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An outdoor professional development model in the era of the next generation science standards

Shana Lee

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An outdoor professional development model in the era of the next generation science standards

By

Shana Nicole Lee

A Dissertation
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in Secondary Science Education
in the Department of Curriculum, Instruction and Special Education

Mississippi State, Mississippi

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Shana Nicole Lee

2019
An outdoor professional development model in the era of the next generation science standards

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Experiential, outdoor education supports improvement in students’ problem-solving skills; collaboration and communication skills; and enjoyment in learning in the outdoors. Outdoor instruction is becoming increasingly underutilized. A residential environmental education center, located in Tennessee has conducted professional development programs in effort to increase teacher implementation of instruction in outdoor spaces. This institute revealed concern for low implementation rates to past professional development opportunities. Their newly designed, long-term professional development explored teacher’s perceived challenges and needs, then combined effective experiential pedagogy in outdoor spaces with pre-established communities of support from the participating schools in effort to contribute to experiential, outdoor instruction reform. This program entailed four workshop meetings over a seven-month time span, producing over 50 hours of face-to-face contact during the training. Program leaders designed the learning experience to include effective professional development strategies; reflective assignments; and activities that related to citizen science, experiential learning, and science and engineering practices found in the recently adopted Tennessee State Science Standards. This study identified concepts of the planned, delivered, and received curricula of the
workshop series to define the intentions, methodologies, and impact of the experience. The intentions of the program were aligned to the delivered curricula then the impact of the program was considered. Data collected during this qualitative study included over 15 hours of interviews; over 110 hours of observation field notes; and various artifacts including journals, handouts and applications. This long-term professional development provided a pre-established community of practice and advocated for experiential instruction in outdoor spaces; eliminating barriers; improving teacher confidence and implementation of knowledge gained; and reinforcing the professional development experience.
DEDICATION

This dissertation is dedicated to my husband William Lee, my parents Andrew and Vanetta McCormick, my brother Jeremy McCormick, his wife Kayla and daughter Jalynn. It is you, my inner circle, I lean on the most.

I also want to dedicate this work in memory of my grandparents Mr. and Mrs. Harold McCormick and Ann Wenger, I miss you.
ACKNOWLEDGEMENTS

First, I want to acknowledge that this dissertation was only possible through my Lord and Savior. It is He who placed me where I am today, and He will continue to guide me. Fortunately, He surrounded me with the best circle of family, friends, and professionals to make the journey easy and enjoyable.

My immediate and extended family has supported me for over eleven years in my collegiate experiences. They have showered me with overwhelming love, homemade chocolate cake, lasagna and other goodies that are usually edible. To all my aunts, uncles, cousins and in-laws; thank you for your love and support.

Throughout my collegiate journey, I have developed more lasting friendships than I can count. To the friends that I call family, thank you all for encouraging me.

I am also fortunate to have formed many professional connections throughout this educational experience. To all that I have worked with across Mississippi State University and have met throughout my research experiences, thank you for mentoring me and for providing the encouragement to take on tasks I would have otherwise dodged. More specifically I want to thank my mentor Dr. Ryan M. Walker and The Great Smoky Mountains Institute at Tremont for allowing me to participate in this experience.

May we all acknowledge that most of our experiences in life are spent in the valley, not on the mountain top; we should value the journey through the valley. Thank you, Lord, for placing such special people in my life!
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CHAPTER I
INTRODUCTION

Background of the Study

The Great Smoky Mountains Institute at Tremont (GSMIT), is a residential environmental education center located in Townsend, Tennessee. This institution is responsible for rigorous, place-based, outdoor, experiential education using engaging, informal lessons, and citizen science (CS) activities. The GSMIT is a leader in residential environmental education centers, it offers teacher professional development (PD) opportunities through teacher escape weekends (TEW) and various summer programs. It also offers three- and five-night stays for students and teachers to participate in experiential, environmental education (Walker, Clary, & Wissehr, 2017). The GSMIT faculty interact with visitors during their stay, continuously working to shape stewardship and life skills even during mealtime, unfavorable weather, and night fall (Walker et al., 2017). In addition to self-discovery, critical thinking, and effective experiential teaching strategies, faculty at the GSMIT encourage the public to interact with nature more often.

Recently, the GSMIT received a grant from the National Parks Foundation (NPF) to fund the Citizen Science 2.0 professional development project (Cit. Sci. 2.0). This project began by recruiting six schools that were located near the Great Smoky Mountains National Park (GSMNP). These schools were carefully selected with a focused objective to include feeder schools. When mentioned in this study, feeder schools will refer to elementary, middle, and
secondary schools that traditionally host the same students from Grades K-12. This scheme was determined by the GSMIT faculty to be the most beneficial in promoting whole school reform throughout the counties involved. The workshop series includes four residential workshops and follow-up support from faculty. The four workshops were scheduled for the 2017-2018 year in December, January, March, and June. The program goals were designed to connect more people with nature. This long-term professional development workshop was created to contribute focus on teaching science practices in various content frames through experiential, outdoor education.

**Experiential Learning in the Outdoors**

Experiential education is a product of Dewey’s (1916) initiative for active, hands-on learning. It has suffered since the standardized testing era began because of the narrowed curriculum that currently engulfs school priorities (Berliner, 2011). Providing experiences for students to learn helps develop ownership and deeper understandings that are retained for long periods of time (Kuhn, Arvidsson, Lesperance, & Corprew 2017; Stern, Powell, & Ardoin, 2008; Walker et al., 2017). Experiential, outdoor education emotionally engages learners in outdoor, inquiry activities. The effectiveness of this type of outdoor instruction may be growing due to the amount of outside time children are exposed to. Most children in the United States are exposed to an average of thirty minutes of outdoor time a week (James & Williams, 2017). James’ and Williams’ (2017) study researched the richness of the neglected outdoor education experience. They concluded, students presented a stronger sense of critical thinking and independence in an outdoor environment than they did in a traditional classroom environment. Students are also more motivated to complete a task when they are learning through experience in the outdoors (Dettweiler, Unlu, Lauterbach, Becker, & Gschrey, 2015). Unfortunately, these effective
practices are not being implemented because of reasons including time restraints for test preparation and lack of professional development opportunities (James & Williams, 2017).

The GSMIT has used experiential, outdoor learning for 50 years. Many of the visitors prefer the outdoor learning experiences and have returned to the GSMIT expressing memories that have lasted into adulthood (Stern et al., 2008). Informal learning programs have used this instruction reporting significant short-term gains in stewardship along with vivid memories within one year of the initial experience at the GSMIT (Stern et al., 2008). The Cit. Sci. 2.0 workshop, held on the GSMIT campus, is intended to build confident teachers and provide support that will begin breaking the instructional barriers of the participating schools.

**Teaching Science Practices**

Teaching student’s science inquiry has been an ongoing objective of many programs including the Association for the Advancement of Science (AAAS), the National Research Council (NRC) and the National Science Teachers Association (NSTA). Science inquiry extends beyond observing, inferring, predicting, measuring, questioning and other process skills. It refers to the approaches used by those participating in science; not a fixed set of steps that are to be followed (Lederman, Lederman, & Antink, 2013).

