected to birds. During the posttrip interview, those students who recognized the family member’s bird interests also named the bird class as one of their favorites, even though they never before recognized an interest in birds.

DR-L, whose interest was in math and who considered science a nice hobby, entered the classes with curiosity, then boredom if the topic was not interesting. He was excited to view the wide variety and beauty of plankton, but was soon disappointed that there were so few plankton specimens and macroinvertebrates to capture and study.
However, DR-L remained excited to explore and discover without the encumberment and limitations of classes. He explored the shoreline and observed the waves, wind, and weather. He took many photographs of waves, and during the final photovoice interview, he pointed to the last of the wave pictures and said, “That was pretty much what I was trying to get the entire time” (LZ-L, May 16, 2013, interview). The wave was breaking over the rocks. DR-L was experiencing the activities with a fresh, new knowledge foundation that was being constructed by these experiences. DR-L was following Montessori’s (2004) prescription for experiential learning of choosing what he would like to do and learn. He was intrinsically motivated to explore and learn; he was interested (Hidi & Renninger, 2006).

The participants gained interest through unstructured experiences when they were able to explore and discover on their own. LK-H’s first memory of the field trip was her experience in the wind atop the jet boat with her friends, which was intense and included all the senses but taste. Without teacher interaction, LK-H and her peers developed rich foundational knowledge concerning wind, the lake, climate, and boats. If any of these or similar topics arise in a learning setting, LK-H will have this foundational knowledge and connections onto which new, deeper learning can be constructed. The sense-rich memories provided that experience value.

LZ-L attended the field trip to have fun. He accomplished his goal in excellent fashion. He was focused on his peers, the activities and classes were the venue where he socialized. Explaining his experiences during the field trip, LZ-L focused on his interactions with peers. He claimed he was bored in some classes, and did not show or claim any excitement about the classes or activities during the four day trip. Still, LZ-L
revealed that he did feel minor interest during the water chemistry, bird and plant classes. Perhaps his knowledge foundation did not grow larger, but he did add to his foundation of experiences that will add some familiarity to future encounters and provide functional scientific literacy as he enters the adult world.

The high science interest students energetically approached the field trip with excitement and glee. They actively participated in all the classes, wanting the hands-on experiences, each desiring support and permission to explore what they found interesting, at their own pace, and with or without partners of their choosing. The students interested in science were intrinsically motivated to maximize their interest development and learning, to explore and discover the natural world on their own terms, and to construct a strong, new level of science knowledge through the multitude of experiences.

Senses. The high science interest students seemed to incorporate more of their senses in their descriptions of experiences. Acknowledging the food available to the participants throughout the trip, TK-H described her experiences using all five senses, although the others focused on using three senses, touch, hearing, and sight. The three students less interested in science did not say much about their sense perceptions until they talked about the alvar, where they experienced a large, visually rich bedrock landscape spotted with algae and lichen, the sounds of waves crashing onto the rocks, the feel of the spray, and the smell of the lake. Such a rich environment awakened the senses, creating an incredibly sense-rich experience for the students. The senses made the memories stronger; the connections available for future learning will be much stronger.
The senses have been implicated as essential in experiential learning. Experiential learning is most effective when all five senses become involved and when the student sees relevance or has something at stake (Crosby, 1995). Montessori (2004) believed students needed to use all five senses to gain full understanding of an experience, at a pace set by each student, and that learning should be exciting to students. She believed each student should choose what they wish to do and learn, promoting concentration, motivation, self-discipline, and love of learning. The participants’ field trip experiences matched Montessori’s recommendations for learning from an experience. Dewey (1929) agreed that the primary, direct, sensory view of the world was the basic foundation of knowledge. The senses were needed to perceive an experience, and then reflection refined the sensory data into well-defined knowledge.

**Question 3.** How did high school students experience the physical and social resources at Stone Laboratory?

**Setting.** The setting was important in two ways. First, it simply provided a venue where the activities took place. The setting provided the definition of the sort of experiences the participants encountered. The setting defined where the field trip experiences occurred. The setting defined what sort of experiences occurred. Second, the uniqueness of the setting determined the students’ motivation to want to explore and discover. At Stone Lab and the other islands, the students were excited and intrinsically compelled to explore and discover this new environment.

The physical setting on this field trip was unique to the students. One participant and several other students had never seen Lake Erie, nor any large open water. New settings are exciting to explore. The teachers allowed all the students to explore Gibraltar
Island the entire first day. Students combed the shoreline, watched the waves, looked for snakes on land and fish in the water. A large group of students decided to play volleyball after exploring. Some students simply sat and looked out over the lake.

The setting was new to DR. He was creating a foundation of experience onto which future knowledge would be built. LZ-L experienced the physical resources only as a setting for his encounters with friends. The one setting he identified as significant was the bonfire, by definition a social connector. TK-H experienced the physical resources at Stone Lab through the classrooms, the dining hall, her room in Barney Cottage, and around the island. She desired to experience the island to its fullest potential, enjoying the camaraderie of the bonfire, the peace of the western beach, the association with friends in the cottage, and the learning during the classes, activities and meetings. She explored the quarry as few students could because she brought boots.

**The Stone Lab Mystique.** Particularly during the summer, but also during the fall and spring workshop programs, some students spend time at Stone Lab and develop an attachment to the island, what this researcher calls “The Stone Lab Mystique.” LK-H may have been developing that connection. During this, her second time on the island, she began to feel the island’s charisma. She described her feelings:

The history, the background behind it. That it has been there so long and so many students have come there, and have had life changing experiences and learned so much. I like that it has that feeling of age and that feeling of knowledge in it.

TK-H also recognized a connection or a sense of fraternity between people who attended Stone Lab in the past. This connection to the island, the setting, or the mystique, seems to be the result of interactions at Stone Lab by individuals with a high level of interest in biological or environmental science.
Tools. Tools provided an avenue or bridge to exploration, discovery, understanding, and in time after reflection, knowledge. The participants did not become excited about the tools themselves, but participants needed to understand how to use the tools to achieve discovery. Tools were essential to the experiences, but held no special place in the participants’ memories.

Peers. Students worked together during the field trip, in the classes, and during the activities. They helped each other by guiding, exploring, discovering, explaining, and asking questions. NRC (1999) identified prior knowledge supplied by peers as an important factor that may elevate an individual’s experience. Peers’ funds of knowledge lead to an increase of motivation and interest through teaching and learning from each other (Moll et al., 1992). Peers who attended Stone Lab two years ago guided those who were attending the first time. Social interaction was an important aspect of every activity at Stone Lab. Activities as simple as walking the shoreline was a group function.

While at the quarry, friends worked together to increase the number of discoveries. The sound of talking and laughter could be heard amid the sounds of rock hammers. During the cat dissection, students were talking, sharing knowledge from their experiences with dissections, talking about cats, talking about unrelated topics. These conversations among peers had the potential to lead to deeper observations, created more curiosity, generated reflection, and inspired further exploration and discovery (Falk & Dierking, 2000).

Among the participants, the priority of the social interactions at Stone Lab varied, but remained important among all participants. To LK-H, friends provided not only support for her interest in science, but created a social outlet for her daily feelings and
non-science persona, where she was able to fully belong. LZ-L admittedly attended the trip to have fun with his friends. He treated each class and activity as a social event. Others interacted with the social resources through friends and peers. Friends shared in activities and discoveries, and participants enjoyed sharing the experiences with somebody. Jointly performed activities resulted in more interest and learning than if the activities had been performed alone (Falk & Dierking, 2000).

