PERCEIVED IMPACT ON STUDENT ENGAGEMENT WHEN LEARNING MIDDLE SCHOOL SCIENCE IN AN OUTDOOR SETTING

A thesis presented by James Abbatiello to The School of Education in partial fulfillment of the requirements for the degree of Doctor of Education in the field of Education

College of Professional Studies Northeastern University Boston, Massachusetts December 2013
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Abstract

Human beings have an innate need to spend time outside, but in recent years children are spending less time outdoors. It is possible that this decline in time spent outdoors could have a negative impact on child development. Science teachers can combat the decline in the amount of time children spend outside by taking their science classes outdoors for regular classroom instruction. This study identified the potential impacts that learning in an outdoor setting might have on student engagement when learning middle school science. One sixth-grade middle school class participated in this case study, and students participated in outdoor intervention lessons where the instructional environment was a courtyard on the middle school campus. The outdoor lessons consisted of the same objectives and content as lessons delivered in an indoor setting during a middle school astronomy unit. Multiple sources of data were collected including questionnaires after each lesson, a focus group, student work samples, and researcher observations. The data was triangulated, and a vignette was written about the class’ experiences learning in an outdoor setting. This study found that the feeling of autonomy and freedom gained by learning in an outdoor setting, and the novelty of the outdoor environment did increase student engagement for learning middle school science. In addition, as a result of this study, more work is needed to identify how peer to peer relationships are impacted by learning outdoors, how teachers could best utilize the outdoor setting for regular science instruction, and how learning in an outdoor setting might impact a feeling of stewardship for the environment in young adults.

Keywords: outdoor learning, student engagement, middle school science
Chapter 1: Statement of the Problem

The Topic

Every day when I get home from work, I ask my son what he did at school. Often his response is, “I can only remember what I did outside.” He provides me a detailed description of what he did on the playground or what was growing in the school garden, but he cannot recall the details of the academic learning that occurred inside the walls of the classroom. For him, like many children, learning in an outdoor setting engages his senses and mind.

The time children spend outside is in decline (Clements, 2004; Karsten, 2005). This decrease in time spent outside has many potential negative impacts on child development and has been termed Nature Deficit Disorder (Louv, 2005). As a science teacher, I have wondered how taking my students outside might impact their engagement for learning science. A number of studies have attempted to identify a connection between learning science and the potential benefits of doing so outdoors in nature (Pasquier & Narguizian, 2006; Tatarchuk & Eick, 2011; Waite, 2010; Maynard & Waters, 2007; Waters & Maynard, 2010). Learning in an outdoor setting has been found to improve student academic achievement in science (Lieberman & Hoody, 1998; American Institutes for Research, 2005), enhance the teaching and learning of science process skills (Pasquier & Narguizian, 2006; Tatarchuk & Eick, 2011), and increase student engagement (Skinner & Chi, 2012).

Research Problem

Several studies link increased time spent outside in nature or learning in an outdoor setting with improved academic success, decreased attention problems, and improved behavior and social skills (Clements, 2004; American Institutes for Research, 2005; Faber-Taylor, Kuo,
Sullivan, 2001). This research study examined the impacts on student engagement that might come from using the outdoors as an instructional setting for middle school science. Influenced by the theories of the Biophilia Hypothesis (Wilson, 1984), which states that humans and nature have an instinctive bond, and Nature Deficit Disorder (Louv, 2005), which identifies a growing absence of nature in the lives of children today, this study identified possible impacts of learning outdoors on student engagement. The mere fact that science class occurred outdoors was the key factor being evaluated. No out of the ordinary curriculum programs, lesson plans, or special projects were used, just the outdoor environment. The question being explored was: Does holding class outside impact the level of student engagement for learning science?

**Justification for the Research Problem**

Skinner and Chi (2012) conducted a qualitative research study using a diverse, urban, low-income middle school population similar to this research study site student population. Their study found that student engagement was high when working in an outdoor setting; but their study focused on a special garden project (Skinner & Chi, 2012). What if the content were no different from what would be taught indoors? Based on the work of Skinner and Chi, there was reason to believe that more could be learned about the potential benefits of learning in an outdoor setting among urban, middle school students when an outdoor instructional environment is utilized for regular classroom science instruction.

While Skinner and Chi (2012) did document that the outdoor environment increased student engagement, there are many obstacles that teachers often identify to teaching outside (Skamp, 2009; Maynard & Waters, 2007; Carrier, 2009). These obstacles include weather and safety (Maynard & Waters, 2007), time taken away from prep for standardized tests, classroom
management (Skamp, 2009), lack of confidence (Carrier, 2009), and lack of time (Pöllänen et al., 2011; Tal & Morag, 2009).

This research study addresses how the regular middle school science curriculum and standards can be taught outdoors with little to no additional planning by the teacher; such instruction does not require extra projects or a specialized outdoor education curriculum. A study of this nature investigated how the potential obstacles to outdoor learning, such as weather, can be overcome, and demonstrates that simply holding class outdoors impacts student engagement for learning science in numerous ways.

Given the decline in time children spend outside over the past several decades (Larson, Green, & Cordell, 2011) and the potential negative impacts this could have on learning (Louv, 2005), classroom instruction in an outdoor setting is an especially important topic for science teachers to examine today. Learning in an outdoor setting does work to meet the needs of middle school science students and it impacts their level of engagement for learning science.

Deficiencies in the Evidence

Despite the growing number of research studies related to learning in an outdoor setting, there is little in the literature specifically regarding how learning in an outdoor setting might impact student engagement for learning middle school science. Additionally, most research studies that focus on student engagement and learning in an outdoor setting discuss the use of a special project such as a field trip or community gardening. This research study examined the perceived impacts of learning in an outdoor setting on student engagement for learning middle school science when no other factor except being outdoors was applied. Students participated in
the regular curriculum activities that would have been completed indoors, but used the outdoors as the location for instruction.

**Summary of Practical and Intellectual Goals**

As the teacher of the participating class, and the researcher conducting this study I had a number of practical and intellectual goals. One of my goals for conducting this research was to obtain a better understanding of how the outdoor setting could be utilized for regular, daily, middle school science instruction; no special planning or projects required. In addition, I also wanted to identify how learning middle school science in an outdoor setting impacts student engagement as identified by participating students, and to inspire other science teachers to utilize the outdoor setting for science instruction in order to help combat Nature Deficit Disorder (Louv, 2005).

**Practical Goals**

After completion of this research study, I have gained a better understanding of how the outdoor setting impacts student engagement. Does being outside increase student engagement for learning science? As a result of this study, there are answers to this question. I hoped to discover if the mere act of being outside, completing the regular lesson and covering the regular science content, impacted student engagement. In order to do this, I used one of my sixth-grade science classes as the population for this investigation.

This exploratory case study provides the material for future research as well. A goal of this work is to inspire other science teachers to increase the amount of time that students spend learning outside in science class. Learning in an outdoor setting may increase student
engagement for learning science, while at the same time increasing the amount of time students are spending outdoors.

This study was conducted in my sixth-grade science classroom at a diverse, urban, public middle school. There is a gap in the amount of research that exists with middle school age students compared to elementary age students who learn science in an outdoor setting. While less work has been conducted with middle school age children compared to primary age children, based on available literature, Skinner and Chi (2012) did find high levels of student engagement in an outdoor setting with a similar demographic as the site for this study. Demonstrating how student engagement for learning science is impacted through instruction in an outdoor setting was a major goal of this work.

**Intellectual Goals**

The intellectual goals guiding this research were to identify the perceived impacts on student engagement when middle school science instruction occurs in an outdoor setting. Intellectual goals attempt to explain a unique circumstance and or process (Maxwell, 2005), such as learning in an outdoor setting, which is not a standard instructional practice for science teachers at many public middle schools. Another goal of this work was to inform teachers that no special planning or projects are necessary to utilize the outdoors as the classroom environment.

The literature on this topic identifies the potential impacts of spending time outside in nature and the potential for learning in an outdoor setting in public school science classes. Science teachers may have been resistant to utilize the outdoors for fear that bad weather might ruin hours of planning a special lesson, or that student behavior would be poor when learning outdoors, and that taking time to learn outdoors might reduce time for standardized test
preparation. The goal of this study was to identify if the regular science content can be taught outdoors, and to what degree student engagement is enhanced or impaired by the outdoor learning experience.

**Significance of Research Problem**

Children are spending significantly less time outside in nature in recent years (Louv, 2005; Clements, 2004; Karsten, 2005). It has been suggested that this decrease in time spent outside negatively affects academic learning, social skill development, and reverence for living things—which would otherwise lead to promoting environmentalism later in life (American Institutes for Research, 2005; Chawla & Cushing, 2007). Science teachers have an opportunity to combat the decline in nature exposure during the school day. By using the outdoors as a classroom instructional environment, teachers have the potential to improve science content learning by increasing student engagement.

Through an exploratory, case study methodology I have attempted to identify the impacts of learning in an outdoor setting on student engagement, and document the process by which science curricula can be delivered in an outdoor setting. A goal of this work was to encourage other science teachers to use the outdoors for a classroom instructional setting.

**Positionality Statement**

Failure to identify the “intent, perspective, or vantage point” (Machi & McEvoy, 2009, p. 24) of the researcher can negatively impact the quality of the research study. The topic of learning in an outdoor setting is extremely interesting to me as an educator. I hold an undergraduate degree in environmental studies and natural resources. Conducting a study on the
impacts of learning in an outdoor setting, stems from my desire to increase outdoor learning as part of regular middle school science curriculum. To explore the potential of this idea, I conducted this study and documented the impacts of the outdoors on my students’ engagement for learning. I feel that science teachers have a moral responsibility to expose students to environmental issues and create positive interactions with nature.

However, it is clear that there are varying degrees to which people and children feel comfortable spending time outside either in play or in a formal educational setting. The degree to which the participants in this study felt comfortable outside could have impacted the results. The degree to which my views as the researcher might have impacted the findings has also been addressed with many techniques for controlling bias and ensuring reliability.

**Identifying and Controlling for Bias**

This research study identified potential bias, and implemented a number of measures in order to control for bias. These included providing participants with an outdoor lesson before beginning the study to increase the level of comfort student participants felt for the outdoor learning environment, undergoing a variety of approval processes, obtaining peer educator feedback on the study design, and providing detailed communication with participants and their families while obtaining informed consent.

Cultural attitudes of fear of nature, and safety when spending time outside were considered and could have impacted willingness to participate as a subject in this study, especially if a child had little experience in nature or spent little time outside. To accommodate for this possibility, a case study methodology allowed me to focus on one of my sixth-grade science classes as the participants in this research study. I was aware that this might mean that
the study findings and recommendations cannot be applied to larger contexts or other student populations. But, in collecting a variety of data from multiple sources, the findings of this study can lead to recommendations for other science teachers interested in improving student engagement and motivation with their own science classes. This research encouraged a holistic examination of data through a critical lens, and ensured accurate data collection, data analysis, and the development of research findings.

Machi and McEvoy (2009) stated that “by identifying and confronting,” (p. 19) researcher bias it is possible to control for and prevent it from impacting the quality of a study’s conclusions. There are numerous ethical considerations that were addressed in the study design. These include the analysis of multiple data sources, conducting a pilot outdoor intervention lesson before the study began, approval from the university Institutional Review Board, and following all informed consent guidelines in the study of human subjects, and special considerations when working with children (Creswell, 2009).

Since I was the teacher of the research study participants, it was important to create a relationship where subjects felt open, able to be honest without consequence, and free of consequences such as being given poor grades as a result of their feedback. None of the academic work generated by students during the intervention lessons was counted toward a student’s class grade; and a student’s standing in class was not impacted if he/she decided to participate or not. Students and families were informed that their child would not be harmed in any way when the informed consent documents were explained.

In addition, creating a pilot intervention lesson before the research began (Creswell, 2009) helped students feel comfortable being honest regarding their experiences during the applied intervention, and established trust between myself and the participants. It was also used
to reassure parents and students that they would be evaluated fairly in the class regardless of the information provided during questionnaires and the focus group or if they decided not to participate.

The informed consent documents clearly and directly communicated to students and families that they did not have to participate in the study, and could opt to participate in only some parts of the study if they wished to do so. Student participants were able to participate in outdoor lessons without participating in the study, could participate in the questionnaire portion of the study only, or could opt in to participate in both the focus group and questionnaire portions of data collection. The informed consent documents also stated that students could participate in the intervention lessons without participating in the study or could opt to complete an alternative assignment covering the same science content indoors during an outdoor intervention lesson.

It is important to use multiple sources of data when conducting research through a case study model (Yin, 2009; Creswell, 2009). I have collected and examined a diverse set of data sources including questionnaire results, focus group transcripts, student work samples, and my observations. This allowed for the development of a case that does not rely on one specific data source, and produced a more accurate summary of the study participants’ experiences, and the effects of the intervention outdoor lessons.

There is potential bias when the researcher acts as a participant observer (Yin, 2009). In an attempt to prevent this bias, data from multiple sources was collected, participants completed anonymous questionnaires, and the focus group session was audiotaped and a transcript was made of the session.
Research Questions and Sub-questions

The research question for this study is:

1. How does learning middle school science in an outdoor setting impact student engagement?

The sub questions for this research question are:

1a. How do students identify their level of engagement for learning science during outdoor lessons?

1b. How does learning in an outdoor setting impact a feeling of competence for students?

1c. How does learning in an outdoor setting impact a feeling of autonomy for students?

1d. How does learning in an outdoor setting impact a feeling of relatedness for students?

The setting for this study was an urban middle school. The school enrolls approximately 450 students in grades six, seven and eight. The sixth grade science curriculum includes many life and Earth science topics that are conducive to learning outdoors. The school campus has a central courtyard that was used for the site of the three outdoor intervention lessons.

The content for the lessons consisted of the regular sixth grade unit of study that was taking place in the classroom at that time. The same unit of study was used for the duration of the
research study. No special curriculum changes were made, and no special, out of the ordinary, projects were part of the intervention lessons. Since the goal of this study was to determine how being outside during the learning process impacts student engagement in science class, the lessons were the same as those planned and delivered for indoor classroom activities.

**Theoretical Framework**

The theoretical framework that guided this research study was Self-Determination Theory (SDT). Ryan and Deci (2000) define Self-Determination Theory as a continuum of student engagement, from passive to engaged. The theory also states that social settings and context impact human self-motivation. Self-Determination Theory includes three essential components of self-motivation: competence, autonomy, and relatedness. When all three areas are satisfied, student engagement is highest (Ryan & Deci, 2000). Competence can be defined as the feeling of being able to meet the challenges of schoolwork or a specific task (Niemiec & Ryan, 2009). Autonomy can be defined as motivation for working which is self-endorsed (Niemiec & Ryan, 2009). Finally, SDT defines relatedness as “a sense of belonging or connectedness” (p. 64, Ryan & Deci, 2000) to others.

**Background on Self-Determination Theory**

Ryan and Deci developed Self Determination Theory around 1985 while they were examining motivation for learning (SelfDeterminationTheory.com, 2012). It has been used in the fields of education, health and medicine, sports, and virtual environments and technology (SelfDeterminationTheory.com, 2012). SDT was an appropriate theory to guide this research study because it merges components of classroom learning with the concept of a sense of place–
common in environmental education. In middle school science class, student engagement for learning is the synergy between how well a child can master the academic work, how much freedom a child feels he or she has within the learning environment, and how accepted a child feels in his/her learning environment.