Many states have recently adopted The Next Generation Science Standards (NGSS) or at least a state-initiated form of the NGSS. Tennessee recently released science standards that are unique to their state but comparable to the NGSS. These Tennessee Science Standards encourage teachers to implement more engineering and scientific practices in instruction. These practices are divided into three groups, investigating practices, sense making practices, and critiquing practices. Each practice includes scientific inquiry skills like asking questions, planning and performing investigations, integration of mathematics and computational thinking, analyzing and
interpreting data, controlling variables, constructing explanations, developing models, and engaging in arguments using evidence (TN Department of Education). To successfully implement these skills for obtaining, evaluating, and communicating information, teachers must reconsider how they teach science and how students should learn science (Roseman, Herrmann-Abell, & Koppal, 2017). Furthermore, learners need to build an understanding of science content through these practices and exploring the natural world (McNeill, Lowenhaupt, & Katsh-Singer, 2018).

**Professional Development**

Science educators are responsible for relaying this understanding of science instruction to pre-service and in-service teachers. This responsibility should be carried out without the assumption that teachers who understand how to define inquiry-based instruction or who have participated in science inquiry PD teach using their understandings (Lederman et al., 2013). It is recommended, that science educators model effective strategies to teach students how to use science practices to make informed decisions and arguments to enhance scientific literacy (Chowdhary, Liu, Yerrick, Smith, & Grant, 2014; Kuhn et al., 2017; Lederman et al., 2013). Furthermore, effective PD should have classroom application and opportunities for teachers to be learners and develop relationships (Whitworth & Chiu, 2015). Professional development opportunities that place teachers in slightly uncomfortable situations of learning, requires multiple learning opportunities, and requires long-term assistance are more successful than when this combination does not exist (Berliner, 2011; Lewis, Baker, & Helding, 2015). Additionally, a broad scope of research notes PD learning opportunities should aim to extend and refine understanding of learners, curriculum and instruction, and proper assessment skills (Darling-Hammond & Bransford, 2005).
Vast research reports inquiry-based instruction is one of the greatest challenges for teachers (Chowdhary et al., 2014; Chun Lee, Nudent, Kunz, Houston, & DeChenne-Peters 2018; Zhang, Parker, Koehler, & Eberhardt, 2015). True inquiry-based instruction guides students to a goal through science processes. These scientific practices, also known as scientific inquiry, are considered by Lederman et al. (2013) to be equal to science content. The National Research Council (2000) concluded science teachers have a poor understanding of inquiry and are uncomfortable when implementing it. Knowing that effective outdoor instruction includes these processes, it is important to address both teacher confidence in inquiry and that of outdoor instruction. Teaching outdoors while using inquiry-based instruction challenges teachers’ routines and beliefs and pushes them beyond their comfort zone to reformed instructional practice.

Effective outdoor, experiential education that incorporates scientific practices can be a daunting subject for teachers. PD that emphasizes the best pedagogical strategies for this learning environment is a crucial aspect for school reform, however, this only scrapes the surface. This approach to instruction moves away from teaching facts and toward the communication of ideas through interdisciplinary, crosscutting concepts. For schools, teachers, and administrators, this is an intimidating concept, but for the GSMIT, this is business as usual (Walker & Lee, 2018).

**Statement of the Problem**

Outdoor educational experiences are effective at engaging all students in motivating and meaningful learning (James & Williams, 2017). Furthermore, researchers have reported outdoor education supports improvement in students’ problem-solving skills; collaboration and communication skills; and enjoyment in learning in the outdoors. Sadly, outdoor activity is becoming increasingly underutilized. There are reports that depression and obesity are
significantly related to less time spent outdoors. Since the early nineteen nineties, studies have shown that activities such as walks in nature can improve mental, physical, and social health (Park Rx, 2016). Most recently, a study concluded children who grow up with the lowest levels of available green spaces have a higher risk of developing psychiatric disorders (Engemann et al., 2019). Providing opportunity for more interaction with the outdoors during school hours may lower this risk. While informal learning institutes specialize in learning outside of the traditional classroom, they cannot accomplish the outdoor education reform alone. This responsibility falls on schools to break away from the confined classroom and expose students to effective outdoor education. The GSMIT’s Cit. Sci. 2.0 is intended to explore the influence of a long-term professional development that includes continued support from administrators, other teachers, and program leaders for experiential, outdoor instruction and learning.

**Purpose of the Study**

The purpose of this study is to describe the impact the Cit. Sci. 2.0 workshops had on the participant teachers through the lens of the planned, delivered, and received curricula format. Understanding the value and meaningful aspects of this program experience is crucial for the generalization and transferability of the workshop series. By closely examining and aligning the goals of the program and the activities the program leaders used with the implementation and perceived value of the teachers, this study will provide a description of the value of the workshop series. Understanding how the perceived value is influenced by the long-term face-to-face meetings, activities, assignments, and established communities of practice (CoP) will establish grounds for the generalization of this professional development model. This generalization refers to the GSMIT’s use of the model for other participant cohorts, use by other National Parks across
the United States and opportunities for use of the model at other programs or institutes with the
desire to promote school reform for outdoor, experiential teaching and learning.

**Research Questions**

This project aims to build an understanding of how effective elements of professional
development interact to influence participants’ perceptions of effective instruction and
application of techniques within the instructional practice. In doing so, the following research
questions will be addressed:

1. What were the intended goals for the workshop series developed by the Great Smoky
   Mountains Institute at Tremont faculty?
2. What methodologies were implemented by the Great Smoky Mountains Institute at
   Tremont faculty to meet the intended goals of the workshop series?
3. How did the experience of the workshops impact the participant teachers?

**Significance of the Study**

School-based experiential outdoor education is valuable for students, resulting in more
evident critical thinking skills, independence, peer cooperation, and the desire for students to
learn more (James & Williams, 2017). Schools and teachers neglect this instruction based on the
following excuses, time constraints, limited space, classroom management, misinterpreting what
their students are capable of, and comfort in a narrowed curriculum from standardized testing
(Berliner, 2011; James & Williams, 2017; Walker, Clary, Carroll, & Anthony, 2015; Whitworth
& Chiu, 2015). These perceived barriers and attitudes may limit teacher response of professional
development in experiential, outdoor education (Walker et al., 2017). With low response to
professional development in outdoor education, teachers are continuing to teach among the
comfort of the four walls in their classrooms. By exploring the perceived value of a workshop that combines effective, experiential pedagogy in outdoor spaces with required support from administrators, teachers and program leaders; this study contributes to the understanding of the effort needed to promote experiential, outdoor instruction reform. Additionally, it provides an applicable model to consider for all purposes of professional development. Taken together, this study seeks to analyze the scope of a series of workshops held at the GSMIT. These workshops were designed to be long-term, learning opportunities with support for the development of communities of practice. Primary desires were to build confident teachers in outdoor, experiential learning pedagogy.

Overview of the Method

Teacher teams from six schools participated in an intensive professional development series designed to increase their use of citizen-science, outdoor spaces, and authentic science processes. The program consisted of four immersive workshops located within the GSMNP and follow-up meetings at the participating schools that were directed by the GSMIT faculty. Pedagogical aspects of the training included modeling, co-design, Understanding by Design (UbD) unit planning, citizen science, and reflective practice/journaling.