**Teachers.** In discussing overnight field trips, Michie (1998) identified an improved social climate between students and the teacher because the students got to see the teacher in a new perspective, providing long term benefits by improving the classroom atmosphere. At school, students perceived the teachers as a source of knowledge and limitations (Hofstein & Rosenfeld, 1996; Zandstra, 2012). However at Stone Lab, the teachers became valuable social resources for the students. The participants talk with the teachers about the world, the future, the student’s future, pastime activities, and if the students desired, science. Falk & Dierking (2000) recognized that students who have increased their interest or passion such as during a field trip, may benefit through discussion and reflection concerning the subject matter with peers and teachers. In another observation, the students were surprised by the level of trust the teachers placed upon them, to responsibly roam free and explore without obvious supervision. The students were also surprised the teachers ate food and laughed, wore casual clothing, and had families. All these new views or perspectives of teachers alter how the students see and respond to the teachers back in the classroom after the field trip (Michie, 1998).
**Question 4.** What aspects of students’ experiences at Stone Lab led to the development of interest in science?

Malinowski and Fortner (2011) illustrated that in spite of inclement weather, students’ attitudes about science increase after a day visit to Stone Lab. During this four day field trip to Stone Lab and the islands, the participants were able to reap the benefits that Stone Lab offered, where students explored, discovered, and reflected over the things that they personally found interesting (Klug et al., 2002; Lei, 2010; Malinowski & Fortner, 2011; NRC, 2009; Woodhouse & Knapp, 2000). Each student constructed an individualized experience in which they followed their interests and derived personal meaning from their experiences (Malinowski & Fortner, 2011).

This study wanted to identify if and how the experiences at Stone Lab trigger interest in science. Hidi and Renninger (2006) proposed the four phase model of interest development, beginning with the situational trigger in phase one. Interest development is multidirectional, meaning the interest can develop positively or the interest can diminish and disappear. The Hidi and Renninger model will be discussed in an upcoming section, but at this moment, the focus shall be on identifying aspects of the students’ experiences that led to developing interest.

It appears that every aspect of Stone Lab triggered interest with WM-H. She loved the exploring. In her post-trip interview and photovoice interview, she talked about exploring. When the trip was over, she stated that she still wanted to explore. She wanted to discover. She wanted to see what was around each corner. Even if the topics were not of interest to her, she still was curious enough to experience the activities. WM-H was interested in science before the trip, and the Stone Lab experience intrinsically motivated
her to continue discovering. What was it that triggered this excitement? Exploration. Discovery. Curiosity. Friends who shared her excitement. Her personality helped to create and maintain her level of excitement.

TK-H had been interested in science since her first Stone Lab trip two years prior to this trip. She arrived onto Gibraltar Island highly motivated and prepared to explore and discover. Her interest was triggered by the hands-on activities, by the new environments, and by the excitement of being surrounded by science. There was not an activity that did not interest and motivate TK-H. The freedom to explore, the independence and trust provided by the teachers, and the availability of equipment to complete the activities was all she needed. Her friends supported her by working, exploring, and discovering together with her. At the bonfire, TK-H enjoyed talking to the teachers about science and topics that are not breached in classrooms. She enjoyed feeling like she belonged, which further motivated her.

The Stone Lab experience triggered interest in LK-H though the hands-on activities, the immersion of the island experience, the connection with her friends, and through contact in the various settings during the trip. LK-H seemed to be most excited when she was directly connected to the experience with all her senses at work. Her friends and peers provided a motivation for her to want to share. She desired relevance to add value to topics that did not originally interest her. Plants became important when she developed awareness of a plant’s anatomical intricacies and complexity. Birds were valued because a family member thought birds were interesting. The activities and immersion nurtured and developed interest within LK-H, who also brought a fund of
knowledge which provided a set of unique connections that helped her develop knowledge and interest in the birds.

The new environment certainly triggered DR’s interest. He had never seen water of this magnitude, nor a body of water with waves or rocky shorelines. DR-L approached each class with expectations and curiosity, but grew bored because there were few specimens to study. He identified the bird course as his favorite, because his dad enjoyed birds and he saw a reason to connect to the topic. DR-L looked forward to the botany class, but could not find any relevance and admitted he lost all interest, an example of triggered interest that dissipated. The island visits interested DR-L through the exploration and discovery of new settings, concepts, and experiences.

LM-L’s interest was triggered through the hands-on activities and experiences. She came to Stone Lab with prior experiences gained from her science fair projects, experience in middle school science, outdoor activities at camp, personal time in nature, and working with her dad in the landscaping business. The prior experiences provided relevance and value to some of the topics, in which she enjoyed and found new interest. The hands-on activities triggered meaningful connections between those activities and the knowledge they conveyed. LM-L’s artistic eye captured lines, angles, shapes, and colors that she found interesting. The artistic knowledge and the outdoor and landscaping knowledge provided LM-L with a unique fund of knowledge that allowed her to experience Stone Lab in a manner unique from any other students.

For LZ-L, the Stone Lab experience triggered interest tangentially through his focus on social interactions, during moments when he was listening to the teacher, and when he was actively playing and exploring. LZ-L entered the trip with little interest in
science, particularly the biological sciences. Each activity triggered LZ-L’s interest, but he was not motivated to develop that interest even to the second phase. His friends’ interests in science drew LZ-L along, and he gained slight but positive interest in a couple of the subject areas, water chemistry, plants and birds. Had LZ-L attended Stone Lab alone, would he have enjoyed himself? Would he have gained any interest? He attended because he wanted to have fun and share time with his friends, so LZ-L’s expectations were met. In spite of his expectations, LZ-L accepted that this was a science field trip and he participated in all the activities. He was open to new experiences and interests, but the immersive Stone Lab experience did not affect LZ-L as it has affected the students interested in science. He admitted, “Everything out here was really cool to do, but I just do not like science” (LZ-L, May 9, 2013, interview). Interestingly, the photovoice exercise added to LZ-L’s experience. He made an effort to record where he was and what he was doing. The camera provided a channel of awareness to LZ-L that may not have been present without the assignment. He still placed a majority of focus on his friends and peers, and his full, photograph gallery explanations were centered on friends, but he did include images of animals, activities, and settings.

The experiential aspects of the field trip that triggered interest in science were diverse and individualized, including: Exploration, discovery, curiosity, freedom, level of science interest before the trip, prior experience, prior interests, presence of friends, support of teachers, unique setting, and new experiences. As discussed earlier, all can be placed in the different lenses of the ecological framework and all the lenses are represented. Together, these traits describe a rich, highly experiential activity in which students may increase their interest in the subject matter at hand.
**Photovoice**

Although the interviews were the primary data collection vehicle, a large amount of insight was provided through the students photovoice work. The unstructured interview in which each participant casually talked about his or her full gallery of images presented interesting holistic data about how they experienced the trip from beginning to end. The students talked about what they considered important. An example was LZ. While flipping through the gallery of photographs, he spoke at length about his friends and what they were doing and saying, but offered only short, one or two word comments when he passed by a non-socially oriented picture.