This study has been guided by the concept that learning in an outdoor setting could enhance student engagement if students feel competent in the work at hand, free to make learning choices on their own (autonomy), and have the ability to relate to their fellow classmates and learning environment (relatedness). For a student to reach the highest level of engagement in learning, all three areas must be activated.

**Continuum of Engagement**

Self Determination Theory’s concept of a continuum of engagement matches the goals of this study. The goal of this research study was to identify the impact that learning in an outdoor setting might have on student engagement for learning science. It cannot be anticipated or expected that students are fully engaged or fully uninterested. There are many dynamic factors that impact a student’s engagement for learning science.

This study explored student engagement through the framework of the continuum described by SDT (Ryan & Deci, 2000). At times during a lesson students’ competence, autonomy, and relatedness may all be engaged at high levels. There are also times where the components of engagement might not be aligned, and student engagement for learning declines. The fluctuation of engagement factors, competence, autonomy, and relatedness, results in students functioning at different points along the continuum from passive to engaged (Ryan & Deci, 2000).
**Competence**

Competence can be defined as the feeling of being able to meet the challenges of schoolwork or a specific task (Niemiec & Ryan, 2009). Students in my sixth-grade science class must be able to feel confident that they are able to complete an assignment given to them by the teacher in order to be fully engaged in the assignment or activity. Given the proper skills, students can control the degree of competence they might feel by asking clarifying questions or re-reading assignment directions. Students can also raise their level of competence by relying on each other; in this way relatedness also might impact a student’s feeling of competence.

In order to learn more about how competence is affected by learning in an outdoor setting, the research study questionnaires and focus group protocol include questions specific to these areas of inquiry such as:

1. Describe what you did outside and what you learned during the outdoor lesson today?
2. Did going outside affect your ability to complete the assignment?
3. When you came to a part of the activity that was difficult or you did not understand, how did you approach the challenge?
4. How did learning in an outdoor setting affect the way you approached learning and the lesson activities?
5. How did learning in an outdoor setting affect your confidence to approach the activity?
**Autonomy**

Autonomy can be defined as motivation for working which is self-endorsed (Niemiec & Ryan, 2009). This might include the sense of freedom a student feels within the classroom or assignment, or the degree to which choice is provided to students during learning activities. Based on SDT, when students do not feel a sense of autonomy, learning might be more passive versus active thereby influencing the total level of student engagement. In order to obtain information about how the feeling of autonomy was affected by learning in an outdoor setting, the researcher used the following questionnaire and focus group questions:

1. How did learning in an outdoor setting make you feel?
2. Were you able to complete your task without the teacher directing your learning?
3. Did you feel like you had freedom when completing your work today?
4. How did learning outdoors affect your ability to do the work without a lot of help from the teacher?
5. How did learning outdoors affect the level of freedom you felt in choosing or working through the activities compared to indoor learning activities?

**Relatedness**

SDT defines relatedness as “a sense of belonging or connectedness” (p. 64, Ryan & Deci, 2000) to others. How a student feels about the classroom environment, their relationship with their teacher, and the way he/she interacts with peers molds a student’s sense of belonging in the class. How safe and connected a student feels in a classroom setting also affects how confident they feel approaching a learning task, and the degree of autonomy a student feels when learning. The questionnaires and focus group protocol also included these relatedness questions:
1. Did being outside affect how you interacted with your group or the rest of the class?
2. Was it easy to stay focused and complete your learning tasks?

**Theoretical Considerations**

The development of this research study was also influenced by Louv’s (2005) theory of Nature Deficit Disorder and Wilson’s Biophilia Hypothesis (Wilson, 1984; Kahn, 1997). Nature Deficit Disorder is the theory that the decreased time spent outside by children today is having a negative impact on child development (Louv, 2005). In addition, the Biophilia Hypothesis states, “there is a fundamental, genetically based, human need and propensity to affiliate with life and lifelike processes” (Kahn, 1997, p.1). That need is not met when children spend little time out of doors. Science teachers can address this disconnect between our need as humans to be outside and the fact that children today spend little time out of doors. They can do so by incorporating methods of outdoor exposure into their instruction. If outdoor learning can positively influence student engagement, science teachers may be more likely to use the outdoors as an instructional environment.

**Conclusion**

This research explored how student engagement is affected when learning in an outdoor setting from the perspective of one sixth-grade class in an urban middle school science class. Ryan and Deci’s, Self-Determination Theory (2000) was used to guide the research design and the data analysis for this study. For each of the components of SDT, competence, autonomy, and relatedness, the focus group protocol and questionnaires included questions developed to gain information about how learning in an outdoor setting impacted each area. The case that was
created as a product of this data, and analysis of it, is organized according to these three components of the theoretical framework.
Chapter 2: Literature Review

Introductory Statement

Torquati, Gabriel, Jones-Branch, and Leeper-Miller (2010) define the purpose of environmental education as “promoting environmental literacy, which includes knowledge about the natural environment, the ways we depend on it for survival, and actions we can take to protect it and improve it” (p. 98). In recent years, the time children spend outside in nature has declined (Clements, 2004; Waite, 2010). Experiences in nature and time spent outside have documented benefits in academic success, decreased attention problems, and improved behavior and social skills in children (The American Institutes of Research, 2005; Lieberman & Hoody, 1998; Mills, 2008; Connors & Perkins, 2009).

Decline of Time Spent Outside by Children

Louv (2010) coined the term Nature Deficit Disorder to describe the negative impact on health and well being stemming from the gap between humans and nature. Clements (2004) has documented a decrease in outdoor play and child initiated play in children when compared to their parents’ childhoods. In addition, compared to children in the 1950’s and 1960’s, children today spend less time outside (Karsten, 2005).

Olson and Clough (2009) state that there has been a decrease in the value given to nature by many children potentially explaining the decline in time spent outdoors in nature. Waite (2010) has also written on the decline in the time children in schools spend outside, and has identified children ages six through eleven to have the lowest incidence of outdoor environmental education today.
Academic Effects of Spending Time Outside

Researchers have concluded that school children learn more through an environment-based context than they do through a traditional context (Lieberman & Hoody, 1998). Researchers documented that students participating in a curriculum with environmental integration performed better academically compared to students at the same schools not participating (Lieberman & Hoody, 1998). In addition, the American Institutes of Research (2005) found that students involved in outdoor learning demonstrated increases in standardized science test score results. Connors and Perkins (2009) have also documented improved standardized test scores after participation in learning in an outdoor setting.

Researchers are connecting time spent outside with enhanced physical health, which leads to improvements in academic learning (Sallis, 2010, Brymer, Cuddihy & Sharma-Brymer, 2010). Allowing activity throughout the school day will improve student health and academic performance (Sallis, 2010). Tatarchuk and Eick (2011) and Heilbronner (2008) observed that an outdoor classroom is motivating and increases enthusiasm for learning.

Berman (2008) states that, “improvements achieved through interacting with nature were selective to directing attention” (p. 1210), concluding that nature experience and exposure are important to cognitive functioning. Parents report that children with Attention Deficit Disorder (ADD) improved attention abilities when doing activities in outdoor spaces (Faber-Taylor, et. al., 2001). In addition, children who play in outdoor spaces had a lower severity of ADD symptoms as compared to children who play in indoor spaces (Faber-Taylor, et. al., 2001). Further evidence from Mills (2008) cited German studies that found that children who attend outdoor preschools have better concentration and cognitive thinking skills compared to children who attended traditional indoor preschool programs.
Taking students outside can provide motivation for writing (Olson & Clough, 2009). Maynard and Waters (2007) found that math and literacy activities are most often reported by teachers as the content taught in an outdoor setting. Some schools have created special outdoor times each week for students (Maynard & Waters, 2007). “The unpredictability of the natural world is a feature that can be harnessed to rekindle excitement and curiosity in children and provide a motivating experiential starting point for further curricular development” (Waite, 2010, p. 120).

**Physical Effects of Spending Time Outside**

“Classrooms are not the only place where learning can take place, some children learn better if allowed to learn while being physically active, while outdoor green time is calming, and enhances the learning experience” (Connors & Perkins, 2009, p.58). Mygind (2007) discusses that many educators feel physical activity is extremely positive for children. Increased physical activity does show a positive relationship with improved academics (Mygind, 2007). In addition, one recommendation from Mygind’s (2007) study stated that teaching in an outdoor setting might reach the portion of children who “lack interest in physical activity” (p. 174). There are clear benefits to children’s physical health that come from experiences in nature (Torquati et al, 2010).

**Student Engagement in an Outdoor Setting**

Learning in the outdoor setting motivates students to initiate conversation with their teachers (Waters & Maynard, 2010) thus building relationships. Nadelson and Jordan (2012) also found that sixth graders showed the most interest and motivation for hands-on activities when
learning in an outdoor setting. Tangen and Fielding-Barnsley (2007) examined the use of an outdoor school gardening project to teach about environmental issues and nutrition. Participation in outdoor learning enhanced oral and written language development among English Language Learners and helped to build a community of acceptance and belonging (Tangen & Fielding-Barnsley, 2007).

Skinner and Chi (2012) conducted a qualitative research study using a diverse, urban, low-income middle school population, and found that student engagement was high when working in an outdoor setting. Skinner and Chi (2012) gave teachers and students answer stems when providing reflections and feedback to identify levels of student engagement while working in an outdoor garden; concluding that engagement was high even when competence was lower than expected.

The student population in the Skinner and Chi (2012) study is extremely similar to the study being conducted. This demonstrates an interest in exposing urban, culturally diverse middle school students to outdoor learning on their school campus. However, in the Skinner and Chi study a special outdoor project was the motivation to participate. The Tagen and Fielding-Barnsley (2007) study also used a special outdoor project as the reason for learning in an outdoor setting. This study builds on the current body of literature by including urban, diverse middle school student participants, but it utilized the outdoor setting for regular, daily classroom instruction using the normal middle school science curriculum, not a special project unrelated to course content and middle school standards or requirements.
Social-emotional Effects of Spending Time Outside

Children who attended an outdoor science school improved their abilities to positively resolve conflicts (American Institutes of Research, 2005). O’Brien’s (2008) examination into Forest Schools in England found that participating children have increased self-esteem as well as improved social skills and communication abilities. O’Brien (2008) also observed that outdoor play in nature forces students to negotiate with each other and work collaboratively to make a shelter in the woods or take turns climbing a tree. In addition, experience in nature taught children to “take a risk that challenges, but does not lead to harm” (O’Brien, 2008, p. 52).”

“Holding a branch so it does not fly in the face of a child behind you” (p. 50) is an example of the awareness for others that children gain when participating in outdoor educational environments (O’Brien, 2008). Positive bonding, relationship building, and interest in others due to shared nature experiences have also been identified as benefits (Heilbronner, 2008; Endreny, 2007). Berger (2008) found that one benefit of nature experiences for children is learning to cope with the unexpected, another important social skill. In addition, experiences in nature teach children appreciation for diversity (Torquati et al, 2010).

STEM Education and Learning in an Outdoor Setting

An important aspect of high quality STEM education includes inquiry-based learning opportunities. Boirdeau and Arnold (2008) share that “experience and observation are key to scientific inquiry” when using the outdoors as a classroom. Inquiry skills are commonly used in science lessons occurring in an outdoor setting (Legaspi & Straits, 2011; Tatarchuk & Eick, 2011).
Reliance on inquiry allows for a focus on process and the ability to learn from peers (Heilbronner, 2008). Common reflection questions after learning in nature often include science concepts that were experienced firsthand, and unanswered questions that generate further inquiry into a topic (Heilbronner, 2008). Educators identify the outdoors as an excellent place for scientific inquiry because it provides context for the learning (Tatarchuk & Eick, 2011). Science process skills commonly documented in outdoor learning activities include observation, classification, measurement, inference, questioning, and making predictions (Tatarchuk & Eick, 2011; Legaspi & Straits, 2011; Mangiante, 2009; Larson & LeMone, 2009; Endreny, 2007). Science curriculum units using outdoor settings for instruction magnify the “power of inquiry-based, real-world learning and help students identify” (p. 39) a deeper understanding of the complexities of a topic (Mangiante, 2009).

Progressive Education and Learning in an Outdoor Setting

Progressive education incorporates many tenants of outdoor education and supports the importance of nature exposure (Lilley, 1967; Reese, 2001). Lilley (1967) summarizes Friedrich Froebel’s writings stating that experience in nature is essential to appreciate the life in all living things (Lilley, 1967). William Reese (2001) connects the similarities of thought and belief in child-centered learning of Pestalozzi and Froebel with American environmentally minded transcendentalists, Ralph Waldo Emerson and Henry David Thoreau. Educational practices that included learning from nature and supported its importance in developmentally appropriate instruction evolved simultaneously in both the United States and Europe in the 1800’s and impacted the Progressive Movement (Reese, 2001).
Reggio Emilia, a preschool program developed in Northern Italy, requires access to an outdoor play area for children (Leddy, 2006). The program design includes a keen sense of children’s physical environment facilitating the learning, not a teacher or a textbook; which is similar to what can be found in many schooling models in progressive education settings (Leddy, 2006). John Dewey, a leader in the progressive educational movement, emphasized developing a sense of aesthetics by learning from nature, and viewed the arts as a lens through which one could appreciate nature (Leddy, 2006).

Dewey (1907) discussed the need for children to experience and explore objects in their natural setting. Dewey also identified the importance of children’s powers of observation and the strength of learning that comes from such observation (Dewey, 1907). To remove or isolate children from nature makes the learning meaningless (Dewey, 1907). In the next section, the current trends in the time children spend outside are documented and deeply contrast with the natural connection to authentic learning presented by progressive education. Ainley and Ainley (2011) support the connection between the Child and Nature Movement and the Progressive Education Movement, and cite, “Dewey as saying, ‘conditions for learning are maximized when the activity is both playful and serious” (Ainley & Ainley, 2011, p.5).

Obstacles to Using the Outdoor Setting in Schools

Teachers have identified weather and safety (Maynard and Waters, 2007), the emphasis on standardized test scores, classroom management (Skamp, 2009), lack of confidence (Carrier, 2009), and lack of time as reasons for not taking students outside during the school day (Pöllänen et al., 2011; Tal & Morag, 2009). There are no standards for outdoor education as part of science classes in the state of Virginia. At the time of this study, the best regulations for taking students
outside were the outdoor physical education policies followed by state, and school division physical education instructors. For example, according to the Prince William County Public Schools Physical Education Administration Guidelines (2013) in the State of Virginia, teachers cannot take students outdoors when the “real feel temperature goes below thirty-two degrees Fahrenheit or above ninety-five degrees Fahrenheit” (p. 9). In addition, when the heat index is over 95 degrees, outdoor activities are prohibited (Prince William County Public Schools Physical Education Administration Guidelines, 2013). These policies, required by the state, are regulations teachers must be aware of when considering taking students outdoors, and could pose an obstacle to learning in an outdoor setting in science class for science teachers.