To answer the research questions, I attended all workshops, reviewed archived assignments and conducted interviews of participant teachers, school administration, and the GSMIT faculty. Field observations of training sessions focused on aligning the delivery of training materials and lessons to program goals and were used to create interview protocol throughout the workshop series. Review of assignments informed the implementation of follow-up, stimulated recall interviews with participant teachers. Explanation of specific research methods and process for interpreting results is included in the later section.
Overview of the Subjects

Six schools were identified by the GSMIT faculty through protocol defined in the Cit. Sci. 2.0 grant proposal. The participant schools included fourteen total teachers who teach various subjects and grade levels, in addition to a representing administrator. Program leaders included three employees of the GSMIT and one employee of the National Parks Services (NPS). All faculty, teachers, and administrators expressed they were willing to participate in this research through official internal review board protocol (Appendix M).

Possible Limitations and Delimitations

The qualitative nature of the study is subject to researcher bias. Interpretations of collected data is largely dependent upon the researcher, especially data collected through interviews and observations. Data collected is not likely to represent all schools interested in integrating experiential, outdoor education into their school culture because the schools involved are regionally specific. The schools are located within close proximity of the GSMIT with the intent to provide better support systems between administrators, teachers, the GSMIT faculty, and even the communities. However, the schools do contain qualities and similarities of most South Eastern, rural school cultures. Socioeconomic status and ethnicity have been concluded as threats to environmental learning facilities (Bonney, Phillips, Ballard, & Enck, 2016; Merenlender, Crall, Drill, Prysby, & Ballard, 2016). This factor should not carry much weight in hindering generalizability because the schools involved were located in metropolitan and rural areas of Knox and Blount county Tennessee, nevertheless, it does exist.

The chief executive officer (CEO) of the GSMIT, who participated in the beginnings of this grant development has retired. Since the June 2018 workshop, a new CEO has been hired. There is no suspicion or evidence that the plans for the grant use for supporting the participants
has changed. However, it is noteworthy to suggest the change in leadership at the GSMIT as a possible limitation because a new professional relationship and trust must be established between the researcher and the CEO.

Another limitation to this study is attrition. One teacher had to remove themselves from the program due to issues unrelated to the experience. Other teachers changed positions after the June 2018 workshop. One of the teachers moved from one participating school to another, thus they were able to continue working with the Cit. Sci. 2.0 program. This changing of roles among teachers may have influenced the response rate for the fall of 2018 follow-up interviews. Due to the length of time between the workshops, unanticipated events arose preventing participants from attending some of them. The GSMIT faculty worked to minimize this event in advance with a syllabus that included meeting dates and times. However, this did not prevent unfortunate private events that arose and caused some teachers to miss part of the workshop experience.

The program leaders did not strictly enforce the submission of many assignments. This likely impeded the response rate for video reflections and prompted reflections in journal entries. Without these, findings are not as robust as they could have potentially been.

Further general limitations exist. The researcher was careful to follow interview protocol and maintain a professional relationship during the workshop series. This same plan was respected throughout the collection of the follow-up interviews. Attitudes of participants during observations or interviews may limit the study as well. Participants were made aware of observations and data collector characteristics were professional and open to all responses provided. Efforts to minimize any threats regarding attitudes of participants was an ongoing requirement. This was accomplished in part through professional interactions with participants and through the researchers’ ability to blend in with the participants in a sense of immersing
themselves into the environment. While blending in, observations were recorded then mapped according to daily activities. These mapped observations were used for the alignment of the goals, determined by three expert reviewers. Some descriptions of assignments were not thorough enough, resulting in reviewers determining a couple of objectives were not completed even though they were. More detail on this limitation is provided in chapter four.

**Definitions**

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

**Communities of Practice** - Social learning groups composed of groups of teachers that share the same passions for education or have other features in common (Lave & Wenger, 1991).

**Co-design** - Requirement of participation from multiple teachers from the same school.

**Experiential Education** - “Experiential education is a teaching philosophy that informs many methodologies in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge, develop skills, clarify values, and develop people's capacity to contribute to their communities” (Association for Experiential Education, n.d.).

**Feeder Schools** - When mentioned in this study, feeder schools will refer to elementary, middle, and secondary schools that traditionally host the same students from Grades K-12. This scheme was determined by the program leaders to be the most beneficial in promoting whole school reform.

**Residential Environmental Learning Centers** – Centers offer environmental education or natural science as the primary program components in an outdoor setting where students stay at
the site at least one night. A typical program is three or five days. Most programs focus on fifth or sixth grade students, but many programs also serve other grades (Walker, 2012)

**Organization of the Study**

Chapter 1 of the study presents the introduction to the research, the background, statement of the problem, purpose of the study, research questions, the significance of the study, an overview of methods and subjects involved, possible limitations and delimitations, and operational definitions of popular terms. Chapter 2 is a review of the relevant literature providing additional background on experiential, outdoor education, and practices that are related to this type of instruction. Effective professional development strategies and impact of the strategies are also included in addition to theoretical frameworks that support these practices. Chapter 3 presents the research methods for this study including a conceptual framework; research questions; description of subjects; instruments and measures used; and a brief explanation of the data analysis procedure for each research question. Chapter 4 presents the results and discussion of the study. Chapter 5 describes the overarching big picture themes of the project along with the implications of these themes.
CHAPTER II
REVIEW OF THE LITERATURE

Introduction

School-based, experiential, outdoor education is valuable for students, but many teachers perceive barriers that prevent them from facilitating learning outside of the four classroom walls (Berliner, 2011; James & Williams, 2017; Walker et al., 2015; Whitworth, Maeng, & Bell, 2018). Low response to professional development in outdoor education has forced informal institutes and PD program leaders to reconsider how they educate in-service teachers. The GSMIT designed their PD program to include aspects of effective PD and structured communities of practice to promote experiential, outdoor instruction reform. These aspects were reinforced with TN state standards with emphasis on the newly adopted science standards. Teachers were pushed beyond their comfort levels and their current routines were challenged (Berliner, 2004; Lewis et al., 2015). A review of the literature describes the influence of science and engineering practices on the use of experiential learning, an overlook of aspects of effective professional development, and the importance of various support structures for implementing knowledge and skills gained during a PD experience.

Gap

The GSMIT’s experience with past PD has revealed low response rates to professional development in outdoor education. A new PD design seeks to explore teacher’s perceived
challenges and needs, then combine effective experiential pedagogy in outdoor spaces with required support from the participating schools in effort to contribute to experiential, outdoor instruction reform. Studies exploring long-term PD and co-design aspects, including support of administrators, have increased success in implementing pedagogy in a traditional classroom. However, a combination of these three aspects have not been located in literature. In addition to this, long-term professional development that advocates for experiential instruction in outdoor spaces with a pre-established community of practice presents a gap in the literature. The existing gap can be studied without PD concentrated on being content specific or grade specific but concentrated on teaching teachers pedagogical strategies to use in an experiential learning, outdoor space. Taken together this study seeks to analyze the scope of a series of workshops held at the GSMIT. Reinforcing an outdoor PD experience with strategies that are grounded in literature and successful in a traditional classroom environment may translate to improved teacher confidence and begin eliminating barriers that teachers traditionally use for excuses.