Concerning the photovoice images, the participants seemed to put great thought into which pictures to choose. Only one participant, LK-H, failed to turn in images. The images generally supported the data collected from the interviews. The participants provided images rich with setting, social interactions, and emotion, in particular, awe and wonder. LM-L wrote for Figure 23:

This picture is of the glacier grooves. It was one of my favorite things from the trip. Two of the things I found myself interested on the trip were rocks and plants. This simply being a big rock that you can see all the layers in was really cool to see. Also just thinking that this was carved by an even bigger peice [sic] of ice is fascinating. On a deeper level, as I said in the interview, these grooves almost make you feel insignificant because of how large and old they are. No one could have stopped it either. Sadly, I was one of the last groups to get there so I did not get to read more information of it but it was still interesting.

LM-L was the least emotional participant in the cohort. Yet the emotion in her description is evident. She talked about interest, awe and wonder, and sadness. She revealed critical thinking, a desirable trait in any student.
LZ-L had the most startling photovoice images and captions. Throughout the interviews, his focus was on friends and social interactions. LZ-L was the last to turn in the images, more than a month after the field trip. Instead of the expected peer related images, all five photovoice images related to setting, and had surprising emotion attached to the images. For the image of the rising moon in Figure 28 he wrote:

I love the night because everything is calm and relaxing. It was the first or second day and a bonfire was being put together, and I saw how the moonlight just reflected so perfectly and needed a picture.

The photovoice data supported the suggestion that in spite of his focus to have fun, LZ-L was paying attention to his surroundings. The experiences did connect with him at some level.

**Implications concerning photovoice.** Because this section specifically pertains to photovoice, implications concerning photovoice will be discussed here. LZ-L’s responses create new questions concerning the use of photovoice for research. Is there a time of reflection that is required before participants should be asked to choose and describe images? Would photovoice enable all students to participate and connect with the topics with field trips?

A teacher might use photovoice to connect students with a field trip experience. Students would approach the field trip with a goal to take photographs of a specific nature. The teacher would be able to direct the students’ attention to the desired topical areas, and assess whether the students experienced the desired information. Adapting some suggestions by Wang and Burris (1997), the teacher would also realize several benefits with a student photovoice project. First, the teacher would see the trip from the viewpoint of the students. Second, the students would be to describe their trip without
words, to explain ideas and stories through their photographs. To implement a class photovoice assignment, the initial cost would be significant, but the photovoice assignment may connect students who traditionally do not enjoy science or field trip experiences.

Implications of Results for Conceptual Framework

The assimilated model of experiential learning. The data and analysis supported the proposed assimilated model of experiential learning (Figure 32), albeit inconclusively, with minimal case study data. Kolb’s (1983) experiential learning cycle required time for students to experience an activity, reflect upon the activity, and then develop new ideas to test in another experience. Students who attended Stone Lab two years ago exhibited such reflection. TK-H and LK-H enjoyed the quarry wetland exploration two years ago. They discovered salamander larvae and tadpoles, but they could only explore the edges. After reflection and thinking, TK-H and LK-H examined what they needed to do, to explore the entire wetland, and on this field trip they decided to bring and carry bulky boots, which indeed enabled them to explore the entire wetland.

Because the Stone Lab field trip was an immersive four day science experience, students had little time for reflection, which had to be done after the field trip, personally and outside of school. The interviews occurred so soon after the trip that the students still had not had time to reflect. The exception was LZ, who submitted his photovoice images and captions more than one month after the field trip. During the trip, LZ-L focused on social interactions; however, one month later, after the excitement of the field trip and after graduation, LZ-L had time to think back about his experiences during the Stone Lab trip. His photovoice images focused on setting and emotion, with zero social codes...
attached to his photovoice selections. The cited examples confirm Kolb’s experiential learning cycle, but time constraints did not allow further examination.

![Figure 32](image)

Figure 32. The assimilated model of experiential learning, comprised of Kolb’s experiential learning cycle (Kolb, 1983), four-phase model of interest development (Hidi & Renninger, 2006), and defined by its ecological framework (NRC, 2009).

Participants described the best experiences which were also the richest experiences concerning the ecological framework (NRC, 2009). The cognitive/affective, physical, and cultural aspects were present in quality and quantity in the richest experiences that included stimulation of all the senses. The alvar was one such experience where the participants saw a visually unique setting, felt a sense of awe and wonder looking out over the lake, heard the waves crashing onto the rocks, smelled the lake and the algae, and sensed the water spray and wind, touched the algae and rocks, and experienced the alvar with friends, peers, and teachers. The bonfire was another rich experience, where participants huddled around a large fire along the lake shore with a
rising full moon in direct view, tasted hotdogs and other snacks, smelled the smoke of the fire, heard the popping of the wood as it burned, felt the heat of the fire on their faces, and talked with friends and teachers. Few participants considered the wildlife museum a significant experience. At the museum, they saw the exhibits that provided the setting, heard the curator talking which was the extent of the cognitive/affective, and they stood quietly with friends. There was little sensory input to develop interest.

In Figure 32, the ecological framework fed into the experiences in Kolb’s experiential learning cycle. The stronger the ecological lenses or aspects, the richer the experience. The experience according to Kolb leads to reflection, but in the proposed assimilated model, the experience first leads to Hidi and Renninger’s (2006) four-phase model of interest development. The four-phase model can be observed throughout the participants’ interviews, as will be demonstrated momentarily. Participant interviews revealed examples of interest that were triggered in phase one and developed to phase two, and examples that were triggered and then extinguished. Some students entered the field trip already intrinsically motivated in phase three. After interest development, the next proposed step returns to Kolb’s reflection step in the experiential learning cycle. The interest motivation is necessary to drive the experiential learning cycle. Each cycle leads to learning. If the motivation is weak or absent, the cycle slows or ceases to flow, and interest is extinguished and learning stops.

The proposed assimilation of the ecological framework, Hidi and Renninger’s model and Kolb’s model seems appropriate. Through each participant’s interview, their described experiences can be classified to an extrinsically or intrinsically motivated level of interest, which either was maintained, developed, or extinguished. The study did not
proceed long enough to track the participants’ interest development beyond two weeks after the field trip. The following examples will demonstrate the flow of the development of interest from an experience.

The three low science interest students, DR, LM, and LZ, provided the most insight into interest triggers and the progression of the developed interest. An example of experiences triggering the first level of interest, DR-L made a statement concerning many things that triggered his interest:

Walking around, on South Bass, whatever, we were looking at the giant geode, playing Putt Putt, going down to the one beach and looking at the, looking for snakes, whatever. The smooth rocks a lot because I have never seen rocks that smooth before unless they were in a store. I remember Stephanie brought some home to put into a bowl for her family. I brought some home to show my dad. Steph brought a whole handful. Watching the sun set… when the waves were coming in.