Tal and Morag’s (2009) study examined teacher attitudes and identified obstacles toward using the outdoors as a classroom instructional setting. Tal and Morag (2009) concluded that teachers needed more training in using the outdoors as a classroom environment, and when a teacher participates in a training program on how to use the outdoors as a classroom, he/she is more likely to utilize it with the students that he/she teaches. This factor does put into question the number of science teachers interested in using the outdoor setting as an instructional environment. However, participants did identify that teachers who use forests for recreation and relaxation might be more likely to use it during the school day for student lessons (Pöllänen, et al, 2011).

Maynard and Waters (2007) have also investigated the obstacles teachers identify for not using the outdoor setting during the school day. Obstacles identified by teachers were commonly weather and safety related, depending on the location of the school (Maynard & Waters, 2007). Skamp (2009) sought to find out how an outdoor-based curriculum changed teacher practice. Participating teachers felt that outdoor learning was valuable, however, teachers expressed
concerns regarding student behavior during outdoor learning experiences (Skamp, 2009).

Additional studies have highlighted that confidence was the most important factor in teachers who use the outdoors as a classroom instructional environment (Nundy et al, 2009; Carrier, 2009). It is possible that if learning outdoors increases student engagement, this factor might increase a teacher’s willingness to try taking their class outside for instructional activities.

**Overcoming the Obstacles to Learning in an Outdoor Setting**

Through in-depth observation and interviews, Blanchet-Cohen and Elliot (2011) identified play outside as highly engaging for children and that these experiences promote environmental citizenship. Participating teachers, across four different school sites, formed productive learning communities for discussion of best practice instructional techniques and resource sharing around outdoor learning. The school programs improved due to the positive collaboration between adults at all four schools (Blanchet-Cohen & Elliot, 2011).

Researchers have also concluded that it takes time for people not used to an outdoor setting to feel comfortable learning in it (Popov & Tevel, 2007). Nadelson and Jordan (2012) found that novelty of activities and enthusiastic leaders were the major factors identified in increased student motivation and participation during outdoor field trips. It is clear that science teachers, given the appropriate support, professional learning community, rationale for improved student motivation, and professional development opportunities, can effectively utilize the outdoor setting in order to create a highly engaging science education instructional environment for children.
Use of Outdoor Learning for Professional Development and Learning Communities

Lee and Buxton (2011) suggest that in order for students to be successful in science courses their teachers must include discourse about connections to real-life, be explicit about norms, classroom practices and procedures, and explain why learning science is important. In many countries, using outdoor nature schools and natural areas for science teacher education has been identified as a priority (Jeronen, Jeronen, & Raustia, 2009). Weiser (2012) discussed the best practices in professional learning communities for science teachers, and found that this should include a focus on environmental education topics.

Popov and Tevel (2007) examined the use of the outdoor setting to teach physical science content to teachers in training. Researchers demonstrated how physics topics could be taught outside and gave examples of how the instructional approaches used in an outdoor setting might enhance learning (Popov & Tevel, 2007).

Environmental issues normally work well as catalysts to finding commonalities with the various participants in science teacher learning communities (Weiser, 2012). In 2007, Watson and Doue published a study on pre-service teachers’ experiences teaching in an outdoor setting. Teachers’ initial attitudes toward instructional approaches are difficult to change. However, hands-on experiences in teaching in an outdoor setting and working directly with students did encourage interest in learning in an outdoor setting in pre-service teachers (Watson & Doue, 2007).

Carrier (2009) also examined how outdoor experiences impact pre-service teacher’s attitudes about teaching science. Carrier’s (2009) study found that teachers were enthusiastic about the potential for learning in an outdoor setting. Bledsoe (2012) shared the experiences and lessons learned from planning a Science Technology Engineering and Math Day for children and
families in an outdoor setting. The article highlighted the steps teachers could follow to plan a similar science related event in an outdoor setting and the benefits of this type of event (Bledsoe, 2012).

**Nature Exposure, Fostering Environmentalism and the School Setting**

Recently there has been a growing environmental focus for outdoor education (Martin & McCullagh, 2011). Environmental attitudes are formed early in life and these attitudes are impacted by positive social interaction with nature and free play in nature (Ewert, Place, & Sibthorp, 2005). Vandala, Bixler, and James (2007) have highlighted parent and school responsibilities in making play in nature possible for the social benefits it engenders. Informal experiences outside generate environmental interests (Vandala, Bixler, & James, 2007). Free play in nature as a child is the number one contributor to future care for nature and the environment (Louv, 2004).

One theme that emerges in the literature regarding fostering environmentalism in students is the importance of role models (Chawla & Cushing, 2007; Littledyke, 2004). When school children had an environmentally aware teacher, the children became more concerned for the environment (Littledyke, 2004). Young children who are fortunate to have adult role models who are environmentally aware are more likely to become environmentally aware themselves (Chawla & Cushing, 2007). Louv (2004) also supports the importance of role models in fostering future environmentalism. He enumerates that attachment to nature depends on the quality of the relationship between youth and nature (Louv, 2004).

“The values that a child forms through nature experiences such as direct play in the natural environment may serve to ‘precondition’ him or her to developing a pro-environment, or
eco-centric set of beliefs and attitudes, about the environment later in life” (Ewert, Place, & Sibthorp, 2005, p. 234). Chawla and Cushing (2007) have concluded that active care for the environment -- pro-environmental action -- in children requires experiences with nature. For preschool years, ecological socialization in the school setting is most influential (Chawla & Cushing, 2007). Humans care for the environment either for the sake of its own value or because of nature’s value for human benefit (Chawla & Cushing, 2007).

There is a need for teachers to get students to think in a global context when experiencing learning outdoors (Boirdeau & Arnold, 2008). This is likely to generate love for nature and the environment in children (Connors & Perkins, 2009). Educators do this by teaching children about the local environment by learning about the watershed (Endreny, 2007) or researching the environmental history of an area and having students propose solutions to environmental problems (Mangiante, 2009). “How we educate our children not only prepares them for higher education, but also to be responsive citizens in a changing world” (Connors & Perkins, 2009, p. 60).

Vandala, Bivler, and James (2007) have highlighted parent, teacher, and school responsibilities in the role in social facilitation of outdoor play by making play in nature possible. Free play in nature as a child is the number one contributor to future care for nature and the environment (Louv, 2004). Chawla and Cushing (2007) cite free play in nature as an important experience for youth who develop a sense of compassion and stewardship for the environment. Learning outdoors is very different from learning indoors and has documented emotional and health benefits when schools utilize outdoor education programs (O’Brien, 2008).

Teachers should try to bring indoor activities such as eating lunch, taking naps, reading, and painting outdoors whenever possible (Torquati et al, 2010). Rosenow (2008) discusses ways
for teachers and schools to inspire environmental stewardship among students. Rosenow (2008) suggests that even children who attend schools located in cities can find nature to observe. It is important that the teacher avoids frightening students with dire environmental issues (Rosenow, 2008). Some examples of activities that could be done in any school setting include: container gardens and worm bins (Rosenow, 2008). Olson and Clough (2009) recommend nature related activities in the classroom such as having classroom plants and a birdfeeder outside of the classroom window.

Science education can act as a vehicle for moral development (Littledyke, 2004). Littledyke (2004) states that moral development is influenced by experience. Littledyke (2004) found that preschool age children practiced environmental stewardship out of fear of getting into trouble. However, as children reach older primary grades they want to practice stewardship for the sake of helping the environment (Littledyke, 2004). Littledyke (2004) found that young children’s environmental concerns were most often care for animals and not wasting. As children grow and develop their care and understanding for environmental issues broadens (Littledyke, 2004).

Children who participate in outdoor free play learn self-direction from the unstructured time (Vandala et al., 2007). In addition, Bixler and James (2008) summarized that choice and independence involved with nature play were beneficial to children. Free play on a child’s own terms allowed for effective environmental socialization (Bixler & James, 2008).
Summary

The time teachers could spend on outdoor learning experiences is being diverted by other academic pressures; especially for children age seven or older (Waite, 2010). Research in the area of learning in an outdoor setting in middle school level science classes is surprisingly rare. There is a need to examine what schools can do to promote outdoor experiences in nature for these students. The potential benefits to academic learning, social development, and health and fitness from learning in an outdoor setting demonstrate the value of further examination.
Chapter 3: Qualitative Research Design

Methodology

There is extensive literature regarding the use of outdoors in elementary schools, and a dearth of literature related to learning in an outdoor setting with middle school age students. In addition, most studies using middle school age children have implemented a special outdoor experience or project. This research study investigated how learning in an outdoor setting during science class impacts student engagement. Learning in an outdoor setting in this study is merely taking a class outdoors to conduct the same or similar instructional activities as those that are being completed inside the classroom.

A case study design adds to the body of literature, and promotes additional work looking into the academic effects of learning in an outdoor setting on middle school adolescents. The research question for this study is:

How does learning middle school science in an outdoor setting impact student engagement?

The sub questions for this research question are:

1a. How do students identify their level of engagement for learning science during outdoor lessons?

1b. How does learning in an outdoor setting impact a feeling of competence for students?
1c. How does learning in an outdoor setting impact a feeling of autonomy for students?

1d. How does learning in an outdoor setting impact a feeling of relatedness for students?

**Research Design**

This exploratory case study used qualitative data from one public school sixth-grade science class. Case studies examine real-life interventions for a contemporary problem (Yin, 2009) and offer a holistic analysis. The case study was selected because it can provide a complete picture of an intervention (Neal, Thapa, & Boyce, 2006) such as learning in an outdoor setting with a specific group of students.

This strategy of inquiry and problem-based research allowed for an in-depth examination of the research question, and strived to obtain valuable recommendations regarding this problem of practice for middle school science teachers. The case study model allows readers of this study to reflect on their own practice, meeting one of my personal goals for conducting this research (Stevenson, 2004), and it utilized students’ perspectives’ which are often overlooked in educational reform focused around improving instructional practices and student engagement in the science classroom.
Participants

The population for this research study consisted of one of my sixth grade science classes at the middle school where I am a science teacher. My school is part of a public school system, and its campus has an outdoor courtyard that was used for the intervention lessons. The class had a total of twenty-four students, fifteen female students and nine male students. None of the students had identified special needs or were English Language Learners.

The recommendations and findings from this study have been clearly defined, and relate to how learning in an outdoor setting impacted student engagement for one class of students. The case is divided into sections based on elements of student engagement as defined by Self-Determination Theory: competence, autonomy, and relatedness. Each section is guided by the associated research questions and sub-questions.

Recruitment and Access

I was the science teacher for all student participants. This role provided access to students for participation in outdoor lessons and data collection phases of the research study. I completed school system approval to conduct research, university IRB approval for human subjects, and required all participants’ parent/guardians to complete informed consent forms or opt out of specific portions of data collection.

Participants were offered incentives for participation in the study. After participating in the study questionnaires, students were awarded one gift card for the cost of a movie ticket. In addition, after participation in the focus group students were awarded one additional gift card for the cost of a movie ticket. Since participants were minors, parents/guardians of these students completed the informed consent documents to participate in the focus group session. A separate
informed consent document was given to parents/guardians informing them that students could opt out of questionnaire participation and/or stop participation at any time. After informed consent documents were completed, I also double-checked with the school nurse to ensure that it was safe for students to participate in outdoor activities.

**Data Collection**

The qualitative data collected for this research study was a combination of unobtrusive data in the form of questionnaires and academic work samples. In addition, at the conclusion of the intervention outdoor lessons, a focus group was completed. The content of the outdoor intervention lessons followed the regular school system curriculum. At the time of the study, I was covering astronomy with my class. No special projects or planning were implemented in administration of the lessons. The goal of this study was to determine if the outdoor location impacts student engagement based on student feedback. There were three outdoor intervention lessons that lasted approximately thirty-minutes each.

The questionnaires consisted of open-ended student engagement related questions created to reflect the core elements of Self-Determination Theory. Data were collected in multiple ways. First, data were collected after each outdoor lesson in the form of an online open-ended questionnaire. These questionnaires were anonymous, and students submitted responses online. This protected the confidentiality of each participant. The questionnaire consisted of nine questions. Three questions attempted to gather participant responses regarding competence for learning the science content in the outdoor lessons. Two questions each attempted to gather data on student’s feelings of autonomy and relatedness. Finally, the survey included one additional question that asked participants to share how participation in the outdoor lessons might impact...
future participation in outdoor and nature related activities. There was also an optional question that asked for any additional feedback and comments regarding the outdoor lesson experiences. A copy of the questionnaire questions is located as appendix F. Students/families could opt out of participating in the questionnaires and were not required to answer every question.

Written work samples were also collected. Students were asked not to write their names on work samples during the outdoor lessons to ensure confidentiality. The collection of written work samples depended on the current part of the curriculum/unit being covered at the time of the outdoor lessons. All three lessons produced different work samples.

In addition, at the end of the last outdoor lesson, a focus group was conducted. The focus group was conducted during the regular school day and was audiotaped. A transcription was made and students’ names were not identified or recorded. In addition, a student’s family had to opt in to participate in the focus group by signing the informed consent documents. The focus group protocol consisted of twelve questions. The first few questions were simple questions to ensure the participants were comfortable with the process. The fifth through ninth questions were directly related to areas of student engagement for learning during the outdoor lessons. The focus group protocol also consisted of predetermined prompts and probing questions which I used as follow up questions. Finally, the last two questions were open-ended questions to bring the session to a close and elicit additional information from the student participant’s perspective.

Data Storage

Data was stored in a password protected online storage site. No participant names were included with the data generated from this research study. The audio recording was stored as an
mp3 file in the same password protected online storage system, and no participant names were
used during the recording of the focus group or the creation of the focus group transcript. Work
samples are stored in a locked file cabinet. Upon receipt of notification that the final research
study has been approved and this degree conferred, the audio files, student work samples, and
transcripts will be destroyed. Informed consent documents are stored in a locked file cabinet and
maintained for three years.

Data Analysis

Data from multiple sources were used in the data analysis portion of the study. Sources
included questionnaire responses, the focus group transcript, student work samples, and my
observations. Data from the audiotaped focus group session was transcribed. Data collected from
the focus group transcript, participant questionnaires, observation, and student work samples,
were organized by area of student engagement based on the Self-Determination theoretical
framework. I created a case in the form of a vignette for my middle school science class that was
guided by the research sub-questions related to competence, autonomy, and relatedness.

The data collected was triangulated. The data was specifically identified and pulled out
from questionnaire responses, student work samples, my observations, and the focus group
transcript when it included similar themes on student engagement. A table was created for each
theme that emerged, and supporting data has been included. The table supported the
development of the case, and highlights where similarly themed data was collected from at least
three sources (Yin, 2005).

In addition, a vignette was created for the case describing the middle school science class
that participated in the outdoor lessons and its experiences. The vignette consists of four
sections: competence, autonomy, relatedness (as components of student engagement when learning in an outdoor setting), and an overall description of my class’s experiences. The vignette includes an explanation of the triangulated data as well as quotes collected from my students (Yin, 2005). No student participant names were used in any part of this study or data analysis.

**Trustworthiness**

I have ensured that the data and conclusions generated from this study are trustworthy. As the student’s science teacher at the location of the research study the participants were selected out of convenience, and I had access to participants and contact with participant families. I obtained all required approvals needed from the school, school system, university IRB, and student/parental informed consent. This process ensured this study in no way placed any participants in any danger, and helped to reduce bias during data collection and data analysis.