**Science and Engineering Practices**

Jean Piaget advocated for active learning. He noticed children have a natural habit of exploring the world around them. This constructive nature of knowing occurs when people actively explore their environment to help them interpret what is going on (Piaget, 1952). Inquiry-based instruction is a product of Piaget’s active learning theory. Inquiry is defined as a set of skills learned by students and applied in investigations, a cognitive achievement, and it is referred to strictly as pedagogy (Lederman et al., 2013; McComas, Almazroa & Clough, 1998). A brief understanding of inquiry and its role in implementing science and engineering processes followed by different views of implementing the practices is further discussed.
The term inquiry-based instruction is mentioned in the classroom more often than it is truly performed. Teachers assign students cookie cutter, hands-on learning opportunities, but instruction rarely involves students in the actual construction and critique of their own knowledge through investigation. True inquiry-based instruction guides students to a goal through prompted questions, methodology, data analysis, or observation. These scientific practices also known as scientific inquiry are considered to be equal to science content (Lederman et al., 2013; McComas, 1997). With the muddied concept of inquiry-based instruction, there is an agreement that students learn science content best by participating in science practices (Lederman et al., 2013). The varied definition was a factor in the shift from the term inquiry to the term science practices (Peters-Burton, Merz, Ramirez & Saroughi, 2015).

The Next Generation Science Standards or a state form of the standards have been adopted by most states across the US. With the inclusion of science and engineering practices, these standards support experiential, inquiry-based learning across disciplines. These science and engineering practices include asking questions, planning and performing investigations, integrating mathematics through application, constructing explanations, developing and using models, and communicating findings (Pratt, 2013). These practices lead students to evidence-based explanations of the natural world that are often reinforced through experience and participation in the science skills. The practices also emphasize instruction that includes social collaboration among the students and teachers. The social aspect of learning is important for successfully preparing students for the responsibilities of citizenry, to be good stewards, and to thrive in the workforce (Darling-Hammond & Bransford, 2005). Scaffolding, collaboration, and reflection are theoretical works that promote social interaction and active participation in schools (Dewey, 1916; Schon, 1983; Vygotsky, 1978). To successfully implement these skills for
obtaining, evaluating, and communicating information, teachers must reconsider how they teach science and how students should learn science (Roseman et al., 2017). Learners need to build an understanding of science content through these practices and exploring the natural world (McNeill et al., 2018).

Lederman et al. (2013) proclaims science educators should not assume teachers who understand how to define inquiry-based instruction or who have participated in science inquiry PD teach using their understandings. With this in mind, science educators should model effective strategies to teach students how to use science practices to make informed decisions and arguments to enhance scientific literacy (Chowdhary et al., 2014; Kuhn et al., 2017; Lederman et al., 2013). Professional development is more effective when these science practices are modeled by the PD leaders, then practiced and reflected on by the learners (Dare, Ellis, & Tyrrell, 2018). A cyclic collaborative inquiry and reflection model encourages teachers to participate as students in activities, then to reflect on the activities together and individually (Todd-Gibson, 2017). This open-inquiry model demonstrates effective pedagogy for teacher participants.

Furthermore, these practices should be implemented across content or disciplines. Interdisciplinary science instruction (ISI) is a framework that generates the shift in science teaching that recommends science practices across disciplines. ISI is defined through the inclusion of science and engineering practices to learn science through problems that are relevant to the students while creating connections across multiple disciplines with material fixed in a specified content (Chowdhary et al., 2014). This framework also provides a layer of support from other disciplines and encourages teachers to work together and integrate content knowledge and skills. The use of this framework provides a platform to help teachers relate the nature of current interdisciplinary science instruction through a student-centered approach of asking
questions, problem solving, and developing technology (Yang, Liu, & Gardella, 2018). CS is a primary opportunity for the GSMIT to include these science practices through the use of ISI in their own instruction.

**Effective Professional Development**

Effective PD should entail classroom application and opportunities for teachers to be learners and develop relationships (Whitworth & Chiu, 2015). When reviewing the literature, experts presented many definitions of PD. Because the term PD is used in more than one context, it is easier to separate the definitions into two categories. First, PD is a learning opportunity that teachers engage in; this can be referred to as the PD experience or PD opportunity. Second, PD is the learning that occurs among teachers who are participating in activities during the PD experience (Darling-Hammond, Hyler, Gardner, & Espinoza, 2017).

One aspect of effective PD is teachers participating as students. Teachers should act as students during the PD experience to encourage more successful implementation of school reform; specifically, reform that is content-rich and learner centered emphasizing problem solving, collaboration, and understanding through application in the world outside of school (Feiman-Nemser, 2001). This aligns with learning theories that promote social interaction and active participation, such as Piaget’s constructive nature of knowing.

Literature also emphasizes, the PD experience should teach teachers what they need to know. This should be based on the teachers’ personal needs not the perceived needs of the PD leader. It should also help them deal with the challenges they face in their instruction (Yang et al., 2018). Zhang et al’s (2015) article on understanding teachers’ needs for PD established three features of PD, (1) focus on subject content knowledge, (2) opportunity for active learning, and (3) coherence with other teachers. The currently discussed PD experience will not neglect the
first but will emphasize the second and third. Although subject content knowledge is important for effective classroom teaching and learning, outdoor education is not content specific. This also helps promote reform across a school, not just in one isolated classroom, content, or grade level. More general effective PD strategies found throughout a broad literature review include: (a) informed pedagogy based on learning theories, (b) intensive, sustained and ongoing support, (c) focus on content and curriculum, (d) rich, active learning, (e) collaboration with teachers preferably from the same school and other schools, (f) a connection to teachers’ current practices, routines and learning goals, (g) alignment with district and state standards, and (h) organized school conditions for implementation after the PD experience.

Additionally, opportunity to reflect on their learning experience could make the process of gaining knowledge more effective (Darling-Hammond & Bransford, 2005). Reflection also leads to better modeling practices. Schon (1983), advocated for reflective practices in inquiry-based learning. Thinking back on lessons taught and determining if the strategies used meet the goal or outcome is a responsibility that is developed through highly effective teaching practice. Teachers need the opportunity to examine their routines, so they can be amended to contribute to school reform (Feiman-Nemser, 2001). Teachers can develop a working relationship with students by exploring their prior knowledge then encouraging them to think about their own processes of thinking, honing those skills for future life endeavors. A highly suggested reflective practice is videoing lessons and reflecting on the actions of the teachers and students. This allows one to build knowledge through experience and confront challenges in student thinking in a diverse classroom (Barnhardt & van Es, 2015; Jacobs, Lamb, & Phillips, 2010; Leatham, Peterson, Stockero, & Van Zoest, 2015). Researchers have used video reflections for stimulated recall interviews in PD opportunities (Nguyen, McFadden, Tangen, & Beutel, 2013). Although
many teachers are not in favor of videoing and reflecting on themselves, it has been powerful in assisting teachers with making connections between their routines and student thinking (Berliner, 2004). Active participation as learners, collaboration, and reflection combined with other effective PD strategies mentioned can enhance a PD experience and lead to curriculum reform.

**Curriculum Reform**

Curriculum reform requires teachers to acquire knowledge and skills that include knowledge of how learners learn and develop, knowledge of curriculum and content, and understanding proper assessment strategies (Darling-Hammond & Bransford, 2005). Many researchers elude to these as being the back-bone of teacher education whether it be for pre-service or in-service teachers. Knowledge of how learners learn and develop is essential to effective teaching. Teachers should aim to develop a learning environment where students are responsible for their own learning through constant and consistent awareness of the way student learning unfolds in their classroom (Todd-Gibson, 2017). Student learning is different for different groups of students and consists of an understanding of development, learning differences, languages, culture, temperaments, interests, and approaches to learning (Darling-Hammond & Bransford, 2005).