DR-L recognized the wide range of things that triggered his interest, but the only experience that seemed to develop to phase two, the maintained situational interest, involved the rocks he took home that intrigued him because of their smooth, worn texture. The flow can be seen in Figure 33. Most of the interest remained in the first phase and re-entered Kolb’s cycle, but the rocks were at the second phase and re-entered Kolb’s model from that second phase, which would reenter the cycle, and if the learning processed appropriately through the cycle, it would return to the second level of interest. If the reflection or critical thinking or reapplication of the experience does not occur, the interest may diminish or extinguish.
Figure 33. DR’s experiences led to triggered interest, which may develop into the extrinsically motivated maintained situational interest such as the interest in rocks, is maintained in phase one and enters the experiential learning cycle, or is extinguished. (Hidi & Renninger, 2006; Kolb, 1983; NRC, 2009)

As another example of interest development, LM-L entered the botany class expecting to be bored, but her interest was triggered and quickly developed into maintained situational and perhaps even phase three, emerging individual interest (Figure 34):

RESEARCHER - What did you like best of all the classes?
LM - (pause) I think I liked the plant one the best.
RESEARCHER - Why did you like the plants? (Long pause) Was it the teacher or the subject?
LM - I think it was the stuff, I think it was pretty cool to be able to key through it and find the different plants just by the number of the leaves or the number of petals.
RESEARCHER - Was that your first plant experience?

Later, LM-L admitted that she craved to get out into nature and search for new plants, and looked forward to her summer vacation trip to explore for plants:
RESEARCHER – “You really became interested in the plants.”
LM – “I know. That’s cool!”

DR-L provided an example of a triggered interest that did not develop and extinguished (Figure 35). DR-L looked forward to the botany class, his interest was triggered and ready to develop, but the class failed to connect with DR-L and the interest faded. Another example of a decrease of interest occurred during the plankton lab. DR-L wanted to see the plankton and searched for them under the microscope, however none were evident. He quickly lost interest when he realized his water specimen was void of any organisms. “I thought [the plankton lab] would be more fun if my samples contained something because I looked through two of them and I did not get anything. After that, I was really bored” (DR-L, May 14, 2013, interview). If the ecological framework is weak, the experience will be weak, and the resulting interest will not be supported. If the interest decreases or is extinguished, Kolb’s experiential learning cycle stalls and little or no learning occurs.
Figure 34. LM-L’s experience in the plant class began with triggered interest, and developed into phase 2, the extrinsically motivated maintained situational interest, or perhaps phase 3, emerging individual interest. (Hidi & Renninger, 2006; Kolb, 1983; NRC, 2009)

Figure 35. DR’s botany experience led to triggered situational interest, which did not connect with DR. He did not attempt to reestablish further experiences, and the interest was extinguished. (Hidi & Renninger, 2006; Kolb, 1983; NRC, 2009)
Three of the participants, TK-H, LK-H, and WM-H, had high science interest. They were already intrinsically motivated concerning their relationship with science. Two of the three, LK-H and WM-H, had plans to enter science related careers, while the third, TK-H, was unsure before the field trip; however since the field trip has decided to enter a science related career. The three high interest participants were excited and could not experience enough of the activities. TK-H, like LK-H, attended the field trip two years ago, and remembered that boots would allow much more exploration of the wetland, resulting in both students carrying boots on the field trip specifically for this wetland visit. TK-H was intrinsically motivated to explore the wetland. Her interest had grown so strong that she wanted to teach others about what she has seen and learned about the wetland (Figure 36). TK-H spoke during her interviews about the enjoyment she derived from teaching and guiding others, such as how to identify the salamander larvae in the quarry, or later during the field trip, helping others perform the cat dissection, suggesting that TK-H’s interest level may be reaching into phase four of the interest model.

Figure 37 depicts what occurred when a participant possessed relevant prior experience or funds of knowledge. Although the participant was experiencing a new activity that would be an interest trigger for most students, the funds of knowledge provided value and relevance to that activity, which raised the level of interest to phase 2 or phase 3, depending on the intensity of that funds of knowledge. DR-L provided an interview statement that illustrated his funds of knowledge and interest concerning birds, a topic that he admitted was of no interest to him before the Stone Lab trip:

My dad likes to bird watch, so it was interesting to me…My dad has talked about bird watching before, so I knew a little bit about that. I did not know we were doing that, but as soon as I heard, I was wow, that won’t be too bad. You are
walking around all day and you take them for granted, but if you stop for a second and look around, you can see tons of different species, that I didn’t even know existed.

The funds of knowledge provided by DR’s dad attached value and relevance to birds, and DR-L realized that the bird class will have value.

The assimilated model of experiential learning has only been tested against six students who participated in an immersive science field trip. The model describes the richness of the experience through the ecological lenses, the connection of the experience to the participant’s level of interest, the development of interest which feeds back into the experiential learning cycle, which the interest has motivated and energized to cycle around to another experience that will be defined by the ecological lenses, which connected to the participant’s interest level, and so the cycle continues. The cycle is augmented by the presence of funds of knowledge, prior interest, and prior knowledge. The assimilated model of experiential learning requires further exploration through experiences in which the ecological lenses have been manipulated, through further investigation of the effects of funds of knowledge, prior interest, and prior knowledge.
Figure 36. TK-H’s wetland experience led to phase 3, emerging individual interest which is intrinsically motivated; her desire to teach peers about what she has seen and learned suggests her interest may be rising to phase 4, well-developed individual interest. (Hidi & Renninger, 2006; Kolb, 1983; NRC, 2009)

Figure 37. The experience associated with funds of knowledge, which provides relevance to the experience, immediately increases the level of interest to the extrinsically motivated maintained situational interest, or the intrinsically motivated emerging individual interest. (Hidi & Renninger, 2006; Kolb, 1983; NRC, 2009)
Implications for Informal Science Education

This study focused on how students acquire interest when they attended an immersive field trip at a biological field station. The implications include informal venue operation, school classroom management, field trip management, and science teacher methods.

Contribution to literature related to informal learning. This dissertation examined the importance of informal venues in a student’s academic career. Most informal venue research to date has focused on museums, zoos, and science centers. Very little research examined the benefits of biological field stations as informal education venues. This dissertation provided an authentic evaluation of biological field stations, specifically, Stone Laboratory. Participants demonstrated that the experiences with the richest ecological framework provided the most powerful memories and developed student interest.

This dissertation introduced the assimilated model of experiential learning, a proposed model of experiential learning and interest development. This model informs educators what is necessary to create or plan a meaningful field experience. A rich experience is defined by its cultural, physical, and cognitive/affective components. The experience triggers interest in Hidi and Renninger’s four phase model of interest development, in which the participant either is motivated to continue with the activity, or is bored and the interest dissolves. If the interest continues, it enters Kolb’s experiential learning cycle, where the experience is reflected upon, is thought about, is tried again leading to another experience, which leads back to the four phase model in the second phase again, where the interest continues to be motivated and reenters the experiential
learning cycle again. Once the interest becomes intrinsically motivated, it steps up to the third phase of the interest model.

**Recommendations to practitioners.** There are several broad implications for teachers and educators that can be derived from this study.

Any classroom or informal activity will be experienced in many different ways, some intended and some unintended. If a specific context is to be taught, the educator must help the students to see that concept. All six participants in this study belonged to the same group that travelled from class to class. They heard the exact same words, saw the exact same demonstrations, and experienced the same activities. Yet, each participant told a different story, saw, heard, and felt different things, and developed different levels of interest. Every student had a highly unique experience. During the participant interviews, students commented how they failed to notice something until the teacher pointed it out to them. Equipped with the new awareness, the students perceived that phenomenon or concept. All students respond to the same experience differently. A teacher needs to utilize this to his or her advantage in the classroom through quality posttrip class reflection and discussion, to allow the students to share what they gained from the experience.