The participants were members of the same sixth-grade science class, and participated in intervention lessons as part of the regular science curriculum and lesson instruction during the regular school day. Outdoor intervention lesson science content followed the regular curriculum unit guides for the school system. Participants completed questionnaires within the regular class periods after each lesson, and nonparticipating students were given alternative non-homework assignments in a different location. As the researcher, I also selected a schedule for outdoor intervention lessons that could accommodate extra time if needed, so that the lessons would not be cut short and potentially impact study results and findings.

The focus group occurred during the regular school day to ensure that all participants could take part if they wished to do so. In order to participate in the focus group session, parents/guardians had to sign the opt-in informed consent document. Participant names were not
recorded during the focus group session, and transcripts were created from the audiotapes. To ensure internal validity, I used triangulation of the multiple data sources as a data analysis tool.

The use of multiple data sources ensured construct validity (Yin, 2005). In addition, the researcher’s faculty advisor and peer educators reviewed the focus group protocols, questionnaire, and other materials to eliminate potential bias in any of the research tools. This peer feedback helped to reduce researcher bias in the research design, data analysis, and research findings.

In addition, Self-Determination Theory, the guiding theoretical framework, also helped to provide direction for the data analysis and coding of data. All procedures have been clearly documented to ensure reliability (Yin, 2005).

Finally, as another method of ensuring validity, I utilized the process of member checking (Maxwell, 2005). After the initial data analysis was completed, I shared the six major themes that emerged with the student participants. An anonymous member checking survey was administered to student participants. The six themes were shared, and students determined the degree to which they agreed with each theme by selecting one of four responses: strongly agree, agree, disagree, and strongly disagree. Participating in the member checking survey was optional, and students could decide not to answer any question they did not wish to. Twenty-three students completed the survey. Students had already received their incentives for participating in the study, and no grade was assigned for participation in this activity. The results of member checking are discussed in chapter five.
Chapter Four: Report of Research Findings

How does learning middle school science in an outdoor setting impact student engagement? In order to find out how middle school students perceived the experience of learning in an outdoor setting during science class, students participated in outdoor lessons during their regular school schedule. The sub questions that guided the data analysis, formation of the case, and research findings and conclusions included:

1a. How do students identify their level of engagement for learning science during outdoor lessons?

1b. How does learning in an outdoor setting impact a feeling of competence for students?

1c. How does learning in an outdoor setting impact a feeling of autonomy for students?

1d. How does learning in an outdoor setting impact a feeling of relatedness for students?

Vignette: Sixth Graders Learn Middle School Science Outdoors

Last spring, one of my sixth grade science classes participated in three-outdoor lessons covering the regular curriculum required by the school district, and the state standards of learning for middle school science. We were studying astronomy at the time, which, in my opinion, is not a topic that would often be connected to outdoor learning during the regular school day. However, students in the participating class were instructed outdoors during this unit of study. The lessons were the same lessons that I would have delivered inside the regular
classroom setting if this class had not participated in the research study. In fact, for other classes I taught at the time, the very same lessons were completed indoors.

**The Class, the Content, and the Lessons**

There were at least twenty-two of my students participating in each lesson. The lessons occurred on our school campus, in an enclosed outdoor courtyard; reducing many safety concerns. The courtyard is about the size of a football field, and has many bushes, flowers and shade trees. There are a few small grass covered open areas, as well as benches, and a few sidewalk paths. Students at the school do not use the courtyard very often during the school day.

On the first outdoor lesson it was sixty-three degrees Fahrenheit and sunny. Some students decided to wear their jackets because it was cool. I gave them the option of getting their jackets before we left the classroom.

The regular curriculum used during this study for my sixth-grade science class was an astronomy unit; the final unit of the year. The learning objectives of the first outdoor lesson were for students to determine the difference between revolution and rotation, the cause of Earth’s tides, and the reason for seasons. These concepts are the main ideas of the entire unit and this lesson was an introduction to our unit.

Since I normally strive to create a student-centered learning environment, I discussed the lesson directions before we left the classroom so that student pairs could work as independently as possible when outdoors, and I could work to facilitate student learning as opposed to directing student learning. I worked to create this type of learning environment throughout the year, and this lesson was guided by the same instructional expectations.
Students were given a small booklet with short-paragraph articles about astronomy topics such as rotation, orbits, seasons, the moon and tides. My students worked in pairs of two and were instructed to read a paragraph from the booklet, and “walk and talk” to discuss a specific comprehension and/or discussion question after reading each section. I set the courtyard paths up as a loop where student pairs could walk side-by-side to discuss the reflection and comprehension questions printed at the bottom of each paragraph in the booklet. Students repeated the process of reading a paragraph together, and walking side-by-side to discuss the question related to the paragraph throughout this portion of our lesson. Each time the students looped the courtyard, sidewalk chalk marked where each partner should share what he/she thought, and whom should be listening or talking. At the halfway point of each loop, the speaker and the listener switched roles. This allowed each partner equal time to share his/her ideas. This sequence of reading together and then “walking and talking” was repeated eight times, one loop for each paragraph in the booklet. I observed the student pairs and did not need to provide much direction as the pairs discussed the articles.

My students took turns reading the paragraphs, discussing the answer, and sharing their ideas as they walked their loop outside in the courtyard. At times, I observed my students looking around or having an off task conversation. This occurred often at the end of the loop, but the pairs seemed to refocus themselves when starting to read a new section. Students did need to be redirected at times and reminded of our behavior expectations. Sometimes a “look” was all it took to redirect students.

After reading the eight paragraphs, and “walking and talking” students completed a nine-question, fill-in-the blank quiz that tested the basic astronomy knowledge covered in the readings. The quiz results of the students were as follows: fourteen students had all of the correct answers,
nine students had one incorrect answer, and one student got two answers incorrect. All of the
students met expectations on this assignment, which was to score a seventy-percent or higher.
This is the criteria considered “meeting expectations” according to the school system grade scale.

On the second outdoor lesson, it was slightly warmer, seventy-three degrees Fahrenheit
and extremely sunny. The lesson objective was to have my students model revolution and
rotation of the Earth and Sun, phases of the moon, the cause of tides, and the position of the
Earth and Sun during the four different seasons. Students worked in small groups of three or four
to complete these activities. Stations were set up around the courtyard on benches, and they were
color coded to help students know what stations to go to according to the order on a chart I had
provided. My students filled in components of the chart using drawings and descriptive phrases
to explain what they had learned at each station. Station materials included background
information and sketches that modeled the different concepts they were exploring. Each station
also included physical objects and tools to use in the creation of the models. These included
Styrofoam balls that were models of the Earth, Moon, and Sun, protractors, rulers, and
flashlights. Students were given five to ten minutes at each station to create their model, record a
drawing of the model, and label their illustration. I walked around the courtyard to check their
progress, and offered suggestions or asked probing questions as needed.

My students also had access to the articles they had used for the first outdoor lesson,
additional diagrams in the science lab book, and a hint sheet that showed parts of the sketch they
were to create for each station. Students were given the hint sheets in a closed envelope, and
could use them at their own discretion. After three stations were completed, four of six groups
had used the hint sheets as a reference to support their work.
The level of challenge of the second outdoor lesson activity was much higher compared to the first outdoor lesson, which did not require higher level thinking skills and modeling. During the second lesson, many student groups were off task and distracted by the insects in the courtyard, the materials that I had provided at some of the stations, and the bright sunlight. I had not anticipated that insects and sunlight would be such a source of distraction, and moved a few groups into a shadier location to complete the assignment. Students had to be redirected often, and many groups struggled to complete the tasks. Five students completed three stations correctly, seven students completed two stations correctly, and nine students had one or zero stations completed correctly; this did not meet expectations for our assignment. A station was considered complete and expectations considered met when all diagrams for that station/lab had been finished with scientific accuracy.

Finally, on the last outdoor lesson it was seventy degrees Fahrenheit, cloudy, overcast, and extremely humid and muggy. During this lesson, I directed a whole group reading on Pluto’s planetary status to begin preparations for writing an essay. The objective for this thirty-minute lesson was to take a position on Pluto’s planetary status – should Pluto be classified as a planet or only a Dwarf Planet? I read the article to my class and stopped to discuss it a few times. We sat in a horseshoe shape. My students were given the task of finding supporting information for their argument within the text of the reading, and then to begin working on a prewriting outline template sheet.

This prewriting assignment would lead to students writing a persuasive essay regarding Pluto’s planetary status. After reading the article, my class found places to sit on benches or the ground in a small portion of the courtyard. Some students sat on plastic mats, as it had rained the night before. This choice in where and how students sat was consistent with my indoor
classroom structure. It was common for this class to have some freedom and choice in how they sat during a class discussion throughout the school year. After about fifteen-minutes of a directed lesson reading one article about Pluto’s planetary status, I gave the students fifteen-minutes to browse other articles I provided for evidence to support their argument. They then plugged this evidence into a prewriting template that helped to organize their persuasive essay argument. The template served as a guide in helping them articulate their position, thesis statement, and supporting arguments. Most students worked silently. Some students had to be reminded to work independently. I observed their work, answered questions, and talked with students about their positions and thoughts on the topic.

After the lesson, I collected student work samples and I examined the work. In order to have fully met the objectives and expectations for the lesson, students had to have determined their position and selected one of three supporting arguments. For example: Pluto should be a planet because it is large enough, and almost as large as Mercury. Or Pluto should not be a planet because it does not clear its orbit due to its low gravitational force. At the conclusion of this lesson, a majority of students had selected a thesis statement and had begun constructing the persuasive argument.

How do students identify their level of engagement for learning science during outdoor lessons?

Based on my observations, questionnaire responses, and the focus group comments, students enjoyed the outdoor lessons and learned the unit content. I also enjoyed sharing this experience with my class. During the focus group session, many students said that they were motivated when learning outdoors and a majority agreed that they were able to meet the learning
objectives for the science content. The student work samples did not corroborate this self-reporting data regarding content learning, but students were adamant that they had learned scientific content as a result of the outdoor lessons. One student said, “I learned about what causes tides,” while another student shared that they had learned about “earth’s revolution and rotation” after the first outdoor lesson.

After the second outdoor lesson, my students shared that, “our group went to different stations, and learned about seasons, phases of the moon, and solar things.” In addition, other students also confirmed in questionnaire responses that they had learned about the Moon, Earth, and Sun. After the last outdoor lesson students said that they read about if Pluto was a planet or not, and one student commented, “I agreed with the statement that Pluto should be a planet. It has most of the characteristics a planet should have.” These comments support the fact that my students learned the science content during the lesson, but may still have needed more time to develop mastery of the learning objectives.

However, many members of the class found the temperature (too cool or too hot depending on the day), the amount of sunlight, and the presence of insects to be major obstacles to completing their classwork. My students felt that the “cold and wind made it more difficult to hear and talk with group members” and were distracted by the bugs and sunlight. One student even said that they were “distracted by the beautiful view.” The majority of the class reported that they did not spend much time outdoors on a consistent basis before the outdoor lessons, and many students felt that it would be easier to focus and be on task during an outdoor lesson if they spent more time outside normally. During the focus group session, less than half of participating students said they normally spend one or more hours outdoors per day. I was not surprised by this statistic.
The novelty of the outdoor learning experiences did motivate my students in many ways. One student said, “the approach to learning was different because I did not have a computer,” and another student said that they have never been outside in any other class except gym class. It was interesting to observe their reactions, and while there was discussion and laughter during the lessons, I never had to ask students to quiet down because they were too loud. Their collective volume never seemed to reach a level to where learning was prevented. Most of the students said that the newness was motivating and that they would like to have learning in an outdoor setting as a regular part of science class in the future.

The majority of the class reported that they had mastered the learning objectives for the three outdoor lessons, and that the work felt easier when completed outside. One student said that they “tried harder outside than they did inside.” Students’ abilities to overcome times when they were not sure about an answer did seem positively impacted by learning outdoors as well. My students seemed to rely on each other more, especially during the lessons in small lab groups. My ability to be in close proximity to all student groups at the same time was hampered by the outdoor environment in a way it is not in my classroom. I was not always just a few feet away which reduced the frequency of times when students sought me out for help. My students also said that they “re-read directions” and that “you had to rely on yourself more when outdoors.” Finally, students also shared that “fresh air makes me understand better” and “fresh air kept my brain awake.”

Insects and weather conditions distracted some members of the class and took away from their learning. From time to time, I observed students swatting at bees or flies, or letting out screams of fear. I shared with a few students that they were probably less likely to be stung if they did not react so dramatically.
My students said that the level and quality of academic work produced did not change during outdoor lessons in a significant way compared to the level and quality they produce during indoor lessons. Most students said that they would have completed the same level of work inside as they did outdoors. While less than half of the members of the class said that outdoor learning motivated them to work harder, one student who normally struggled to remain focused indoors completed the most of any student during the third day of outdoor learning. Overall, my class seemed happy to be outdoors. Even with the weather, bugs, and sunlight they had fun. They exhibited a higher level of independence, were motivated by the novelty of the change in setting, and many of the members of my class shared that after this experience they planned to spend more time outdoors in the future.

How does learning in an outdoor setting impact a feeling of competence for students?

Being outdoors did not seem to make my students feel more competent. Less than half of my students reported that being outdoors increased their confidence with the assignments. On the other hand, students shared comments such as “the work felt easier outside” and that they had tried harder and did not give up as easily as they might have inside when work was challenging or they did not understand it immediately. Working on academic assignments outside did seem to improve my students’ willingness to struggle through a difficult question before giving up and asking me for help. This seemed especially true when I was across the courtyard assisting another group.

However, students also shared that “being outdoors did not change my level of work” and many students shared that it was difficult for them to complete the assignment or that they did
not complete the assignment especially after outdoor lessons two and three which were a higher degree of difficulty compared to the first outdoor lesson. While there were some students whose feeling of competence did increase when outdoors, a majority of my students did not feel that the quality of work they completed was positively impacted or that they experienced an increased level of competence when learning in an outdoor setting.

**How does learning in an outdoor setting impact a feeling of autonomy for students?**

My students did identify that the feeling of freedom gained by learning science outside impacted them positively. Students used words such as *free, relaxed, and independent* to describe how they felt while working on assignments outside. A majority of my students felt motivated by the freedom, and a majority of outdoor lessons produced better academic results compared to the last major assignment or test/quiz scores the class had completed indoors. Students also described the enjoyment in being able to “work at their own pace” and that they were “trusted with their own learning.” I had worked to create a student-centered classroom throughout the school year, one in which I had often offered choice, and variety through diverse methods of working towards content mastery. I think the fact that these had been hallmarks of my instruction all along might have better prepared my students to feel successful learning this way in an outdoor setting.

**How does learning in an outdoor setting impact a feeling of relatedness for students?**

Less than half of my students reported that they spent an hour or more outdoors most days. However, a majority of the class said that after participating in the lessons they would like
to spend more time outside. One student said, “The great thing about learning outside is that you are around nature.” Another student said that it “felt right and good to be outdoors in science class.” One group of students had an experience with a pill bug and had never taken time before the outdoor lesson to notice nature up close in the way they did with that creature. My students took turns holding the bug, gave it a name, and carried it around from station to station. Other groups wanted to meet their new group member too.