When teachers put themselves in the place of a learner, the knowledge gained can be more powerful than if teachers were simply fed information through lecture (Darling-Hammond & Bransford, 2005). Modeling or demonstrating a behavior or action for teachers to use in their practice is necessary in teacher education (Darling-Hammond & Bransford, 2005). Creating norms and clearly establishing them for the PD experience can create a connection to teachers’ current practices, routines, and learning goals. Classroom management research suggests developing norms makes it easier for teachers to place the responsibility of learning on the
students. Norms are rules designed to build a class culture and are more effective if introduced at the beginning of the year. Establishing and practicing norms for outdoor learning is beneficial to the learning process.

Encouraging collaboration among teachers and students through creating an inviting, safe learning environment is highly effective in the classroom. When students learn from each other, they begin to connect personal prior experiences or prior experiences from other students with new material. Collaboration is also a key component for inquiry-based instruction. Asking questions, discussing ideas on how to solve problems, and possible outcomes, and peer feedback can encourage exploration. According to Wiggins and McTighe (1998), for students to understand complex issues they need to be able to explain them in multiple ways. Collaboration encourages this in the process of learning. Encouraged collaboration along with other highly effective teaching strategies like active monitoring and establishing clear expectations should be modeled by PD leaders to enhance teacher buy-in of these effective strategies.

Research shows effective classroom management begins with meaningful curriculum that engages and motivates students (Darling-Hammond & Bransford, 2005). The basics of designing meaningful curriculum begins with authentic assessment. In order to place responsibility on the learner or create a learner-centered environment, students need to be motivated to learn. Students can be intrinsically and extrinsically motivated; it is upon the teacher to help the students figure out what motivates them to learn (Skinner & Belmont, 1993). Depending on the subject, students could rely on intrinsic or extrinsic motivation separately or a combination of both. Teachers can inspire motivation by connecting interests and strengths of students and providing challenges for them. A teacher can use scaffolding through Vygotsky’s (1978) zone of proximal development (ZPD) to motivate students to learn. A flexible understanding of content and an understanding
for how students learn helps teachers make content knowledge easier for students to understand (Darling-Hammond & Bransford, 2005). All of the skills for planning effective instruction and using effective teaching strategies will not suffice when planning effective PD opportunities or when teaching in a classroom. Developing subject matter knowledge for teaching prior knowledge, modeling, and inquiry-based processes need to have a purpose in the content (Feiman-Nemser, 2001). Teachers need to understand how these concepts and processes connect across instructional discipline and how they relate to their life, community, and the world.

Authentic assessment strategies are a key in curriculum reform. This purposeful way of evaluating what you want students to learn, requires aligning the assessment with learning goals and objectives (Wiggins & McTighe, 1998). Formative assessment produces quick responses from students that teachers can use to gauge the scaffolding process. It allows teachers to improve the learning process and guide the students to the learning goal or objective. Therefore, understanding what you want from the students is necessary before assessing.

Effective PD should provide knowledge to teachers that is requested by them to help them confront challenges that arise (Zhang et al., 2015). These needs depend on the background of teachers and may be different depending on factors such as grade level, student socioeconomic status, and content. (Zhang et al., 2015). Leadership that understands and supports effective practices for instruction may motivate teachers to implement the strategies promoted in PD (Whitworth et al., 2018). Research also suggests PD program leaders should use administrator knowledge when preparing and designing a PD experience. Sound administrators usually know which teachers need assistance and what forms of PD are preferred. In combination with effective PD pedagogy, strategies for providing adequate support can enhance
the impact and implementation of a PD experience. Successful support can be provided through administration involvement, the development of CoP’s, and through long-term PD experiences.

**Support**

Research has shown support during and after professional development opportunities most often increases teacher performance and implementation of the knowledge gained in the PD experience. A recently developed model linking PD to student achievement emphasizes support from the school and district leadership that is specific to providing PD that supports teachers through the experience with additional resources, mentoring, and opportunities for growth (Witworth, Maeng, & Bell, 2018). According to Whitworth’s (2015) model this support increases change in teacher attitudes, beliefs, and practice resulting in improved student achievement. This also suggests, PD that focuses solely on teachers and students limits school reform. Since principals and other administration are most publicly responsible for leading school reform, placing more focus on including them in PD experiences could possibly increase performance of students (Darling-Hammond, Lapointe, Meyerson, & Orr, 2007).

Administrator responsibility is complex; they must make sure the school is operating efficiently and safely while assuming the role of a leader (McNeil et al., 2018). They are also responsible for encouraging teachers to motivate students to increase standardized test scores due to policy responsibilities (Darling-Hammond et al., 2007; McNeil et al., 2018). Educational leadership is a key component to professional development success, greatly influencing teacher implementation of the knowledge gained from a PD experience (Whitworth et al., 2018). There are more times than not that school leaders forget their role as a mentor and proceed to manage instead of lead their teachers resulting in established barriers for effective learning environments. In general, people (teachers) need to be led, not managed (Sergiovanni, 1990). Most often the
lack of administrator leadership and mentoring is a cause of educational politics such as school boards and state offices. These offices are responsible for providing support to their administration to begin the snowball effect toward student achievement (Darling-Hammond et al., 2007).

Value added leadership is when a leader invests time, effort, and emotion and seeks a return from the followers. This leadership theory suggested by Sergiovanni (1990) can provide a way to help teachers meet student needs. This leadership advocates for empowering, enabling, and enhancing teachers. In order for value added leadership to work, the administration must first build trust and confidence in teachers by establishing shared educational visions. There are many building blocks for this including taking risks to solve problems, encouraging reflection for teachers, committing to the school, motivating teachers, encouraging proper workplace behavior, high standards, accountability, and an open-mind for inquiry or unconventional teaching strategies (Sergiovanni, 1990).

Research also suggests administrators and teachers assume they do not share a common goal (Sergiovanni, 1990). This is a barrier that can be addressed through adding value to leadership. To be a successful leader, one must attain attributes of a good follower (Sergiovanni, 1990). In other words, the administrator first needs to make a connection with the teachers by making choices that benefit the teachers and in turn the students while maintaining a balance among other requirements. The goal of value-added leadership is for an administrator to become more of a principal teacher who encourages good followers. As a result, value can be added through solving problems for themselves, maintaining self-control in uncanny situations, meeting obligations, and by accepting responsibility (Sergiovanni, 1990). Additional means of support include sustained involvement of the PD leaders and established communities of practice.
Communities of Practice

Motivation for teacher buy-in can be support through social learning groups called communities of practice. Theorists have promoted social learning for over 100 years (Dewey, 1916; Schon, 1983; Vygotsky, 1978.) This concept of learning through conversation and collaborations was introduces by Lave and Wenger (1991) and has been adopted among many professional development leaders. This framework for teacher learning through participation is typically composed of groups of teachers that share the same passions for education or have other features in common. Many teachers express feeling alone when trying to encourage school reform. Either joining or forming a CoP has resulted in teachers feeling safe and supported through others who share commitments in the community (Patton & Parker, 2017). Establishing a working CoP through co-design could greatly benefit the implementation process of what is learned at a PD program. A pre-established CoP could also reinforce the collaborative inquiry and reflection cycle (Todd-Gibson, 2017). Research shows it is best for teachers to work together and collaborate. Building mentorships and collaborative communities of practice during PD improves this. This mentorship is not only powerful for novices but also for the seasoned teachers because it requires them to pay more attention to the skills, strategies, or pedagogy they use in the classroom (Feiman-Nemser, 2001).