The interest development observed in this study illustrates the value of connecting students to the activity through senses, peers, teachers and unique setting. Teachers may create more connections by adding more student interfaces to the activity. One method that has been well documented is journaling (Chorice, 1997). By encouraging students to write and sketch what they see, Churchman (1992) noted that observations were fuller, more complete, more accurate, and more memorable. Students described, analyzed,
inferred and evaluated as they observed to discover what an animal or plant was doing and why it might have been doing that. More specifically, writing and drawing focuses on questions such as: How are animals and plants interacting? Who is eating who? How do plants and animals protect themselves? Where do animals find shelter? What animals live where? What plants live where? Journals are hands-on and minds-on, a direct experience that encourages critical and creative reasoning while the experience is being recorded. The process in the end fosters increased personal caring, understanding and responsible action concerning nature, ecology, and the environment (Leslie & Roth, 1998).

Teacher education programs must educate pre-service teachers on how to set up and run field trips: Field trips must be planned, teachers must prepare the students for the context of the trip, and teachers need to pre-visit the field trip venue to enable the preparations. A quality posttrip reflection is mandatory if the students are to fully understand what they experienced. Well planned field trips allow all students to explore and discover new, unique settings and the lessons that they hold. Teachers should explore for ways to continue the students’ interests that were derived during the field trip. Any student interest developed during the field trip should be reinforced and strengthened to prevent it from extinguishing once back home. Through reflection and by connecting the informal learning of the field trip to concepts taught in the classroom, a teacher will help students realize relevance and applications, potentially strengthening the students’ interest and knowledge of the subject matter. When on field trips, a teacher must allow the students to explore and discover. During the field trip, the teacher is a tool, scaffolding previously learned concepts and subject matter. The teacher should mentor
students who have questions, be excited about any discovery a student has made, and if something important is happening or needs to be seen, the teacher needs to make all the students aware (Dewey, 1998). The teacher also should be open to having fun and have casual conversations with students. After the field trip and back in the classroom, the students may have a closer relationship with the teacher, and they may see the teacher in a different perspective, as a real person, and somebody who they want to respect.

Science Club and similar informal school science organizations allow students to explore science and develop science interest at their pace and without fear of assessment. The ROHS science club provided its members, many of whom had minimal interest in science, monthly activities and field trips, developing science interest in some students, and science literacy in all. As another example, every participant in this study participated in science fair, an additional informal learning activity offered at ROHS. Once the topic of science fair was broached, all six students talked with pride and excitement about their projects, underscoring the importance of informal education opportunities that benefit students and develop interest in science.

As discussed in the photovoice section, the use of cameras for a class activity or field trip might help students to focus on a desired topic or concept. The resulting photographs inform the teacher of what the students experienced and what the students thought was important or significant. The cameras engage the students and empower the teacher to gain understanding of some students who are secretive or do not normally contribute to class discussions.

Finally, all students possess a personal fund of knowledge. A teacher who is able to tap into each child’s fund of knowledge will have students who are quickly made
interested in those topics that are relevant to them, their family, and their culture. Students should be encouraged to share prior topical experiences or knowledge during class discussions and activities.

**Implications for Future Research**

This study was confined to interviewing students one week after the immersive field trip. What are the long term effects of an immersive high school field trip to Stone Lab? A potential long term study may continue this research and follow the six participants over the next decade, contacting them for an interview in one, four, and ten years to evaluate how the Stone Lab field trip affected their views and relationships with science.

Research concerning funds of knowledge concentrates on the social and cultural aspects of individuals, families, and cultures. Little research has been conducted concerning science education. How do the funds of knowledge and prior experience affect a student’s interest in science? How do the funds of knowledge among different cultural groups affect their view of science and their science education?

One participant in this study attended the field trip to a biological field station in spite of not enjoying science, and especially biology. His responses in this study were focused on having fun or interacting with peers. What do students who dislike science gain when they attend an immersive science field trip? Will the experiences help them improve their scientific literacy? What specific experiences added to their scientific literacy? Did the presence of friends and peers add to realized and unrealized experiential learning gains?
Biological field stations are excellent informal education venues that are grossly understudied in literature. How do biological field stations compare to other informal venues in terms of interest, attitude, and learning gains? In another manner, this qualitative study might be repeated, but using different student populations such as students from an urban school, using all male or all female student attendees, or targeting a group of students that have been identified to have minimal interest in science. Another variable to consider changing is the time of year. How do the experiences differ in the different seasons?

Finally, the assimilated model of experiential learning was proposed in this study. Further exploration is necessary to test this model through experiential learning activities and venues. The ecological framework needs refined. What aspects of each lens are important? Which are unnecessary? The Kolb, Hidi and Renninger, and NRC compositional models are well-known, however, how reliable are they when assimilated or linked together?

**Limitations of the Study**

There were three limitations in this study. The field experience only lasted four days. The participants were constrained by the short time frame and were only able to explore for a finite amount of time. Each activity was constrained by time; participants were not free to explore until they tired of exploring, rather they had to follow a time schedule that may have limited their experiences. Time also worked against this researcher, who could not be in multiple places at the same time. The photovoice activity helped to record the events and activities not observed by the researcher, but more time would have enabled the collection of more observation data.
Time also limited the depth of the interviews in two different manners. Participant interviews took place during school, per agreement with the school. Interviews were scheduled during the participants’ study hall or lunch periods, thus interviews were limited to the length of a school period or about 50 minutes. A second issue with time was unexpected and not brought to the researcher’s attention until after the field trip. The school had agreed to participate in a pilot assessment program that, when added to the early final exams for seniors, the last three weeks of school were not available for participant interviews. The post trip interviews needed to be conducted a week after the field trip, which did not allow the participants optimal time to reflect on their experiences. The time issue also forced the photovoice interview to change focus from the photovoice images, to each participant’s full gallery of images. The photovoice images were turned in after the interviews had been completed.

This study was limited by the size of the participant pool. Six participants in this study were intended to be purposefully selected from a sizeable population of students who were attending the field trip. Only six students presented the required paperwork, and they became the study’s participant subjects. It was fortuitous that three participants found science interesting and three participants did not find science interesting. Another limitation concerning the participant pool was the homogeneity of the population. The participants all lived in a rural agricultural region, and there was no diversity among the student population.

A final limitation to this study was the inability to replicate results. Due to the time constraint by the cooperating school and for this dissertation research to be processed, analyzed, and written, there was little time for follow-up interviews with the
participants, or for interviews with other non-participant students who attended the field trip.

**Conclusion**

American science education is in crisis and we need people to solve the crisis. We have to prepare students for things that have not been invented yet. Teachers need to take action and provide students with knowledge and impactful experiences that will equip the adults of tomorrow with the tools necessary to solve these problems. One problem with science education today is the pushback from science teachers who are comfortable and locked in with the standards and formal traditional education system. Classroom lecture alone will not get the job done. Students go into drone-mode and become uninterested and unmotivated.

The classroom must be taken somewhere else so that the students are able to become interested, which opens the door to deeper knowledge. It is our responsibility as educators to inspire these young scientists to understand the interconnectedness between the basics of science, the environment, and everyday life. Quality experiences impact student learning through increased interest, increased motivation to learn, increased knowledge and a broader perspective that will help them to apply their knowledge to the world around them.