On the whole, learning in an outdoor setting did not change the way that my students interacted with each other during class. Behavior and group dynamics were similar to the indoor classroom setting. My students also consistently felt that the way they interacted with each other was not impacted in a positive or negative manner compared to indoor learning. However, some students did share that “no one was angry outside” and that “groups depended on each other more and discussed difficult problems or questions more when outdoors.” Again I suspect that the fact teamwork and positive interpersonal interactions had been expectations of my classes all year may have prepared my students to be successful with these aspects of the work they did together during the outdoor lessons.

In retrospect, the outdoor lessons were a bonding experience for all of the class and myself. Now that we have started a new school year, many students still see me in the hallway and reminisce about the experience of learning in an outdoor setting.

**Creation of the Vignette**

I created the vignette to tell the story of my class and their experiences while learning middle school science in an outdoor setting. The vignette was guided by the four research sub-questions. The vignette attempts to share how the class experienced the outdoor lessons, and how
the outdoor lessons impacted student engagement according to the three aspects of student engagement as described by SDT: competence, autonomy, and relatedness. The vignette also attempts to provide a holistic view of my sixth-grade classes’ experience when learning in an outdoor setting, and how they perceived the impact of learning outdoors on their engagement for learning science.

**Research Findings**

The outdoor intervention lessons involved in this study were three, thirty-minute, outdoor lessons for one of my sixth grade science classes. After students participated in the study lessons, the work samples were collected and each participating student completed a questionnaire. After the last outdoor science lesson was completed, my students participated in a focus group. During the focus group, students shared their feelings and experiences of learning middle school science in an outdoor setting.

Based on analysis of this data, the following conclusions have been made:

1. Environmental conditions, such as weather and insects, can be a major distraction for students when learning in an outdoor setting.

2. Students did not interact with each other differently when outdoors compared to indoors.

3. The sense of freedom (autonomy) students felt when learning in an outdoor setting increased their engagement for learning science.
4. The novelty of learning in an outdoor setting increased student motivation for science class.

5. Learning in an outdoor setting enhanced student abilities and attitudes for solving their own problems when academic work was challenging. Students reported that they felt less likely to give up on a challenging assignment when working outdoors, compared to experiences they have had working in an indoor classroom setting.

6. Learning in an outdoor setting during middle school science class does increase student interest in having more outdoor experiences.

**Study Participation**

Table 4.1 summarizes the rate of student participation for each outdoor lesson. Twenty-four students, my entire class, participated in the first outdoor lesson and all twenty-four students completed a work sample, and the questionnaire. Twenty-two students participated in the second outdoor lesson. One student was absent from school that day, and one student elected not to participate; they did not share a reason for not participating. Every participating student completed a work sample and the questionnaire. Finally, on the last outdoor intervention lesson, twenty-three students participated. One student elected not to participate in the third outdoor lesson; this was the same individual who did not participate in the second outdoor lesson. Again, they did not share a reason for not participating. Twenty students completed the work sample, three students had no evidence of any work completed, and twenty-three students completed a questionnaire at the conclusion of the final outdoor intervention lesson.
### Table 4.1

*Student Participation During Outdoor Lessons*

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Number Participating</th>
<th>Number Not Participating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor Lesson 1</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>Outdoor Lesson 2</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Outdoor Lesson 3</td>
<td>23</td>
<td>1</td>
</tr>
</tbody>
</table>
In total, sixty-seven questionnaires were completed during the data collection portion of the study, and all questionnaire responses were reviewed and analyzed, yielding the research findings. In addition, sixty-four work samples were produced and reviewed as part of the data collection of the study (See Appendix H). The work samples consisted of a fill-in-the-blank quiz after a partner reading activity at the conclusion of the first outdoor lesson; a small group lab activity where my students had to create drawings and diagrams as part of the second outdoor lesson, and the final outdoor lesson work sample was a prewriting template to begin brainstorming for a persuasive essay.

Finally, twenty-one students participated in the focus group as part of the final part of the study data collection, and a transcript was made. A copy of the focus group protocol can be found as appendix G. Three members of the class did not complete the required informed consent document; but did not provide a reason why they were not participating.

Data Analysis

Data was collected from a varied number of sources to ensure a holistic examination of the students’ experiences and feelings related to learning in an outdoor setting and how this setting impacted their engagement for learning middle school science. Data was collected from questionnaires, a focus group, student academic work samples, and my personal observations.

The questionnaire responses from each lesson were analyzed separately to begin the analysis of data. The three major components of Self-Determination Theory (SDT): relatedness, autonomy, and competence, were used to organize the responses generated from the questionnaires for each outdoor intervention lesson. Next, the data from the transcript of the focus group was analyzed for responses related to the three parts of SDT, and quotes were
recorded that provided specific commentary regarding how students perceived the experience of
the outdoor lessons. Finally, since I was the researcher delivering the outdoor intervention
lessons, the anecdotal observations that were recorded after each lesson were reviewed, and
student work samples were examined.

At the conclusion of each outdoor lesson I recorded my observation notes. Handwritten
notes were recorded such as observations of student participation, weather and environmental
conditions, and what my students were doing during the outdoor lessons.

All of this data was then triangulated. This helped to identify what themes emerged in at
least three sources of data. A data table was created to assist with the triangulation of information.
Data table 4.2 is included later in this chapter. All of the data was utilized during the creation of
the vignette.

**Triangulated Data Table: Questionnaires, Focus Group, and Observations and**

**Student Work Samples**

All of the six conclusions identified as a result of this study were developed due to
triangulation of the data writing the vignette. Similarities between questionnaires from the three
outdoor lessons, the focus group, observations, and student work samples were analyzed, making
the triangulated data the most important data analysis method for this research study.

When the data showed similarities among at least three different types of data, a theme
was confirmed. In many cases, all four types of data could be used to support a study finding.
This method was helpful in eliminating responses that may have been shared during a focus
group, but not consistent among questionnaire responses. The triangulated data table also
ensured that the focus of analysis were the research questions. While the data may not be
generalizable to the larger population of middle school science students, it does present one of my class’ experiences when learning in an outdoor setting, and how these student participants felt it impacted their engagement for learning middle school science.
Table 4.2

*Triangulated Data for Questionnaires, Focus Group, Observations, and Student Work Samples*

<table>
<thead>
<tr>
<th>Data from Questionnaires</th>
<th>Data from Focus Group</th>
<th>Data from Work Samples</th>
<th>Data from Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theme 1:</strong> Environmental conditions, such as weather and insects, can be a major distraction for many students when learning in an outdoor setting.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students commonly mentioned insects throughout the three questionnaire responses as a source of distraction.

Students mentioned the weather being too cold, too hot, too sunny, and too humid as another source of distraction during the outdoor lessons.

One student wrote, “the cold and wind made it difficult to hear and talk with group members.”

Another student wrote, “I was distracted by the beautiful view.”

Students shared that insects, the sun, and the temperature were all conditions that distracted from their ability to focus on the lesson and complete the academic work.

A majority of students agreed that it would be easier to remain focused when learning outdoors if a student was used to spending time outside.

After lesson two, a day when the weather was warm and sunny, and many bugs were out, the number of students meeting expectations on the assignment was extremely low.

During outdoor lesson two, the weather was warmer and more bugs were out. Many students swatted at bugs, and screamed when an insect flew near them. This was very distracting to their work and the work of other groups nearby.
<table>
<thead>
<tr>
<th>Data from Questionnaires</th>
<th>Data from Focus Group</th>
<th>Data from Work Samples</th>
<th>Data from Observations</th>
</tr>
</thead>
</table>

**Theme 2: Learning in an outdoor setting did not impact or change how students related to each other compared to learning in an inside setting. Students did not interact with each other differently when outdoors compared to indoors.**

Many students reported that they did not interact differently with classmates or with partners and groups during outdoor lessons.

"I did not interact differently" was a common response in all three-questionnaire administrations for question 7.

Questionnaire responses consistently showed no specific trend (positive or negative) in relation to changing the way that students related to or interacted with each other.

Students did not report that their interactions with fellow classmates were different outside compared to indoors.

The work sample generated from lesson two required the most group interaction. This lesson generated the lowest number of students in the class meeting expectations.

Students interacted with groups with no observable differences compared to indoor learning.

When students were distracted and one group was off task due to an insect, these behaviors distracted nearby groups as well.
Theme 3: Students did feel motivated by a sense of freedom (autonomy) when learning in an outdoor setting.

The feeling of the sense of freedom gained from learning in an outdoor setting was repeatedly mentioned in questionnaire responses to question 5.

Students used the words freedom, relaxed, independent, and more space to describe their feelings about learning outdoors.

Specific comments included “more freedom to discuss a problem with my group” and “I did not feel enforced” are some examples of student quotes from questionnaire responses.

During the focus group session, students shared that there was an increased sense of freedom, and more space to work.

All students agreed with the comment from one student, “it is better than being stuck in the classroom.”

A majority of participants acknowledged the increased feeling of freedom as motivating during the outdoor lessons.

Students shared comments such as “you could feel like you could work at your own pace” and “we were trusted with our own learning” during the portion of the focus group session discussing autonomy.

The assignment that had the highest level of autonomy had the highest number of students meeting expectations; the entire class. This occurred during the first outdoor lesson, and fourteen students had all answers correct, nine students had one answer incorrect, and one student had two incorrect responses.

This was by far a higher pass rate than data from recent indoor assignments completed by the same class.

Students had lots of space in both lessons one and two in the courtyard. They moved around, and talked with each other about the work.

Students did not skip sections on any of the assignments, but it did appear that some students needed more time to complete lessons two and three.

Students had lots of space in both lessons one and two in the courtyard. They moved around, and talked with each other about the work.

Students did not skip sections on any of the assignments, but it did appear that some students needed more time to complete lessons two and three.
Responses to all three questionnaires included statements that outdoor learning made the students feel happy and that participation in the outdoor lessons was fun.

One student commented that, “the approach to learning was different because I did not have a computer.”

Almost all of students agreed that the novelty of the outdoor learning sessions was motivating.

A comment from one student included, “I have never done outdoor learning in any class except physical education.

A majority of the students agreed that they would be more motivated in science class if learning in an outdoor setting were a regular component of the course.

Students shared that it was fun to try something new.

Two of three outdoor lessons created more “meets expectations” ratings based on the student work samples, when compared to the two most recent indoor assignments completed by the class prior to beginning the science lessons in an outdoor setting.

Students appeared excited to begin the lessons and disappointed when it was time to go inside.

Students followed directions well, listened to directions at the beginning of the lessons, and were engaged in the assignments outdoors.

**Theme 4: The novelty of learning in an outdoor setting increased student motivation for learning science.**
**Theme 5: Learning in an outdoor setting enhanced student abilities and attitudes for solving their own problems when academic work was challenging.**

Questionnaire responses included, “re-reading the directions” when students, pairs, and groups came to a question or problem they did not understand the first time.

Students also shared comments such as “you have to rely on yourself more (when learning outdoors),” “inside I just ask the teacher, but outside I tried again when I did not understand,” and “outdoor learning made me feel that the problem was not as hard.”

Nearly all students agreed that they had mastered the content of the outdoor lessons.

In addition, almost all of students also agreed that the work felt easier when outdoors.

One student shared that they “tried harder outside and did not give up.”

In two of the three outdoor lessons, a majority of students met expectations when compared to recent assignments completed indoors.

No answers were left blank on the first outdoor lesson work samples.

Students worked the entire time during the three outdoor lessons.

Some groups completed more work compared to indoor class sessions, and students asked clarifying questions as needed.

Due to the amount of space in the courtyard, the teacher was not in as close in proximity to many students as compared to the indoor learning environment.
### Theme 6: Learning in an outdoor setting during middle school science class could increase student interest in having more outdoor experiences.

<table>
<thead>
<tr>
<th>Data from Questionnaires</th>
<th>Data from Focus Group</th>
<th>Data from Work Samples</th>
<th>Data from Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>One student said, &quot;The great thing about learning outside is that nature is all around you.&quot;</td>
<td>A majority of students agreed with the statement: I would like to spend more time outside afterschool or on weekends.</td>
<td>No evidence.</td>
<td>One group discovered a pill bug, and was very excited that they were able to hold it. The group gave it a name and carried it around as they switched stations. For many students, it was the first time they had held a bug in their hands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>One student shared that the bug &quot;became part of their group.&quot;</td>
</tr>
</tbody>
</table>
Validity Checks

The validity of findings and conclusions was continually considered during research study design, data collection, data analysis, and the determination of study findings and conclusions. Data were collected from a diverse number of sources. This included questionnaires administered on three separate occasions, a focus group, three sets of student work samples, and my observations. Triangulation was utilized to “reduce the risk of chance associations” (p. 112) and bias (Maxwell, 2005). In addition, since this was an exploratory case study and there was no theory to be developed, researcher bias impacting the findings and conclusions was reduced (Maxwell, 2005). The research questions simply asked what impacts students perceived to engagement when learning middle school science in an outdoor setting. The anonymous online questionnaires and student work samples did not identify any participants by name, and promoted honest feedback after each outdoor lesson.

The fact that I was also the students’ science teacher may raise questions about the validity of the study findings and conclusions. The possibility that the researcher may have influenced the participants must be discussed, and is called reactivity (Maxwell, 2005). Maxwell (2005) states that reactivity is not as serious a threat to validity as many believe. Based on the data collected, including questionnaire responses and the focus group transcript, student participants provided both positive and negative feelings about the outdoor intervention lessons. This balance of responses in the data tends to confirm that the data was not influenced by my presence and pervious relationship as the participating students’ science teacher.

Based on the data generated from the student work samples, questionnaires, and focus group results; a data table was created and has been included. The transparency of the data ensures validity for a study of this nature (Maxwell, 2005). In addition, the next section
acknowledges the inconsistences that I have found during data analysis, and what was done to control for potential bias.

**Inconsistencies of Research Findings**

While there are numerous consistencies between the multiple data sources involved with this study, possible inconsistencies of research findings must be recognized. For each of the findings with possible inconsistencies, an explanation regarding variations has been included.

There was consistent evidence in the data that environmental conditions such as weather, insects, and sunlight, are a major distraction for many students when learning middle school science in an outdoor setting. However, some evidence suggests that for some participants, this was not the case. The outdoor setting did make them feel more comfortable and motivated. One participant shared, “even though it was cold, I dealt with it and never gave up,” while another student shared, “nice warm weather made it amazing to work, it was not too cold or sunny; it was perfect.” In addition, my students acknowledged during the focus group session that participants who normally spent time outside were less distracted compared to students with less experience spending time outdoors.

Second, this study also attempted to find out how the outdoor setting impacted students interactions with each other as part of SDT’s relatedness component. Based on the evidence in the questionnaires, focus group, student work samples, and my observations, another finding was that learning middle school science in an outdoor setting did not change the manner in which students interacted with each other when compared to interactions in the regular classroom indoor environment. The majority of the comments in the questionnaire portion of the study did not provide any data that would have supported a more positive or cooperative classroom
environment when learning in an outdoor setting. Based on participant observation, student behavior and interactions with peers during partner and group work did not appear to be different outside as compared to the inside learning environment. However, some students did share comments such as “no one seemed angry outside,” and “I got the time to share ideas (with group members).” This might demonstrate that there was a difference in the way that some individuals interacted with their peers when outside.