Professional development leaders have started implementing requirements of teacher pairs or teacher groups from the same grade or school when recruiting for PD opportunity. CoP’s reduce isolation and build personal and professional relationships that are sharpened through a safe but challenging environment (Patton & Parker, 2017). Building a CoP can enhance the collaboration of teachers who teach at the same schools and can build bridges between teachers who teach at schools in the same district. This could be most beneficial for feeder schools.
Research reinforces the idea that teacher beliefs or teacher buy-in effects the level of the use of knowledge gained from a PD experience which in turn effects students’ learning.

Professional development requirements of multiple teacher attendance from the same school has become popular. The goal of multiple teachers present provides a foundation for a community-centered support system that is needed for successful PD implementation in schools (Darling-Hammond & Bransford, 2005; Yang et al., 2018; Zhang et al., 2015). This co-design aspect provides intensive, sustained, and ongoing support for structured collaboration outside of the PD experience and continues the learning process for the teachers involved. This also leads to organized conditions for implementation after the PD experience.

**Length**

Furthermore, short-term PD can be a barrier to implementing knowledge learned during the experience. In addition to this find, research suggests 50 or more hours of PD on related strategies and content is needed to provide confidence in teacher implementation (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). A PD experience that includes multiple face-to-face meetings and opportunity to work on the skills outside of the meeting times is suggested. Teacher self-confidence has been improved through the use of continuous professional development (CPD; Valdmann, Holdbrook, & Rannikmae, 2017). Valdmann’s (2017) study that continued over a period of one year, including a minimum of 40 contact hours per teacher, revealed a lack of administrative support and reservations toward inquiry-based experiences were among the top reasons for lack of teacher self-confidence. Long-term PD can be reinforced through CoP’s and can provide gains that significantly outweigh those of a one-and-done type of professional development model.
Theoretical Framework

When designing a professional development experience, it is pertinent to keep in mind the teachers participating are professionals differing in levels of pedagogical and content expertise. Also, they harness positive and negative experiences that either encourages them to try new teaching techniques or discourages them to change their habits. How these teachers teach depends on the knowledge and skills they have acquired. Among the many positive attributes of expert teachers (optimism, flexibility, awareness of students, valuable feedback), teaching routines can pose a barrier to professional development, especially if innovative concepts are introduced (Berliner, 2004; Lewis et al., 2015). Taking teachers out of their classroom breaks their routines and places them in uncomfortable situations which in turn promotes learning (Berliner, 2004). This is supported by Vygotsky’s theory (1978) of scaffolding using the ZPD.

In addition to prior knowledge and routines, policy, co-workers, administrators, student statuses, and course load all effect how powerful a teacher can be in the classroom. A powerful teacher can encourage a powerful learning experience (Feiman-Nemser, 2001). To produce a powerful teacher who provides their students with powerful learning experiences, teacher educators should provide powerful professional development opportunities.

Grounding PD in theory and frameworks produces more successful outcomes (Darling-Hammond & Bransford 2005). When designing experiential outdoor PD theoretical frameworks such as how people learn (HPL), situated learning theory, teacher self-efficacy and expectancy value could help provide more successful implementation of knowledge learned. These theories and frameworks will be discussed further with respect to experiential outdoor education. Much of the research shows active, experiential education that integrates subject matter is the most
effective instruction for motivating and engaging students, which in turn produces high order
thinking skills and high performance.

**How People Learn**

The How People Learn Framework (HPL) is composed of four domains, (1) the learner, (2) knowledge, (3) assessment, and (4) community (Darling-Hammond & Bransford, 2005). The community is where learning occurs, therefore, the learner, knowledge, and assessment are encompassed in the community. This community-centeredness is influenced by the teachers’ ability to use effective strategies and create norms and expectations that result in student responsibility of learning. Teachers must find an appropriate balance of these four domains to be highly effective. To do this, one is required to understand what the learner needs and how to best motivate the learner to learn. Then, with a standard, objective, or goal in mind prepare an effective lesson using strategies that will allow the learner to make the best connection to the concept they are being taught (Thorndike, 1968). Knowledge is connected to learners through assessment. Although summative assessment is important, this discussion is focused on formative assessment. Formative assessment, or regular feedback is essential for student motivation and teacher understanding. It allows the teacher to facilitate and guide the learner to the end goal or knowledge to be obtained. This framework can be used to help teachers organize thinking. Using this framework when planning lessons guides teachers to think about (1) knowledge - what should be taught, (2) the learner - how they learn and why, (3) community - what environment enhances learning, and (4) assessment - what kind of evidence eludes to effective learning (Darling-Hammond & Bransford, 2005). Balancing this information may help teachers become more comfortable in planning for outdoor learning.
One can argue learner centeredness and knowledge centeredness are the easiest of the four domains to connect. Learners have prior knowledge that teachers build on to make connections and strengthen understanding of concepts that are related to teaching standards and ideally the surrounding environment. Knowledge-centeredness requires a teacher to have effective teaching strategies and pedagogical content knowledge (PCK) to enhance the learners’ experience. PCK is the knowledge a teacher possesses that helps them to know when to use certain strategies and environments for teaching while taking into consideration the needs of the students. Shulman’s (1986) PCK theory suggests a knowledge that is required by teachers makes learning more assessable to students. PCK connects knowledge of content to the practice of teaching (Ball, Thames, & Phelps, 2008). With respect to experiential outdoor education, sufficient PCK allows teachers to effectively implement inquiry-based instruction or science practices. The PCK that is highly effective for this type of learning environment is interdisciplinary and consists of strategies such as a) clearly stated expectations, (b) use of models, (c) teachers actively monitoring students, (d) students in small groups (no rows of desks), (e) encouraged student collaboration with teachers and other students, (f) organized and easily assessable materials, and (g) well prepared lessons with no wasted class time (Darling-Hammond & Bransford, 2005).

An assessment-centered classroom relies on formative assessment to motivate students and provide feedback that facilitates learning. Frequent feedback can encourage motivation in students. Feedback strengthens connections during learning processes. When someone receives a positive response as a result of an action they tend to repeat the action again (Thorndike, 1968). Without formative assessment, students could persistently make the same learning mistake, therefore, it is required to facilitate learning. When preparing assessment for outdoor instruction,
teachers must think about the integration and usefulness of the content and skills they are teaching the students. Building an understanding of how to use the content and skills could produce better stewards. Teachers should plan learning experiences with educational purpose that reflect content and are evaluated with frequent authentic assessment (Darling-Hammond & Bransford, 2005).

As mentioned before, community-centeredness encompasses learner, knowledge and assessment centeredness with special attention on the social collaboration between students and the teacher (Darling-Hammond & Bransford, 2005). This social nature of learning aligns with learning theories that promote social interaction and active participation like Schon’s (1983) change through active reflection, Dewey’s (1916) education as a social process, and Vygotsky’s (1978) ZPD. Teachers can use student knowledge to develop a sense of expectations for each student. Understanding the ZPD, requires a teacher to know where each student can successfully apply knowledge and know where the challenge of application may be too much. If a teacher does not challenge a student to build their knowledge to “advance to the next level” they are most likely not gaining from the learning experience. If the teacher is challenging the student too much, they may become frustrated and lose motivation for learning. When a teacher has developed an understanding of the ZPD, they are able to use it to support learners during new experiences. Effective learning occurs when the distance between the zones is narrow enough to encourage learning but large enough to pose a challenge. If it is too narrow, little learning will be provoked, and if it is too large, the challenge will be too complex and out of reach. Teachers can use the ZPD in experiential, outdoor education to scaffold learning accordingly. Recent research has determined scaffolding the learning from the classroom to the outdoors back to the classroom
is a highly effective teaching strategy that results in long-term learning (James & Williams, 2017).