From this study of students’ experiences while on the Stone Laboratory field trip, significant findings were identified:

1. Prior experience, prior knowledge, and funds of knowledge added relevance and value to an experience, facilitating interest development.
2. Experiences appeared to be more meaningful when all the senses were stimulated.

3. Friends and peers were an essential part of a quality experience.

4. Quality experiences included a wow factor or sudden awareness.

5. Teachers needed to be within the experience, not the focus of the experience, and needed to be available to answer questions, be enthusiastic when a discovery was made, and promote student reflection concerning their perceptions and discoveries.

6. A quality informal learning situation incorporated the cognitive/affective, physical, and cultural aspects into the experience.

7. The field trip created science interest that students desired to continue when they returned to their classroom.

8. Stone Laboratory and the additional exploratory excursions on the surrounding islands provided high quality experiences that encouraged student interest in the biological and environmental sciences.

   The Stone Lab field trip physically ended in April, however the participants will remember the activities and the experiences all their lives. How the field trip changed those students’ lives cannot be determined, but it did make an impact. Field trips make a difference in student science interest development. The students step out of their classrooms, away from the formality and assessment, where they are free to learn. As WM-H stated, “It is an experience, not a lesson.”
References


Appendix A: Questionnaire for Participating Students

Questionnaire for participating students

Name __________________________________________________________________

Address_________________________________________________________________

City______________________________________Zip___________________________

Phone___________________________________________________________________

Parents’ or Guardians’ names______________________________________________

Best times to contact parents or guardians________________________________

Please describe the following:

Subjects you enjoy _______________________________________________________

Subjects you dislike _______________________________________________________

Activities you enjoy _______________________________________________________

Activities you dislike _______________________________________________________

What is your career goal?___________________________________________________

What will you be doing in 4 years?_________________________________________

________________________________________________________________________

What will you be doing in 10 years?________________________________________

________________________________________________________________________

Circle your level of interest in science (please be honest, you are not being judged)

1                            2                             3                             4                        5

Not interested                                                                                              Very interested
Appendix B: Ohio University Parental Consent Form

Title of Research: Student Science Interests while at Stone Laboratory

Researcher: Marc Behrendt MEd, PhD Candidate

You are being asked permission for your child to participate in research. For you to be able to decide whether you want your child to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your child’s personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your child’s participation in this study. You should receive a copy of this document to take with you.

Explanation of Study
This study is being done because there is a need to find ways to connect science education to what students personally consider interesting while on a field trip.

If you agree to allow your child participate, your child will fill out a science interest survey prior to the field trip. Your child will be asked to participate in a pre-trip and a post-trip interview, and your child will be asked to take photographs with a camera supplied to them, specifically for the Stone Lab trip. At Stone Lab, during the activities, your child will be observed for indications of interest.

Your child’s participation in the study will last 2 weeks before the Stone Laboratory trip until about two weeks after the field trip, when the final interview is completed, or the school year ends, whichever comes first.

Risks and Discomforts
No risks or discomforts are anticipated

Benefits
This study is important to science/society because it is important for our country’s future to generate students who are interested and excited about science.

Your child may not benefit, personally by participating in this study.

Confidentiality and Records
Your child’s study information will be kept confidential by the use of a pseudonym instead of using your child’s name. Your child’s name will not be connected to any data in this research. The code list relating your child's name to the pseudonyms will be maintained on a password protected computer and in a locked cabinet, and will be destroyed once the research is published.
Additionally, while every effort will be made to keep your child’s study-related information confidential, there may be circumstances where this information must be shared with:

* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;
* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU

Contact Information
If you have any questions regarding this study, please contact

**Researcher: Marc Behrendt, email: mb109411@ohio.edu  740-743-2818, c 740-605-1187**

**Advisor: Dr. Danielle Dani, email: dani@ohio.edu  740-593-4438**

If you have any questions regarding your child’s rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

By signing below, you are agreeing that:

- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered
- you have been informed of potential risks to your child and they have been explained to your satisfaction.
- you understand Ohio University has no funds set aside for any injuries your child might receive as a result of participating in this study
- you are 18 years of age or older
- your child’s participation in this research is completely voluntary
- your child may leave the study at any time. If your child decides to stop participating in the study, there will be no penalty to your child and he/she will not lose any benefits to which he/she is otherwise entitled.

Parent Signature___________________________________________ Date________

Printed Name______________________________________________

Child’s Name______________________________________________

Version Date: 03/18/2013
Appendix C: Pretrip Interview Instrument

Interview Instrument – Semi-Structured Probing Interview - Pretrip

1. Would you please tell me your name, and a little bit about yourself?

2. What are your goals for after high school and college?
   (Follow-up)
   Do you think science will play any part in your career?

3. How do you feel about science?
   (Follow-up)
   Are you planning to take more science courses in high school?

4. What kind of activities do you do, that include science at school?
   (Follow-up)
   Science fair? Science club? How do you work with others (teachers, students, parents) during these types of activities?
   How do you learn science in the classroom? How do you work with others (teachers, students, parents) during these types of activities?
   Which of these types of activities do you prefer?

5. How do you learn science when you are not in school?
   (Follow-up)
   At home – nature related hobbies? Science magazines? Science television shows?
   Who shares these experiences with you?
   Where do you learn science outside of school?
   What types of equipment or tools do you use?
   (Follow-up)
   Do you belong to any science specific groups?
   Do you talk about science with friends or family?

6. In what ways do these activities help you to understand science?
   (Follow-up)
   If a younger student asked you to explain what science is, what would you say?
   Is there anything that I haven’t asked that you would like to add, or something that you would like to follow up on?
Appendix D: Posttrip Interview Instrument

Interview Instrument Semi-Structured Probing Interview Posttrip

1. Describe to me an experience that you found noteworthy during the Stone Lab trip?
   (Follow-up) -
   What happened? What were you doing?
   Who were you with? What did you use? What about those activities, interactions, or tools did you find interesting? How did that make you feel?
   Describe where you were on the island? How did that place make you feel?
   What else about this experience captured your interest and made it noteworthy?
   Are there any more experiences you found memorable or noteworthy? Same follow up questions.

2. You participated in the classes and activities at Stone Lab. What topics or ideas did you learn that resonated with you, that you felt were important?
   (Follow-up) -
   Why do you feel this topic is important?
   Was the topic something you were interested in before? If not, what made the topic interesting?
   How have you thought about this topic since?
   Have you talked to others about it during the field trip or since?
   If yes - Probe - How were those conversations helpful to you as you think about the topic, science, and future goals.

3. You spent the last day on Kelley’s Island, what experience stands out from that day? Why?
   (Follow-up) -
   What happened? What were you doing?
   Who were you with? What did you use?
   What about those activities, interactions, or tools did you find interesting?
   How did that make you feel?
   Describe where you were on the island? How did that place make you feel?
   What else about this experience captured your interest and made it noteworthy?
   Are there any more experiences you found memorable or noteworthy? Same follow up questions.

4. People who attend Stone Lab report all sorts of feelings. Can you describe how Stone Lab made you feel? Can you recall any specific activities or places or moments that affected how you felt?
   (Follow-up) – How do you feel now about the trip or the activities? Have your feelings changed? Probe for specific moments, places, activities, people, interactions.