Students reported that learning middle school science in an outdoor setting did not impact or improve the quality in their work compared to indoor learning. Due to the fact that the three outdoor lessons utilized different types of learning strategies, it is difficult to compare the three experiences. The first lesson was a partner activity, the second lesson was a group lab activity, and the final lesson was a teacher directed reading and discussion with an individual work component. A majority of student responses from questionnaires and the focus group did not reflect a feeling of improved academic work during a class that was held outside compared to one occurring indoors. Student work samples also provided inconsistent evidence due to the variation in the nature of work generated for each lesson.

After the first lesson, students completed a fill-in-the-blank quiz, and the scores for this assignment showed that all of the participants met expectations. After the second lesson, a more challenging hands-on laboratory assignment, the lowest number of participants met expectations. In the final outdoor lesson, just a slight majority of students fully completed the task of independent prewriting for an essay. In both the second and third outdoor lessons it is possible that the nature of the assignments or the amount of time allotted for these tasks provided inconsistencies in the data which impact the potential for a research finding to be established. The work samples are anonymous, and individual student grades cannot be compared. If the
study design allowed for a specific student to be matched to an unobtrusive set of data such as class grades, or grades on intervention lesson work samples, it might have been possible to identify how previous experience outdoors may have impacted academic learning. One specific student who had struggled academically throughout the school year was observed completing more of the final outdoor assignment than any of the other students. While this might demonstrate positive impacts of learning in an outdoor setting, this anecdote does not compare to the larger research findings based on the diverse set of data collected.

Finally, another conclusion from this study is that learning in an outdoor setting during middle school science classes may increase a student’s interest in spending more time outside in the future. A majority of participants during the focus group said that they would like to spend more time outside as a result of participating in these outdoor lessons. However, almost all of students said that they would be more motivated for science class if learning in an outdoor setting was a regular part of the course. Most of the participating students reported that it would be easier to remain focused on school work when learning in an outdoor setting if a student was used to being outdoors. The newness of being outdoors, and in nature, might have created inconsistencies in the data collected.

Conclusions

This research study did yield some interesting conclusions. The conclusions based on this research demonstrate that environmental conditions can be a major distraction for many students when learning in an outdoor setting, and that learning in an outdoor setting did not impact or change how students related to each other. However, this study did show that that students felt motivated by a sense of freedom and novelty when learning in an outdoor setting, and that this
experience enhanced their abilities and attitudes toward solving their own problems. Finally, learning in an outdoor setting during middle school science class does increase student interest in having more outdoor experiences.
Chapter 5: Discussion of Research Findings and Implications for Educational Practice

In recent years, the time children spend outside is in decline (Clements, 2004; Karsten, 2005). This decrease in time spent outside has many potential negative impacts on child development and has been termed Nature Deficit Disorder (Louv, 2005). A number of studies have attempted to identify a connection between learning science and the potential benefits of doing so outdoors (Pasquier & Narguizian, 2006; Tatarchuk & Eick, 2011; Waite, 2010; Maynard & Waters, 2007; Waters & Maynard, 2010). My research study contributes to the body of literature on how middle school science teachers can combat this decline in exposure to the outdoors, and how learning outdoors can enhance student engagement for learning science.

Purpose of Research

Given the decline in time children spend outside over the past several decades (Larson, Green, & Cordell, 2011) and the potential negative impacts this could have on learning (Louv, 2011), classroom instruction in an outdoor setting is an especially important topic for science teachers to examine today. The goals for my research study were to obtain a better understanding of how the outdoor setting could be utilized for regular, daily, middle school science instruction, to identify how learning middle school science in an outdoor setting impacts student engagement as identified by participating students, and to inspire other science teachers to utilize the outdoor setting for science instruction in order to combat Nature Deficit Disorder (Louv, 2005).
Meaning of Findings in Relation to the Research Questions

The setting for this study was the urban middle school where I teach. This research study utilized a case study methodology, and developed a case for one of my sixth-grade science classes during experiences learning in an outdoor setting. It is important to note, that the findings might not be generalizable to the larger context of all middle school science classes, but the study findings do provide a students’ perspective on what motivates and interests middle school students, and offers a student voice as a tool for influencing improvements in science and outdoor education.

How does learning middle school science in an outdoor setting impact student engagement?

Based on this study, it is possible to conclude that learning in an outdoor setting does impact student engagement for learning middle school science. Some students are more engaged than others when learning outdoors. One potential explanation for this is the continuum of engagement as described by SDT (Ryan & Deci, 2000).

Another explanation is that students’ perspectives could have been impacted by their previous experiences outdoors. For students more accustomed to spending time outdoors, the environmental conditions may have been less distracting. For example, if an insect landed near such a student or the sun was bright it might not prevent them from learning. For students who have little exposure to nature, and have spent little time outdoors, insects and weather conditions were extremely distracting and made it difficult to navigate a new and uncomfortable environment, while simultaneously balancing the rigors of academic work.
Based on the findings in this study, the novelty of going outside in classes other than physical education, and the feeling of autonomy created by the outdoor learning setting are engaging for middle school students. My students consistently shared that the newness, variation, and fun increased their level of engagement, and interest for learning science.

**How do students identify their level of engagement for learning science during outdoor lessons, and its impact on feelings of competence, autonomy, and relatedness?**

Self-Determination Theory (SDT) identifies three factors that impact student engagement. These include competence, relatedness, and autonomy. When a student feels that all of these three areas are activated, the highest levels of engagement for learning are possible (Ryan & Deci, 2000).

Based on the findings of this research study, there was little evidence that just being outdoors enhanced the feeling of competence: the ability for students to master the learning objectives. Student questionnaire responses did provide some evidence that competence had been positively impacted. But there were inconsistencies in the data such as the fact that students were able to identify the learning goals and objectives during questionnaires, but the analyzed student work samples did not confirm mastery of lesson objectives across all three outdoor intervention lessons.

Additional research might help to confirm that the feeling of acceptance among members of the class, or relatedness; is impacted positively by learning in an outdoor setting. There was some evidence to suggest that student interactions changed when learning outdoors compared to
how students related to each other when learning indoors based on survey responses and my observation of my students during outdoor lessons.

O’Brien (2008) has observed that outdoor play in nature forces students to negotiate with each other and work collaboratively. There was not enough evidence to conclude that outdoor learning improved a feeling of relatedness amongst students in this study. It is possible that the shared experience of learning in an outdoor setting during middle school science class might enhance the connection students have with each other and their teacher based on a common experience. It might also be interesting to examine whether a certain duration of time is required in the outdoor learning environment to impact relatedness among classmates and/or to discover if the duration of the use of the outdoor learning environment over an entire school year impacts student engagement.

The area of Self-Determination Theory most positively enhanced by learning middle school science in an outdoor setting was autonomy: the feeling of independence a student experiences. After learning in an outdoor setting, students felt increased levels of independence and freedom, which did increase their engagement for learning science. In addition, this increase in the feeling of autonomy reduced student stress levels, and made students feel they did not have to rush through an assignment based on focus group comments and questionnaire responses.

Learning in an outdoor setting provided my students more space to work, novelty, and made it easier for kinesthetic movement during regular classroom time. These factors also may have impacted my students’ motivation for learning and demand further study in order to pinpoint how they could be used by science teachers, and what types of learning activities are best suited for the outdoor learning environment.
Significance of Findings for Education Practice

The findings of this research study are significant for educational practice in a few ways. First, some of the findings demonstrated that science teachers like myself could use the outdoor setting for classroom instruction without extra planning. Second, increasing a student’s feeling of autonomy by utilizing an outdoor instructional environment enhances student motivation and interest in having more experiences outdoors.

Reduced Obstacles to Outdoor Learning

One goal of my research was to encourage other science teachers to use the outdoors for a classroom instructional setting. To do so science teachers must overcome the commonly identified obstacles of weather, safety, (Maynard & Waters, 2007), lack of time, and confidence (Carrier, 2009), which have been identified as obstacles to the use of the outdoors as an instructional environment. The content for the outdoor intervention lessons that I delivered to my students consisted of the regular unit of study for my sixth-grade science class. I did not create any special curriculum changes, and no special, out of the ordinary; projects were part of the intervention lessons. I would have used the same lessons and materials indoors, and did so with other classes.

Increased Autonomy

One of the most consistent findings from my study is how my students perceived the feeling of autonomy during outdoor lessons. The focus group and questionnaire responses revealed a high level of freedom perceived by participating students and this autonomy and independence was motivating. The fact that increased autonomy has been found to increase
student engagement for learning in adolescents has also been documented by other researchers (Hafen et. al, 2011; Skinner, 2008). Changing the setting of the instructional environment, motivated students to be less likely to give up when a problem was challenging, and more likely to enjoy science class. The outdoor setting also reduced my proximity to students which could have also increased their independence and reliance on each other. In addition, students who reported that the outdoor environment was distracting due to environmental conditions also shared that the freedom and independence was extremely motivating for learning science.

My study findings, as well as the work of other scholars (Hafen et. al, 2011; Skinner, 2008) support the notion that a feeling of increased autonomy due to learning outdoors increases student engagement. Since teachers are often looking for methods of increasing student engagement for learning science, it is likely that all middle school science teachers could benefit from taking students outside and/or holding class outside for regular science instruction. The duration of the outdoor experiences should not matter. The change in learning environment, as well as the feeling of freedom encouraged by the outdoor setting is likely to increase the feeling of autonomy for students in any class, thus increasing student engagement for learning at the same time.

**Increased Interest in Spending Time Outdoors**

My students were interested in spending more time outdoors during science class, and spending more time outdoors outside of school after participating in the outdoor lessons. It is possible that science teachers who use the outdoor setting regularly will increase a student’s engagement during class as well as increase student interest in spending more time outdoors overall.
Limitations

The limitations of this study must be noted. The limitations of my study include a lack of generalizability due to the fact that participants were from only one middle school science class in a specific location in the United States and took place in a specific time of year: the end of spring. In addition, as the researcher, I was the regular teacher of the participants in this research study, the scope of this study occurred over a relatively short time period, and the degree to which student participants have spent time outdoors previously also varied prior to the study.

One Class’ Experience Only

Participants were members of one of my sixth-grade science classes, and participated in intervention lessons as part of the regular science curriculum and lesson instruction during the regular school day. Since this study examined only one sixth-grade class of students, its population size was small. It is not possible to generalize these results to the greater context of all middle school science students, or even all sixth-grade science students.

Teacher as Researcher

I was the researcher and the participating class consisted of my students. Participant responses could have been affected by this power dynamic. Due to the potential power dynamic involved with a research study design where the researcher is close to the population being studied, it was important to create a relationship where subjects felt open, able to be honest without consequence, and free of consequences such as being given poor grades as a result of their feedback. In spite of my efforts in this regard, such concerns on the part of my students could have impacted their willingness to share authentic responses.
**Intervention Lessons Occurred Over a Short Period of Time**

This study occurred over a relatively short period of time, but it did span half of the full astronomy unit. A longer study, over the scope of the full school year, would provide more information. The study also occurred at the end of the school year. However, multiple sources of data were collected and triangulated to ensure that the findings were accurate. In addition, as the students’ teacher, I was able to observe them throughout the school year, and compare their engagement during the outdoor lessons to my prior experiences earlier in the year.

**Varying Levels of Experience Outdoors**

Due to the fact that less than half of my students reported that they spent an hour outdoors or more each day, while a majority reported that they spent little time outdoors, it is possible that the level of experience with nature and how comfortable an individual is spending time outside could have impacted the findings of this study. Students who were used to spending more time outdoors could have been more comfortable compared to students who have little to no experiences outdoors. This difference could affect their responses in the data collection phases of this study. However, a pilot intervention lesson before the research began (Creswell, 2009) helped students feel comfortable being honest regarding their experiences during the outdoor intervention lessons, established trust between me and my students, and allowed students to gain a level of comfort with the outdoor setting.

**Location, Geography, and Seasons**

It must also be noted that the findings of this study are related to a specific location/geography, and season. Science teachers who are interested in utilizing the outdoor
setting for an instructional environment must consider their specific geography and season in which the outdoor lessons can take place as long as state or school district regulations governing the use of the outdoors are followed. Many of the student responses on questionnaires and to focus group questions were a product of the climate and time of year that the outdoor lessons occurred. In a different season or time of year, responses may have been different.

**Summary**

Louv (2005) coined the term Nature Deficit Disorder to describe the negative impact on health and well being stemming from the gap between humans and nature. In addition, the Biophilia Hypothesis states that human beings have an innate need to spend time in nature (Kahn, 1997). Based on the problem of the decline in time children are spending outdoors, and the need for humans to spend time outside, science teachers might be able to use the outdoor setting as an instructional setting and increase student engagement for learning science. This research study has documented how students perceive the impact of learning in an outdoor setting on their engagement for learning science.

Waite (2010) concluded that the time for outdoor learning experiences is being diverted by other academic pressures; especially for children age seven or older. In addition, Skinner and Chi (2012) found that student engagement was high when working in an outdoor setting. My study builds on studies such as the ones previously identified, by asking middle school age students actually participating in the lessons how they felt when learning outdoors, and how they perceived their learning being affected by the outdoor setting. Students were asked to reflect on their own levels of engagement for learning science while learning in an outdoor setting.
The concept of student engagement was modeled after Self-Determination Theory (SDT). Ryan and Deci (2000) define Self-Determination Theory as a continuum of student engagement, from passive to engaged. The theory also states that social settings and context impact human self-motivation. Self-Determination Theory includes three essential components of self-motivation: competence, autonomy, and relatedness. When all three areas are satisfied; student engagement is at the highest levels (Ryan & Deci, 2000).

Data from multiple sources were used and included questionnaire responses, a focus group, student work samples, and personal observations. This set of data collected from many different sources provided a holistic view of how students perceived their learning and engagement for learning science when class was held outdoors. A single case was created for the participating middle school science class, and was guided by the research sub-questions related to: competence, autonomy, and relatedness. The questionnaires and focus group protocol consisted of open-ended student engagement-related questions created to reflect the core elements of Self-Determination Theory.

**Interpretation of Research Findings**

Each research finding is listed below and an interpretation of each finding is provided:

1. Learning in an outdoor setting did not impact student feelings of relatedness toward peers. Students did not interact with each other differently when outdoors compared to indoors. SDT defines relatedness as “a sense of belonging or connectedness” (p. 64, Ryan & Deci, 2000) to others. There was not enough consistency between the triangulated data, to confirm an impact on the feelings associated with relatedness among students when learning outdoors. Some
students felt learning in an outdoor setting did improve how they related to peers, while others did not identify that learning outdoors impacted how they interacted with each other.

Some literature identifies positive bonding, relationship building, and gaining a greater interest in others due to shared nature experiences as benefits of learning in an outdoor setting (Heilbronner, 2008; Endreny, 2007), but my research study did not confirm these conclusions. For the assignment that required the greatest level of peer interaction, the fewest number of students met expectations. In addition, a majority of students agreed that learning in an outdoor setting did not impact their interactions with peers, while less than half thought it might have and disagreed with this finding. For some of my students, interactions with peers were enhanced, but this was not the experience of the majority of the class and did not affect the feeling of engagement according to participating students.