PD that mirrors the HPL framework has been suggested with expectations for teachers’ beliefs about science instruction and even outdoor teaching to be changed more effectively (Chowdary et al., 2014). Each domain of the HPL framework is established on educational theories. When all four aspects of the HPL framework are balanced, motivation to learn is enhanced; especially if teachers link importance of the skills and content in the learning process to students’ lives, surrounding environment, and world. UbD, a planning framework introduced by Wiggins & McTighe (1998), suggests planning backwards by identifying the goals students should meet then choosing teaching strategies to meet them. This theoretical framework provides a procedure for connecting the four domains together. Providing experiences outside of the classroom for students to build knowledge and skills that are relevant to them while providing frequent feedback establishes a successful, healthy community-centered environment.

**Situated Learning Theory**

Administrative support, alignment to standards, long-term PD opportunities, and teacher collaboration have been identified as some of the important pieces of successful professional development (Darling-Hammond & Bransford, 2005; Yang et al., 2018; Zhang et al., 2015). Teachers acting as learners during professional development opportunities have enhanced the success of the use of knowledge gained when they return to their classrooms (Darling-Hammond & Bransford, 2005). Furthermore, adding reflection and revision to the above components establishes an experiential PD model similar to the situated learning theory. The use of reflection, social interaction, collaboration, scaffolded learning, multiple practice, problem solving, and reasoning, are the foundation of the situated learning theory. The context of this
theory suggests learners create knowledge as they interact with the environment and with each other to achieve a desired goal (McLellan, 1996). Identifying teacher needs and conforming a PD experience that meets those needs provides a more valuable experience for the teachers involved (Zhang et al., 2015). To successfully encourage teachers to teach outside, they must first be comfortable and confident in using their personal outdoor space.

**Teacher Buy-in: Self-efficacy and Expectancy Value**

Teacher attitude toward experiential education has been indicated to be a major barrier for implementation in schools (Walker et al., 2017). These negative attitudes are most likely results of lack of experience teaching outside. Teachers need experience with experiential, outdoor pedagogical content knowledge through professional development opportunities to help produce effective instruction outdoors. Suggestions have been made for prolonged professional development and teacher involvement to improve attitudes and break the barriers for transferring experiential outdoor education from informal learning institutes to the classroom (Stern et al., 2008; Walker et al., 2017).

Before teachers begin teaching outdoors and incorporate more experiential learning in their instruction, they need to see the value of this type of learning experience in addition to building confidence. Self-efficacy refers to one’s confidence in successfully executing a task (Bandura, 1977). Research suggests if teachers have high perceived self-efficacy, they are confident in their capabilities and perform better when differentiating instruction, selecting tasks and teaching strategies, and motivating students (Peters-Burton et al., 2015). Additionally, the theory of expectancy value refers to the belief that one expects to gain value from a task and is in turn motivated to complete the task (Wigfield & Eccles, 1992). The amount of effort one applies
to a performance or task is related to the value that will be directly gained from the task (Wigfield & Eccles, 2000). Bandura’s self-efficacy and Wigfield and Eccles’ expectancy value are related and usually studied together in research. Self-efficacy is more predictive of performance and academic achievement while expectancy value is more predictive of the outcome and persistence of behaviors (Muwonge, Schiefele, Ssenyonga & Kibedi, 2017; Wigfield & Eccles, 2000). Self-efficacy is usually measured at a task specific level making these theories conveniently relatable. Teacher self-efficacy and understanding of the value of the task influence the implementation of knowledge gained during a professional development experience. Establishing an outlet and planning activities and assignments that will heighten the self-efficacy of teachers and will increase their understanding of the outcome should be a focus of PD programs. If a PD program were to use these theoretical frameworks effectively, teachers should begin to build confidence in their ability to teach science practices through experiential learning in an outdoor environment. Teacher self-efficacy and expectancy value (perceived value) contribute together to strengthen the implementation of materials and skills learned in PD experiences.

Taken together, in order for these theoretical frameworks to be highly effective, teachers must first be willing to change their perceptions of teaching and learning. Also, the PD program must provide the participants with powerful learning experiences that meet challenges and standards. Willing teacher participants engulfed in powerful learning experience that requires interacting with the learning environment could increase teacher self-efficacy toward teaching experientially in an outdoor space.
Summary

This PD is designed to encourage teachers to plan learning experiences with purposeful reflection of the content and skills being evaluated by frequent, authentic assessment. Most of the literature reviewed resulted in variation of growth in application of content and pedagogy among teachers that participated in the PD. Teacher perceptions had the most influence on the rate of implementation of the knowledge gained during a PD experience. The current PD design confronts this by first requesting prior knowledge and recognizing needs and challenges the teachers have, establishing expectations and norms, and providing teachers with highly effective teaching strategies and tools to plan outdoor lessons effectively. All the while the program leaders model activities and assessment strategies for the teachers to use. The cycle of collaborative inquiry and reflection component of the design demonstrates an open-inquiry process and provides multiple perspectives for teachers to draw from (Todd-Gibson, 2017). Support systems established in the schools, help reinforce successful implementation. Darling-Hammond and Bransford (2005), proposed PD should mirror classroom instruction by considering the educational goals and purpose, and align standards with practice and assessment when developing a curriculum. This guided practice will engage and motivate teachers to develop and implement what they learn through reflecting on and revising curriculum plans.
CHAPTER III
METHODS

Conceptual Framework

Based on a traditional curriculum development process, this study will identify concepts of the planned, delivered, and received curricula of the workshop series. The planned curricula refers to the intent of the program leaders. Program goals (Appendix A) will be aligned to activities, assignments and assessments. Additionally, program leader kickoff interviews and artifacts from the design process will be used to provide answers for research question one. The delivered curricula refers to the strategies, skills, and materials conveyed to the participants. Field observation notes of activities presented and the methods of instruction used by the leaders; along with collected artifacts and interviews will provide answers for research question number two. Finally, the received curriculum, the perceived value, and the impact of the delivered curriculum, will be analyzed using interviews, collected artifacts, and field observation notes. This part of the study will seek to answer research question three. Research questions along with a table organizing the concept of the study follow.
Table 1

*Conceptual Framework*

<table>
<thead>
<tr>
<th>Framework</th>
<th>Questions</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned</td>
<td>Program goals</td>
<td>Interviews, goals of Cit. Sci. 2.0 grant (artifacts)</td>
</tr>
<tr>
<td></td>
<td>RQ 1</td>
<td></td>
</tr>
<tr>
<td>Delivered</td>
<td>Activities and Methodology</td>
<td>Field notes 110+ hours, interviews and artifacts</td>
</tr>
<tr>
<td></td>
<td>RQ 2</td>
<td></td>
</tr>
<tr>
<td>Received</td>
<td>Impact/Value</td>
<td>Follow-up and archived interviews, artifacts and field notes.</td>
</tr>
<tr>
<td></td>
<td>RQ 3</td>
<td></td>
</tr>
</tbody>
</table>

**Questions**

This project addressed the following research questions:

1) What were the intended goals for the workshop series developed by the Great Smoky Mountains Institute at Tremont faculty?

2) What methodologies were implemented by the Great Smoky Mountains Institute at Tremont faculty to meet the intended goals of the workshop series?