5. Has your interest in science changed during or since the Stone Lab field trip?
   (Follow-up) -
What do you think caused this change in your ideas about science?
Do you think you will take more science courses in high school (college)? Why?
Which ones and why?
Do you think science will play any part in your career?
Do you feel compelled to experience more science when you are not at school?
If not, why not?

6. How were your experiences at Stone Lab similar or different from your experiences with science at your school?
   (Follow-up) –
   Which types of experiences do you like best? Why?
   probe for interest, type of activities, and the interactions involved.
   Would you feel the same about these activities if they took place in your classroom, or someplace else? Why?
   Which types of experiences do you think should always be part of your school science class? Why?

7. What surprised you during the field trip? Was there anything which you did not expect?
   (Follow-up) -
   Did you expect something that did not happen?

8. Is there anything that I haven’t asked that you would like to add, or something that you would like to follow up on?
Appendix E: Photovoice Essay Assignment

Photovoice essay assignment post-field trip

Dear photovoice participating student,

When you are home after the Stone Laboratory field trip, please examine all the photographs that you had taken during the course of the trip. Please follow the following steps:

Choose 5 photographs that best capture the experiences that you found most interesting or meaningful. Write a paragraph or more to describe the activities that made that photograph significant for you. You may describe, for example, the people, place, event or activity, tools, and/or the feelings that make this photograph symbolic or noteworthy.
Appendix F: Photo Release Form

Photo Release Form

Return Release to: Marc Behrendt M.Ed., MT(ASCP) (Ohio University Ph.D. Candidate)
421 S Columbus St.
Somerset, Ohio 43783
740-743-2818
Email: mb109411@ohio.edu
Advisor: Dr. Danielle Dani
Email: dani@ohio.edu

I give to Marc Behrendt and Ohio University, its nominees, partners, and assigns, unlimited permission to copyright and use photographs that may include me in presentations, as long as they do not identify me by name or through other background information. I hereby waive any right that I (and Minor) may have to inspect or approve the copy and/or finished product or products that may be used in connection therewith or the use to which it may be applied.

Name of person photographed (please print): ____________________________________________
Age (if under 18): _________
Street address, city, state, and zip code: ____________________________________________

Signature: __________________________________________ Date: __________________

Consent of parent or legal guardian if above individual is a minor

I consent and agree, individually and, as parent or legal guardian of the minor named above, to the foregoing terms and provisions. I hereby warrant that I am of full age and have every right to contract for the minor in the above regard. I state further that I have read the above information release and that I am fully familiar with the contents.

Photographer name: __________________________________________

Signature: __________________________________________ Date: __________________

Assignment: __________________________________________ Date: __________________

Location: __________________________________________

Revision 2-14-2013
Appendix G: Gibraltar Island Map (Ohio State University, 2013)

The Gem of Lake Erie. Gib. The Rock. Gibraltar Island has many names and a long history. Originally a territory of the state of Connecticut, ownership of the island changed hands several times in the 1800s before Julius Stone gave it to Ohio State University in 1925. Franz Theodore Stone Laboratory is named after Julius Stone’s father, a naturalist.

Gibraltar Island itself gets its name because of its resemblance to the famous British fortress at the western end of the Mediterranean Sea. Its location at the entrance to Put-in-Bay Harbor allows it to serve as a natural breakwater to South Bass Island.
PEACH POINT
South Bass Island

Peach Point Research Laboratory
Originally a federal fish hatchery, Peach Point Research Laboratory now houses a chemistry laboratory, holding tanks for aquatic organisms, and general field support space.

Staff Housing
The lab manager and instructors stay in the Sycamore and Peach Point cottages.

Peach Point Cottage

Aquatic Visitors Center
The Aquatic Visitors Center is operated by Ohio Sea Grant and CONR Division of Wildlife from June through August. The center features educational displays, aquaria filled with fish, children’s programs, and a public fishing dock. For more information, visit ohioseagrant.osu.edu/AVC.

Sycamore Cottage

Glacial Grooves
Along Gibraltar’s western shore are deep striations running Northeast to Southwest. These grooves are remnants of the last great glacier in North America more than 10,000 years ago.

Bayview Office
Bayview is Stone Lab’s office on South Bass Island. All students and visitors must stop here to check in and arrange for transportation to Gibraltar.

Solar Panels

Dining Hall
Stone Lab staff caters all meals for summer courses, field trips, and special events from this facility.

Main Dock
Students pick up the water taxi to South Bass Island here.

Stone Laboratory
This 21-room structure is the main instruction building on the island, containing laboratories, classrooms, and office space, in addition to a meeting room for special lectures, a library, a computer lab, and the Stone Lab bookstore.
Appendix H: Stone Lab Workshop Program Course Options

(Ohio State’s Stone Laboratory (2013a) Field Trips. Retrieved from http://stonelab.osu.edu/tripsandtours/fieldtrips/)

**Lake Erie Science Cruise** - On a research boat, students do the hands-on work of a scientist, measuring current environmental conditions, such as wind speed and direction, water depth, temperature, oxygen content, wave heights, and sunlight intensity. They also have the opportunity to use Secchi disks to determine water clarity, plankton nets to collect algae and zooplankton, an Ekman dredge to survey benthic macroinvertebrates, and a fish trawl to collect and observe Lake Erie fish.

**Laboratory Research** - Groups take their samples from the Science Cruise into the research building for the two-hour Plankton and Fish Labs. These labs start with a limnology overview, including a discussion of the geology, chemistry, physics, and biology of aquatic ecosystems, food pyramids, and the examination of live phytoplankton and zooplankton under compound microscopes. Students learn fish identification techniques, using a dichotomous key to determine the identity of selected families of fish, and the session ends with a fish dissection to examine internal organs, stomach contents, and parasites and/or diseases.

**Invertebrate Walk** - Learn to use “biological indicators” by collecting macroinvertebrates on Gibraltar Island’s Alligator Bar, a rocky shoal, using kick seines, dip nets, and direct observations. The specimens are examined under a dissecting scope, and then a score is computed to determine local water quality. This technique can then be applied back at the school’s local stream to compare the results.

**Exotic Species Slide Show** - Discuss invasive species of plants and animals and their impacts on Lake Erie’s ecosystem, and view specimens of several common exotic species now found in North America.
**Island Geology** - Walk around Gibraltar Island and hear about and see evidence of the area’s ancient history through embedded fossils, rock formations, and glacial grooves, then discuss it in a short classroom session.

**Herpetology** - See live and preserved specimens and photos of a variety of Ohio’s reptiles and amphibians, and learn about current snake research underway at Stone Lab, which has been featured on the Discovery Channel’s “Dirty Jobs.”

**Ornithology Hike** - See a large variety of bird museum specimens, then hike around Gibraltar with a set of binoculars to spot and learn about Western Lake Erie’s local bird life and its world-wide importance as a migratory flyway corridor.

**Edible Plants Walk** - Take a walk around Gibraltar Island to locate a wide range of edible wild vegetables, nuts, herbs, fruits, and berries that were or are used for food by pioneers, other cultures, and wildlife.

**Climate Expedition** - Explore Gibraltar Island while learning about climate change, its effects on Lake Erie, and how small changes can have big impacts on the world. This self-directed activity lets students see the impacts of climate change in the Great Lakes first-hand while visiting island locations. (Stone Lab staff members can be scheduled for a guided tour for an additional fee.)