2. Environmental conditions, such as weather and insects, can be a major distraction for many students when learning in an outdoor setting. Participating students shared that they were “distracted by the beautiful view” and that the “cold and wind made it difficult to hear and talk to group members.” Maynard and Waters (2007) also documented this when they investigated the obstacles teachers identified for not using the outdoor setting during the school day. Obstacles identified by teachers were commonly weather and safety related, depending on the location of the school (Maynard & Waters, 2007). After the member checking activity, participant opinions strongly supported this finding that the outdoor setting was a source of distraction.

The outdoor intervention lesson content for this study followed the regular school system curriculum, and no special projects or planning were implemented in delivery of the lessons. Other classes participated in these lessons indoors. This might enable teachers to reduce some of
the obstacles of weather conditions impacting instruction as the lessons can occur indoors if the conditions are not favorable for outdoor learning. Tal and Morag (2009) concluded that teachers needed more training in using the outdoors as a classroom environment, and this could include methods of planning activities that could be conducted in either outdoor or indoor settings, and the types of lessons that are best suited for outdoor learning. Further work is needed to examine the best practice methods of training science teachers to utilize the outdoor setting in an effective manner that offers the highest levels of student engagement.

3. Students did feel motivated by a sense of freedom and autonomy when learning in an outdoor setting. A majority of students agreed that the feeling of autonomy motivated them during the outdoor lessons. In addition, a majority of my students confirmed this finding by agreeing with the theme that autonomy promoted student engagement during member checking. Students also described the sense of freedom and autonomy as being able to “work at their own pace” because they were outdoors, and that they felt “trusted with their own learning.”

Autonomy can be defined as motivation for working, which is self-endorsed (Niemiec & Ryan, 2009). Other scholars have also found that increased autonomy, increased student engagement (Hafen et al, 2011). This includes the sense of freedom a student feels within the classroom or assignment, or the degree to which choice is provided to students during learning activities. Based on SDT, when students do not feel a sense of autonomy, learning might be more passive versus active, reducing the total level of student engagement. My students were more engaged due to the autonomy felt when learning in an outdoor setting.
4. The novelty of learning in an outdoor setting increased student engagement for science class. Students shared that the “approach to learning was different because I did not have a computer,” and that this was the only time they had been outdoors during a class besides physical education. A majority of students agreed with this finding during the member checking activity. In addition, literature on the topic of learning outdoors and its impact on students confirms this finding as well (Waite, 2010). “The unpredictability of the natural world is a feature that can be harnessed to rekindle excitement and curiosity in children and provide a motivating experiential starting point for further curricular development” (Waite, 2010, p. 120).

5. Learning in an outdoor setting enhanced student abilities and attitudes for solving their own problems when academic work was challenging. My students were less likely to give up when working outdoors compared to working in an indoor setting. Students reported that they “re-read directions” and that “you had to rely on yourself more when outdoors.” This finding relates to the competence aspect of SDT and can be defined as the feeling of being able to meet the challenges of schoolwork or a specific task (Niemiec & Ryan, 2009). The students in my sixth-grade science class must be able to feel confident that they can complete an assignment in order to be fully engaged in the assignment or activity. Member checking also confirmed that this finding was an accurate representation of the class’ experiences while learning in an outdoor setting.

In addition, I observed one of my students who normally struggled to remain focused in the classroom perform better and work with an enhanced level of attention when learning in an outdoor setting. Researchers have found that children with Attention Deficit Disorder (ADD) improve attention abilities when doing activities in outdoor spaces (Faber-Taylor, et. al., 2001).
In addition, children who play in outdoor spaces have a lower severity of ADD symptoms as compared to children who play in indoor spaces (Faber-Taylor, et. al., 2001). My students also shared that the “fresh air kept my brain awake” and that the “fresh air makes me understand better.”

6. Learning in an outdoor setting during middle school science class may increase student interest in having more outdoor experiences. Students shared that “the great thing about learning outside is that you are around nature.” During member checking, a majority of students agreed that the experience of learning outdoors in science class increased their interest in having more outdoor experiences. If we know that decreased time spent outside by children today is having a negative impact on their development (Louv, 2005), and that “there is a fundamental, genetically based, human need to be outdoors (Kahn, 1997, p.1), science teachers can be part of the solution by using the outdoor setting to inspire students to be more interested in nature.

**Scholarly Significance**

After the conclusion of this research study and the identification of the themes that emerged, it is possible to better understand how students perceived the affects of learning in an outdoor setting on their engagement for learning middle school science. From the data gathered and its analysis, engagement for learning was enhanced due to an increase in a feeling of autonomy and the level of novelty involved in doing something that students “had only done in physical education classes,” but not in science classes on a regular basis.

Another discovery of this study is that students feel they learn more, and can approach a challenging question or problem with greater effort when learning in an outdoor setting. Students shared that “the work felt easier outside” and many students reported that they did not give up as
easily when a question was challenging during the outdoor lessons. The feeling of autonomy, novelty, and the larger space available for students to work in could have impacted this. Reducing the proximity of the teacher and the ease of asking for immediate help may push students to work through their own confusion. This availability of space is easily promoted by learning outdoors.

This study also demonstrated that outdoor experiences yield interest in having more outdoor experiences. Students often said that they would like to spend more time in science class learning outdoors, would find regular outdoor learning in science class motivating, and shared that after participating in outdoor lessons in school, they were more interested in spending time outdoors during the school day and after school or on weekends. Science teachers may play an important role in exposing a student to the outdoors and nature, providing them with a foundation for future interest in spending time outside.

Due to the design of this study, and that the researcher was also the students’ teacher, member checking was implemented in order to ensure that participants agreed with the findings after the initial data analysis. An anonymous member checking survey was created to reduce the power dynamic during the member checking discussion. Students could opt to take a short member checking survey, and select the level of agreement they felt for each theme that emerged. This tool helped to reduce a student’s feeling he/she needed to agree with their teacher’s research findings, giving the students an opportunity to share their feelings free of any identification or consequence.

As a result of this study, it is also evident that a science teacher can effectively use the outdoor setting as an extension of the classroom, and overcome many of the obstacles that have been identified regarding outdoor learning. There is not a requirement of an elaborate project or
extra preparation needed by the teacher. Using the same instructional methods indoors or outdoors eliminates the potential for a loss of teaching time due to environmental conditions such as weather. When teachers start with a big outdoor project that is derailed by weather factors they might be less likely to go through the time it took to plan a special lesson on a repeated basis. But this study demonstrates that doing the same assignments outdoors as those completed in the classroom allows for a greater likelihood that a science teacher could use the outdoor setting on a regular basis. It is clear this simple practice might have many positive impacts on a student’s interest in science class, engagement for learning science, and their interest in spending time outdoors and in nature.

**Need for Future Research**

As a result of this study, the needs of future research have been identified. These include a more in-depth study on how SDT’s component of relatedness is affected by learning in an outdoor setting; an examination of what types of assignments are best suited for the outdoor setting in order to yield the highest levels of competence; and a study of formal outdoor classrooms on school campuses and how these might reduce or eliminate the obstacles to outdoor learning, leading to an increase in student engagement for learning science.

**Relatedness**

More work is needed to examine how learning in an outdoor setting might impact the component of relatedness; part of Self-Determination Theory. There was not enough evidence that demonstrated the impact learning in an outdoor setting has on how connected my students felt toward classmates due to learning outdoors. The relationships middle school students create
with each other during outdoor learning activities, and how learning in an outdoor setting might impact peer-to-peer interactions on a daily basis during science classes, are important topics for further study.

**Assignments Best Suited for Outdoor Learning**

While this study did examine student work generated during outdoor lessons, all of the assignments were extremely different in nature, delivery, process, and levels of affiliation. It would be interesting to examine what types of assignments, and what degree of affiliation between students produces the greatest levels of student engagement and mastery of the science content when learning outdoors. Work in this area could be used to better inform science teachers about how to utilize the outdoor setting in science class to improve learning experiences for students. It could also encourage more science teachers to utilize the outdoor setting for daily science instruction if a study could link increased student achievement with learning science in an outdoor setting.

**Outdoor Classrooms**

Lastly, future research is also needed into how having a formal outdoor learning space, such as an outdoor classroom might impact student engagement for learning science. As a science teacher, I am constantly searching for engaging methods of presenting materials, and setting up practical learning experiences for students. Future work in this area might reduce the obstacles to taking students outdoors, and help to discover how these spaces might impact student engagement and achievement in science. It would be interesting to examine how an
outdoor classroom on a school campus might impact the time teachers spend outdoors with students, and how these spaces generate interest in spending more time outside.

**Applications of Educational Practice**

The findings of this research study are significant for many reasons. This study highlights how I was able to increase student engagement for learning science for my own class, but supports the need for outdoor classrooms and formal outdoor learning areas on school campuses, and offers a common theme for enhanced, relevant professional development topics for middle school science teachers.

In many countries, using outdoor nature schools and natural areas for science teacher education has been identified as a priority (Jeronen, Jeronen, & Raustia, 2009). The small efforts a science teacher makes during the regular school day to expose students to the outdoors might also inspire a greater interest in nature and the outdoors beyond the classroom, thereby combating Nature Deficit Disorder (Louv, 2011). The more this becomes part of the school curriculum, the more students will reap the benefits of nature exposure for child development. This shift would be in line with current efforts in the United States and many countries worldwide to combat and bring attention to the decline in the time children spend outdoors and the potential negative developmental consequences of this decline.

**Student Engagement in the Science Classroom**

The findings from this research study offer potential improvements to science instruction. If science teachers use the outdoor setting as an instructional environment, student engagement and motivation for learning science can be enhanced. Due to the factors I have identified such as
novelty, increased autonomy, and increased space for kinesthetic movement, the outdoor setting improved my students’ engagement for learning science. If science teachers were provided the space and resources; including outdoor classrooms, for regular learning in an outdoor setting, the obstacles identified by teachers that prevent the use of the outdoors as an instructional environment could be reduced. The consistent use of a formal outdoor space offers teachers many benefits such as increasing novelty and autonomy within their classroom instruction, increasing student engagement for learning science, and promoting higher levels of interest and enthusiasm for learning science by middle school students.

**Professional Development for Science Teachers**

Learning in an outdoor setting may be an instructional tool that could be used by science teachers in all branches of scientific disciplines; providing a focus for professional development for science teachers. Weiser (2012) discussed the best practices in professional learning communities for science teachers, and found that this should include a focus on environmental education topics.

Environmental issues normally work well as catalysts to finding commonalities with the various participants in science teacher learning communities, and professional development activities (Weiser, 2012). In 2007, Watson and Doue published a study on pre-service teachers’ experiences teaching in an outdoor setting. Teachers’ initial attitudes toward instructional approaches are difficult to change, however, hands-on experiences in teaching in an outdoor setting and working directly with students did encourage interest in learning in an outdoor setting (Watson & Doue, 2007). Professional development for science teachers should focus on outdoor educational learning experiences.
Fostering Environmental Stewardship

Studies have concluded that positive experiences outdoors in nature as a child, foster an interest in environmental stewardship later in adulthood (Chawla & Cushing, 2007). Learning in an outdoor setting might help to increase the time children and young adults spend outdoors; fostering environmental stewardship. These experiences in school could also promote a greater interest in spending time in nature outside of school. My students said they were more interested in spending time outdoors after participating in this research study. As the time spent outdoors increases, the likelihood that a young adult might have a positive experience in nature increases. There is a concern that if children do not have these positive memories and experiences outdoors, they will not care about topics of environmental concern such as air and water pollution, or saving endangered species as an adult (Chawla & Cushing, 2007). Without these nature experiences our society may experience a decline in citizens concerned with environmental stewardship.

Future of Science Education

It is crucially important that science teachers promote high levels of student engagement within their content. Learning in an outdoor setting during science class offers a teacher methods of increasing engagement, while also increasing a child’s interest in nature and spending time outdoors. This could have profound implications for science education and foster interest in environmental stewardship. The potential positive benefits of learning in an outdoor setting on science instruction and the development of environmentalism in children and young adults must become an important topic of discussion among middle school science educators.
Implications for my Teaching Practice

The experience of serving as both researcher and teacher of the participating class of students for this research study has had many implications for my own teaching practice. I continue to view my role as teacher as that of a partner in learning middle school science content with my students. This study enabled me to reach my personal goal which was to allow my students to be co-participants in my research, and to make my professional development a learning experience for myself as well as my students. In many ways my students were my partners in collecting and analyzing this research, exploring this topic, and trying something novel to see if it could increase engagement for learning science.

As a person who is passionate about the environment, I try to instill an interest in environmental stewardship in the students I teach. This passion fueled my interest in this work, and motivated me to take students outside during regular classroom instruction. However, I also have to remember that not all students feel the same way about the outdoors and feel comfortable while learning in an outdoor setting. This study allowed me to expose my students to learning in an outdoor setting and I have personally observed the power of this simple act of taking the middle school classroom outdoors. The novelty of the experience for students was engaging and exciting. It accomplished my personal goal of increasing student interest in spending time outdoors, and to provided my students with positive experiences in nature that hopefully lead to a sense of stewardship for the environment and nature. I plan to continue to do this as a science teacher.

The use of the outdoor setting required my students to exercise more autonomy in the larger space for instruction. I observed that this increased sense of autonomy inspired a higher level of persistence among my students when a question or part of an assignment was
challenging. I am always looking for new ways to foster a learning environment where I facilitate content understanding as a partner in learning and build learning independence in my students. Allowing my students more space to work increased their level of independence. What I have gleaned from this research is that simply by taking the classroom outdoors, without any other tweaks to the curriculum, children feel more autonomy and can further develop the confidence to struggle through the learning process even when it is difficult.

Finally, this work allowed me to give a space for my students’ voices through their participation in my study. I work to promote a classroom environment and culture where students feel comfortable to share ideas with me as their teacher, and suggestions to improve my practice as an educator and scholar. The member checking activity was particularly empowering for my students as they were able to clearly see their role as co-participants in my study. I actually asked my students to comment on my conclusions, and to judge the validity of my findings for this research study. As a teacher, I will continue to recognize the value of student input and seek formal and informal opportunities to find out how they feel our learning is progressing and what new things we might try to make the learning process better.

My teaching practice will forever be influenced by my experience conducting this research study with my students. What I have discovered has impacted the things I do in my class today. I now look for opportunities within my lessons to increase autonomy and add novelty. I think about how and when I might alter the learning environment particularly so students have the opportunity to learn in bigger physical spaces. And I make sure that I provide multiple opportunities for students to offer me feedback. All of these changes to my practice increase engagement for learning science, and create a positive classroom culture for learning. The outdoor setting served as the location for the discoveries that my students and I made as a
result of this study, and I now utilize the outdoor setting as an instructional environment on a regular basis.
Appendix A: Protecting Human Subjects Training Certificate

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that James Abbatiello successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 10/20/2012
Certification Number: 1033027
Appendix B: Informed Consent Form for Focus Group Participation

Northeastern University
College of Professional Studies, School of Education
Principal Investigator: Kelly Conn  Student Investigator: James Abbatiello
Title of Project: Perceived Impact on Student Engagement When Learning Middle School Science in an Outdoor Setting

Informed Consent to Participate in a Research Study Focus Group

I am inviting your child to take part in a research study focus group. This form will tell you about the study, but I will explain it to you first. Billye N. Rhodes, Ph.D., is supervising this research study and is the advisor for Mr. Abbatiello. You may ask the researcher, Mr. Abbatiello, or Dr. Billye Rhodes, advisor for this project, any questions that you may have.

When you are ready to make a decision, you may tell the researcher if you would like your child to participate in the focus group session by signing the informed consent document. Your child does not have to participate if you do not want them to do so. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?
The purpose of this research is to identify how student engagement for learning science is affected by learning outdoors. Mr. Abbatiello is conducting this study in order to complete a Doctor of Education degree and to learn methods of improving science instruction for your child, and future students.

What will your child be asked to do?
If you decide to take part in the focus group portion of the study, your child will be asked to:
Participate in one focus group session during the regular class schedule.

Since this focus group research will occur during our regular class time, students may participate in outdoor lessons and study questionnaires, but are not required to participate in the focus group. Nonparticipating students will be given a non-homework assignment related to class content when the focus group takes place.

Where will this take place and how much of my time will it take?
All of the activities related to the research study focus group will occur on our school campus during the regular school day. Participating students will share their experiences during one focus group session after the completion of the last outdoor lesson. The focus group will last for no more than one class period. This will occur during the regular school day. Student names will not be included on focus group transcripts.

Will there be any risk or discomfort to me/my child?
There are no repercussions for your child if they do not participate in the research study. There is no foreseeable risk or discomfort associated with participation in this research study. Student
grades will not be impacted in any way if they do or do not participate in the focus group session.

**Will I, your child benefit by being in this research?**
Participation in this research study focus group session will be an educational experience for your child. Participating students will learn about data collection methods and research procedures. In addition, the goal of this research is to improve science education by identifying methods that increase student engagement for learning middle school science.

**Who will see the information about me?**
No participant will be identified by name. While the researcher conducting the focus group will know the participant’s identity, the audio recording and transcripts will not record the participant’s name. No reports or publications will use information that can identify your child in any way.
After credit is awarded and degree conferred, the researcher will destroy all transcripts, and the focus group audiotape, made as part of this research study. Mr. Abbatiello, as your child’s teacher in the state of Virginia, is a mandated reporter for child abuse. The research study has been approved by the IRB at Northeastern University, the school principal, and the school system. In addition, Mr. Abbatiello’s research is also being supervised by Dr. Billye Rhodes, Northeastern University professor.

**If I do not want to take part in the study, what choices do I have?**
Your child does not have to take part in this focus group if you or they do not wish to do so. Student participants may also stop their participation at any time or decide not to answer a question they do not wish to answer.

**Can I stop my participation in this study?**
Your child’s participation in the focus group is completely voluntary. You/your child do not have to participate if you do not want to. Even if your child begins the focus group, he or she may quit at any time. If your child does not participate or if decides to quit, he or she will not lose any rights. Your child’s grade for class will not be affected in any way and there will be absolutely no repercussions for not participating. Non-participating students will be provided an alternative class-related activity.

**Who can I contact if I have questions or problems?**
Please contact James Abbatiello at abbbatiello.j@husky.neu.edu if you have any questions about this research study. You may also contact Billye Rhodes, Ph.D at b.rhodes@neu.edu or 617-390-1852 or at College of Professional Studies, Northeastern University, 360 Huntington, Mailstop 20 BV, Boston, MA 02115. She is Mr. Abbatillo’s advisor for this research study.

**Who can I contact about my rights as a participant?**
If you have any questions about your and your child’s rights in this research you may contact Nan C. Kogina, Director, Human Subject Research Protection, 950 Renaissance Park, Northeastern University, Boston, MA 02115. Tel. 617.373.4588. Email: irb@neu.edu. You may call anonymously if you wish.

**Will I/my child be paid for my participation?**
Students who participate in the focus group session will be given a gift card for the price of one movie ticket.
Will it cost me anything to participate?
There is no cost to participants or their families.

Is there anything else I need to know?
1. The date of the focus group is dependent on weather conditions, completion of the three outdoor lessons, and school schedule.
2. There is no consequence for withdrawing from participation in the focus group session.
3. The approximate number of subjects involved in the study is twenty students. Students will not be identified by name in any way during this research study or in the collection of data for this study.

I agree to [have my child] take part in this focus group session.

______________________________  ______________________
Signature of person [parent] agreeing to take part  Date:

______________________________
Printed name of person above

______________________________  ______________________
Signature of person who explained the study to the participant above and obtained consent  Date:

______________________________
Printed name of person above

APPROVED
NJ IRB 13-04-07
VALID: 5-3-13
THROUGH: 5-3-14
Appendix C: Informed Consent Form for Study Questionnaires

Passive Consent/Active Opt-Out Consent Form for Parents/Guardians
Request to Participate in Research Questionnaires

Dear Parent/Guardian,

My name is James Abbatiello and I am your child’s science teacher. I am also an Ed.D student working under the supervision of Dr. Billy Rhodes at Northeastern University’s College of Professional Studies in the Curriculum Leadership Department. As part of my doctoral dissertation, I am conducting a research study that investigates the Perceived Impact on Student Engagement When Learning Middle School Science in an Outdoor Setting. I have undertaken this research to understand and find better ways to improve middle school science instruction for children.

I am contacting you because I would like to invite your child to participate in this research study. Participation in this research consists of your child responding to a questionnaire after participating in science lessons that take place outdoors. The questionnaire will be administered after each outdoor lesson during regular class time using the school’s computers and should take your child approximately fifteen minutes or less to complete. There will be no more than three, thirty-minute outdoor lessons. Students will not identify themselves on the questionnaires. Neither the researcher nor the teacher will be able to match the student to an individual questionnaire once completed.

The decision to participate in this research project is up to you. Your child does not have to participate and can refuse to answer any question. Even if your child begins the study, he or she may withdraw at any time. Your decision to participate or not to participate will have no effect on your child’s class standing. Students who opt out of participation will complete other class related assignments while the questionnaires are administered. Students who participate in the questionnaires will be given one gift card for a movie ticket.

If you have any questions or concerns about your child participating in this research you may contact me at: abbatelloj@husky.neu.edu or 703-461-4190. You can also contact Billy Rhodes, Ph.D at b.rhodes@neu.edu or 617-390-3852 or at College of Professional Studies, Northeastern University, 360 Huntington, Mailstop 20 BV, Boston, MA 02115. Dr. Rhodes is the Principal Investigator overseeing my research.

If you have any questions about your and your child’s rights in this research you may contact Nan C. Regis, Director, Human Subject Research Protection, 360 Renaissance Park, Northeastern University, Boston, MA 02115. Tel. 617.373.4584, Email: info@hus.edu. You may call anonymously if you wish.

If you agree to allow your child to participate do nothing. However, if you would prefer that your child NOT participate please sign and return the bottom part of this form to James Abbatiello, no later than this date: ________________.

Sincerely,

James Abbatiello
Doctoral Student Northeastern University

Thank you for offering, however I do NOT wish to have my child participate in this study.

Print name of student: ___________________________  Teacher’s name: ___________________________

Signature of parent/guardian: ___________________________  Date: ___________________________

Printed name of parent/guardian: ___________________________

Return to Mr. Abbatiello no later than ________________.

APPROVED
NU IRB # PS 01-04-07
VALID 3-1-12
THROUGH 3-1-14
Appendix D: Northeastern University IRB Approval

Northeastern

NOTIFICATION OF IRB ACTION

Date: May 2, 2013
IRB #: CPS13-04-07

Principal Investigator(s): Billye Rhodes
James Abbatangelo

Department: Doctor of Education Program
College of Professional Studies

Address: 20 Belvidere
Northeastern University

Title of Project: Perceived Impact on Student Engagement When Learning
Middle School Science in an Outdoor Setting

Participating Sites: School District Superintendent’s Permission Letter on file
Alexandria City Public Schools

DHHS Review Category: Expedited #6, #7

Informed Consents: Two (2) signed parent/guardian consent and child assent form
Passive for Survey, Active for Focus Group

Monitoring Interval: 12 months

APPROVAL EXPIRATION DATE: MAY 1, 2014

Investigator’s Responsibilities:
1. The informed consent form bearing the IRB approval stamp must be used when
recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new
information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must
be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month
prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any
other university approvals that may be necessary.

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #4630
Appendix E: Study Definitions

**Competence:** Competence is the ability for the student to master the learning objectives.

**Autonomy:** Autonomy is the feeling of independence that students have to approach their work and learning.

**Relatedness:** Relatedness deals with the feeling of acceptance among members of the learning environment.

**Outdoor Setting:** The outdoor setting will be taking the students outside on the school campus in the school courtyard or fields.
Appendix F: Questionnaire

Directions: This questionnaire is anonymous; you do not have to put your name on it. You will complete a questionnaire after each outdoor lesson.

1. Describe what you did outside and what you learned during the outdoor lesson today.

2. Did going outside affect your ability to complete the assignment? Explain.

3. Do you think you learned what you were supposed to learn? How do you know?

4. How did learning outdoors make you feel?

5. Were you able to complete the task without your teacher directing your learning? Did you feel like you had some freedom when completing your work today?

6. When you came to a part of the activity that was difficult or that you did not understand, how did you approach the challenge? How might your approach have been affected by learning outside?

7. Did being outside affect how you interacted with your group or the rest of the class? If so, how?

8. Would you like to spend more time outside? Why or why not? At school? After school? Weekends?
9. Optional: Please share any additional comments you may have.
Appendix G: Focus Group Protocol

Thank you for participating in the outdoor lessons related to this research study and this focus group. This session will be audio-recorded so that a transcript of your answers can be created and analyzed.

1. How did you like having science class outside?

2. What did you learn about during the outdoor lessons?

3. What did you like about having class outside?

4. What did you not like about having class outside?

5. How did learning in an outdoor setting affect the way you approached learning and the lesson activities (competence)?

Follow up questions:
What obstacles did you face?
What prevented your learning?
What enhanced your learning?
Did the outdoor setting make the lesson activities feel easier or more difficult in any way?
6. How did learning in an outdoor setting affect your confidence to approach the activity (competence)?

Follow up questions:
Describe the way you felt when learning outside.
Was it easy to stay focused and complete your learning tasks?
How was your focus on your work and learning different compared to learning inside?

7. Why was the activity you were completing important (relatedness)?

Follow up questions:
What was the purpose of what you were learning about?
Were the activities you completed outside meaningful? How?

8. Did learning outdoors change the importance of the activity for you (relatedness)?

Follow up questions:
Did you take the activity more seriously because you were outside?
What were the obstacles to completing the outdoor activities?

9. How did learning outdoors affect your ability to do the work without a lot of help from the teacher (autonomy)?
Follow up Questions:

Did you feel more confident? How?
Can you give a specific example?

10. How did learning outdoors affect the level of freedom you felt in choosing or working through the activities compared to indoor learning activities (autonomy)?

Follow up questions:

Did learning outdoors make you feel more or less free to approach the activities in different ways compared to fellow classmates?

Do you think there was one correct way to complete the activities?

11. Would you like your science teachers to use the outdoors in the future?

Follow up:

In what ways?

Can you think of any specific activities that would be improved if they were completed outside?

12. Do you have any comments, concerns, or suggestions for teachers who use the outdoors as a classroom learning environment?

Thank you for participating. Your work will help to improve Mr. Abbiello’s teaching as well as that of other middle school science teachers.
Appendix H: Student Work Assignments for Each Outdoor Lesson

Astronomy Walk and Talk (Revolution) Activity Directions
(Outdoor Lesson #1)

1. Work with a partner.
2. Read each of the eight sections together, at the reading spot, taking turns (odd/even).
3. After reading, walk and talk together and discuss the section and the question. Person 1 (odd) shares first until your team gets to the switch spot. Person 2 (even) share second until your team gets back to the reading spot.
4. Repeat for as many sections as possible.

Complete the sentences at the END of the lesson. Use the words in the word bank one time only.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>rotation</td>
</tr>
<tr>
<td>Waxing</td>
</tr>
<tr>
<td>Phases</td>
</tr>
</tbody>
</table>

1. A planet orbiting the sun is an example of ____________________________.
2. Spinning on an axis is an example of ________________________________.
3. The reason for seasons is the __________________________ on Earth’s axis.
4. In our winter, the Northern Hemisphere receives _____________ solar radiation.
5. The light from the moon comes from the _____________________________.
6. __________________ is a word that means the moon is growing larger.
7. Tides on Earth are caused by the __________________________ on Earth by the moon.
8. The moon has many __________ as it revolves around the Earth each month.
   Every 24 hours there are two high and low ______________________.
Astronomy Diagrams Activity (Outdoor Lesson #2)
Draw a diagram(s) for each activity to simulate rotation and revolution, seasons, phases of the moon, tides, and the size of creators hitting the moons surface due to gravity.

**Revolution and Rotation** (Red)
Use the globe and the model of the sun to simulate revolution (heliocentric model of the solar system) and rotation of earth on its axis. Finally, try to create a simulation where rotation and revolution (orbiting) are occurring at the same time.

<table>
<thead>
<tr>
<th>Revolution</th>
<th>Rotation</th>
<th>Revolution and Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Seasons (Green)**
Use the models of the Earth and Sun to create a diagram for each season in the Northern Hemisphere.

<table>
<thead>
<tr>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Phases of the Moon (Orange)**
Use the model of the Sun (the light) and the moon to create the phases of the moon. The moon revolved around the Earth, but does not spin on its axis. Shade in the amount of the moon that you would see in the sky.

<table>
<thead>
<tr>
<th>New Moon</th>
<th>Waxing Crescent</th>
<th>First Quarter (Half)</th>
<th>Waxing Gibbous (3/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full Moon</th>
<th>Waning Gibbous</th>
<th>Last Quarter</th>
<th>Waning Crescent</th>
</tr>
</thead>
</table>
**Crater Diameter due to Gravity (Blue)**
Gravity is the force of attraction between objects. Conduct three trials of craters on the moon’s surface and how height of the fall impacts the diameter of the crater. Drop the marble from the three different heights, measure the diameter of the crater formed, and draw a diagram of the crater.

<table>
<thead>
<tr>
<th>Height</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 cm</td>
<td></td>
</tr>
<tr>
<td>30 cm</td>
<td></td>
</tr>
<tr>
<td>45 cm</td>
<td></td>
</tr>
</tbody>
</table>

Explain the relationship between drop height and the size of the diameter of the crater. For example, as height increased…..

**Tides (Purple)**
Use the materials of the moon and earth models, as well as the ocean water to create a diagram of low and high tides.

<table>
<thead>
<tr>
<th>Tide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

**Tilt of the Earth and Solar Radiation (Yellow)**
Use the materials to create position A and position B. The solar cell in position A should be held at a 23 degree angle. In position B the solar cell should be flat (a zero degree angle). Draw diagrams of your set up and use arrows to simulate sunlight.

<table>
<thead>
<tr>
<th>Position</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
</tbody>
</table>

Which position received the most solar radiation and why? What is (would be if you had more time) your evidence?
Outdoor Lesson #3: Pluto Essay Prewriting Template

Essay Structure Ideas Map: Agree or disagree, Pluto should be considered a planet not a dwarf planet.

<table>
<thead>
<tr>
<th>Introduction:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2nd paragraph:</th>
<th>3rd paragraph:</th>
<th>4th paragraph:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Conclusion:</th>
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</thead>
</table>
References


doi:10.1080/13504620701581539


Retrieved from EBSCOhost.


doi:10.1016/j.jenvp.2009.05.002


Retrieved from EBSCOhost.