**Aquatic Visitors Center** - Learn about the complex Lake Erie ecosystem and current lake research by getting a first-hand look at live fish on this guided tour of a historic Put-In-Bay fish hatchery.
Appendix I: Stone Lab Ornithology Workshop Lesson (Created by Researcher)

Ornithology Class Lesson and Activity

The following is a detailed description of an ornithology workshop class at Stone Lab as experienced and taught by this researcher.

During the summer, there are many birds to observe in the trees, on the shoreline, and in the water, but this workshop takes place in late April, resulting in only a few resting migrants in the trees, and an occasional gull or waterfowl on the water.

Students arrived at the assigned second floor room dedicated to Ornithology at 0800, immediately after breakfast. The room is long and narrow, with a sink and large wash basin along one narrow wall, windows along one long wall and the opposite narrow wall, and a blackboard taking up most of the opposite long wall. By the door is a large set of book shelves which hold bird field guides and binoculars. There are 4 tables for students, plus a smaller table on which sets a box of bird skins.

Everything the instructor needed was set up and ready to use. The blackboard had chalk drawings of birds identifying external anatomy vocabulary. Also on the board were drawings of different types of bird feet and bird bills, and a drawing of North America showing bird migration patterns. As soon as the students settled into their seats, a few moments were taken for introductions, a time when the instructor could gauge the knowledge and interest level of the students. When birds are common on the island, the classroom portion of the ornithology class takes no more than 30 minutes, and often only 15 minutes. Since there were fewer birds on the island, more time was spent examining the preserved bird specimens.

Students were encouraged to talk and share stories and participate in all classroom and field discussions. The instructor began by introducing students to the bird drawing on the blackboard, identifying the vocabulary so that all students understand the basic vocabulary. The discussion was light and conversational, but also informative. Most of the external anatomy
vocabulary is necessary to identify birds when using a field guide, which was shown by pulling a random taxidermy preserved bird from the specimen box, and then having students help identify the important field markings, important features used for identification.

Bird feet and bird bills not only help identify the bird, but are also important to understand the bird’s habitat and food. From their own experience, students help to identify birds of each bill and foot type. Finally, most students are aware that many types of birds migrate. A short discussion about why and how birds migrate usually leads to student amazement and wonderment about how birds are able to fly thousands of miles south for the autumn, and then return to the exact same yard the next spring.

Examples of many kinds of preserved birds are pulled out for students to observe. The first bird shown is well known, such as the robin. Even though the students generally recognize a robin, few have ever looked at one close-up. They are amazed that the robin has the hooked beak of a predator, and that robins have subtle markings on their heads. Then a blue jay was shown, leading to a quick discussion about bird colors. Students are surprised to discover that blue jay feathers are not blue, but black, refracting light into a blue color. More birds were shown to the students - hawks, ducks, song birds, hummingbirds, and whatever species Stone Lab organizers decided to include for the season’s classroom. While examining each bird, the instructor helps students to notice the field markings on each bird, and helps students to locate that bird in the field guide.

Depending on the depth of discussion, the preceding activities take 30 minutes or less. In previous years, the US Fish and Wildlife Service culled populations of cormorants and donated four birds to examine and dissect. No cormorants were culled recently, so the students donned their jackets, were issued a pair of newly purchased binoculars and walked quietly with the instructor around the island. Due to incessant pouring rain, rather than stalk around the island, the group was led to a large gazebo, and searched for birds through the binoculars. Starlings live on
the island, so they are usually available to watch. However the students looked in the trees and shrubs for migrating warblers and songbirds, and scanned the rocky shorelines and water for gulls and ducks. The binocular activity required the instructor to help students learn how to use binoculars, even though the students swore they knew how to use the instruments prior to leaving the classroom. Some students became very focused in searching for, and then identifying birds. Other students got quickly bored. Students were encouraged to try, but were not admonished for giving up or not having interest. All it took was one student to spot a bird and announce, “there’s a bird” and all the students focus their binoculars in that direction to get a glimpse. When time was up, the students returned to the classroom, set the binoculars on the shelf, and then had some personal time until their next workshop class.

Like almost every room in the laboratory building, the ornithology room is never locked. (The exception is the herpetology room with live animals.) Interested students are encouraged to use the binoculars and field guides on their own before or after the workshop classes in the mornings or evenings.
# Appendix J: Ornithology Workshop Unit Plan

## Workshop Unit Plan

<table>
<thead>
<tr>
<th>Concept</th>
<th>Grade Level</th>
<th>Unit Theme</th>
<th>Essential Understandings</th>
<th>Essential Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds are unique animals, are important indicators of environmental changes, and are important members of an ecosystem.</td>
<td>4-12</td>
<td>Value of birds in ecosystems</td>
<td>Birds are a unique class of animals</td>
<td>What makes an animal a bird?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>By examining the bill and feet of a bird, the bird’s food and habitat can be determined</td>
<td>Why can birds fly?</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Feathers are specialized serving important functions.</td>
<td>How many different kinds of birds inhabit the region?</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Birds live in every habitat on Earth</td>
<td>Why and how do birds migrate?</td>
</tr>
</tbody>
</table>

**Connections:** Ecology, Entomology, Invasive Species

<table>
<thead>
<tr>
<th>Processes (Complex Performances)</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe and explore preserved bird skins.</td>
<td>Identify the features that are unique to birds. Identify the different types of feathers. Determine the habitat and food of a bird by examining the bill and feet. Use binoculars. Identify using field guides or keys.</td>
</tr>
<tr>
<td>Locate and identify birds in the region.</td>
<td></td>
</tr>
</tbody>
</table>

**Text:**

**Assessment:**
Instructor observation, student participation, post field trip teacher evaluation.
Appendix K: IRB Approval Form

The following research study has been approved by the Institutional Review Board at Ohio University for the period listed below. This review was conducted through an expedited review procedure as defined in the federal regulations as Category(ies):

Project Title: Nature of High School Students’ Experiences at a Biological Field Station

Primary Investigator: Marc E. Behrendt

Co-Investigator(s):

Faculty Advisor: Danielle Dani

Department: Teacher Education

Rebecca Cale
Rebecca Cale, AAB, CIP
Office of Research Compliance

3/12/13
Approval Date

3/11/14
Expiration Date

This approval is valid until expiration date listed above. If you wish to continue beyond expiration date, you must submit a periodic review application and obtain approval prior to continuation.

Adverse events must be reported to the IRB promptly, within 5 working days of the occurrence.

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved by the IRB (as an amendment) prior to implementation.
### Appendix L: Group Schedule for Stone Lab Classes

<table>
<thead>
<tr>
<th>Group</th>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
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<tr>
<td>A</td>
<td>Wed</td>
<td>8-10</td>
<td>Fish/Water</td>
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<td></td>
<td></td>
<td>Climate</td>
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<td></td>
<td>Thurs</td>
<td>8-10</td>
<td>Science Cruise</td>
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<td>10-12</td>
<td>Island Ecol Water</td>
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<td>12:45-</td>
<td>Fish/Water</td>
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<td>2:45</td>
<td>Climate</td>
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<td></td>
<td></td>
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<td>Botany</td>
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<td></td>
<td></td>
<td>4:45</td>
<td>Ornithology</td>
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<td>B</td>
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<td>Botany</td>
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<td>Climate</td>
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