3) How did the experience of the workshops impact the participant teachers?

**Research Design and Methodology**

All participants were chosen by the program leaders through protocol defined in the Cit. Sci. 2.0 grant proposal (Appendix A). All participants within the realm of the study encompassed all teachers, administrators, and faculty involved in the Cit. Sci. 2.0 program. All participants agreed to participate in the interviews throughout the workshop series.
The goal of this study is to assess the deeply informative professional development design of the Cit. Sci. 2.0 program held on the GSMIT campus. The unit of analysis for this study includes teacher, administrator, and program leader perspectives. To describe these perspectives, existing data including approximately 110 hours of field observations, more than 15 hours of interviews, and artifacts collected throughout the workshops were used. In this chapter, a description of the design of the program is presented along with a process of collecting, measuring, and analyzing the available data.

**Citizen Science 2.0**

The Cit. Sci 2.0 program was designed for in-service teachers. A call was made to invite schools from counties surrounding the GSMIT then six of those schools were selected to participate in the workshop series. This series consisted of a kickoff meeting that lasted about five hours on Saturday December 2, 2017. Then a three-day, two-night residential workshop in January, March, and June 2018. Each of the six schools had at least two teachers and one administrator who committed to the program. The GSMIT faculty understood from experience for teachers to use experiential outdoor instruction they needed training, support, materials, and collaboration between other teachers who have the same interests (Walker et al., 2017). As stated in the grant proposal (Appendix A), the Cit. Sci. 2.0 program was designed to “provide scientifically accurate, relevant, and accessible information while simultaneously introducing teachers to research-based teaching techniques that are student-centered.”

**Participants**

Six schools from two counties near the GSMIT were chosen to participate. Two of the schools had three participating teachers and the other four schools had two participating teachers,
providing a total of 14 teacher participants and 6 administrator participants. Two of the participating schools were high schools with attending teachers endorsed in either biological sciences or social studies. The other schools were comprised of elementary and middle schools with participants who taught grade levels ranging from kindergarten to eighth grade and varying endorsements in all subjects including special education. Applications submitted by the teachers revealed most were looking for new ideas to enhance outdoor learning experiences and create socially and environmentally literate students. Each administrator agreed to participate in the kickoff meeting (workshop 1) and the final meeting in June (workshop 4). They were also required to be available for calls and on campus visits from the GSMIT program leaders. Most importantly, they were asked to serve a key role in supporting teacher implementation of knowledge gained from the experience.

Program leaders included three employees of the GSMIT faculty and one employee of the NPS. Two of the faculty members co-planned and attended all four workshops. The member of the NPS was a park ranger who was responsible for educating and connecting teachers to the resources made available by the Great Smoky Mountains NPS. All program leaders have multiple years of experience and are trained in informal education. They are also familiar with the theoretical frameworks associated with outdoor, experiential education.

Tennessee schools were chosen for this study based on stipulations associated with the grant services. Program leaders desired schools that had close access to the Great Smoky Mountains National Park and to the GSMIT campus. The GSMIT campus is housed in Blount County and located on its North boarder is Knox County. Blount County supports 20 schools and Knox County supports 87 schools (Tennessee Department of Education, 2019). Participating schools
consisted of two schools from Blount County School District and four schools from Knox County School District. Both of the counties are housed in the East Tennessee CORE Region (Tennessee Department of Education, 2019). Each county total ethnicity compared with the states total school enrollment ethnicity (n = 999,701), for the school year 2016-2017 is located in table 2.
Table 2  

**Blount and Knox Ethnicity Comparisons**

<table>
<thead>
<tr>
<th></th>
<th>State of Tennessee</th>
<th>Blount county (n = 92,599)</th>
<th>Blount County School District (n = 10,857)</th>
<th>Knox County (n = 461,860)</th>
<th>Knox County School District (n = 60,356)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White</strong></td>
<td>74.3%</td>
<td>White 91.4%</td>
<td>White 93.2%</td>
<td>White 82.2%</td>
<td>White 82.2%</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>16.7%</td>
<td>Black 2.5%</td>
<td>Black 1.6%</td>
<td>Black 8.9%</td>
<td>Black 8.9%</td>
</tr>
<tr>
<td><strong>Hispanic</strong></td>
<td>5.2 %</td>
<td>Hispanic 3.1%</td>
<td>Hispanic 2.8%</td>
<td>Hispanic 4.3%</td>
<td>Hispanic 4.3%</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>3.8 %</td>
<td>Other 3.0%</td>
<td>Other 2.4%</td>
<td>Other 4.6%</td>
<td>Other 4.6%</td>
</tr>
</tbody>
</table>

The numbers were located via the Tennessee department of education website, and through a link on the website that re-directed to the U.S. Census Bureau (2017a-d).
Compared to the state of Tennessee, Blount County has 17.1% more white residents and Knox County has 7.9% more, with similar differences within the school district population. Both counties have fewer black residents compared to the state. Blount County populations have 14.2% fewer black residents with a 15.1% difference in the school district population. Knox County has 7.8% fewer black residents and members of the school district population. The Hispanic and other populations are slightly more comparable. Selecting schools that surround the GSMIT will limit the range of generalization for this study. However, the proximity of the school districts may provide better support systems between administrators, teachers, faculty, and even the communities.

**The GSMIT faculty.** The faculty at the GSMIT are well qualified in experiential, outdoor education. The three program leaders have more than ten years of experience teaching outdoors and one of them has experience in the traditional classroom. Two of these leaders were present during the entirety of each workshop while the other leader was present when other obligations were not conflicting. The GSMIT has about 10 naturalists who work on campus. Most have a science degree and are conducting research along with teaching the visiting students. Each naturalist has training in educational pedagogy, particularly experiential education in outdoor spaces. All faculty were aware of this research and research focus was placed on the two primary program leaders.

**National Park ranger.** One of the requirements of the grant was that the GSMIT work closely with the NPS during the training experience. The Great Smoky Mountains National Park designated a park ranger to work with the GSMIT faculty to support the fulfillment of the grant requirement. The ranger involved has experience with education as it is a large component of their occupational conditions. They were present during each of the workshop sessions, and they
helped lead workshop activities, especially the activities that were focused on citizen science. In March, the national park ranger introduced Parks in the Classroom and Parks as Classroom. Both of these are programs that encourage teachers to use National Park resources as teaching tools in their classrooms.

**Participating schools.** The professional development workshop began the application process with a commitment requirement of at least two teachers from the same school, along with support from at least one administrator from each school. This idea allows opportunity for sustained support for the teachers. Of the six participating schools, four of them had two teachers actively participating and the other two had three teachers participating, providing a total of 14 teacher participants. Each of these schools had one administrator involved, resulting in six administrator participants. All of the participating schools were public schools. A case outline for each school is located in Appendix B. Each case outline provides a detailed background of the schools that participated. The majority of the information was included in the applications submitted by each school.

**Data Collection**

Data collection occurred in two phases; phase one, collection of observations, artifacts, and interviews conducted during the workshop series (existing data); then phase two, follow-up interviews, and stimulated recall interviews that were conducted in the fall of 2018. Existing data were collected under an IRB approved program evaluation. An additional proposal including the follow-up interviews and stimulated recall interviews was submitted and approved in September 2018 (Appendix M).

When gathering existing data (data collection phase one), there were four segments that existed. The first segment included the initial December meeting collection and organization of
data, with all other segments for January, March, and June occurring in a consecutive manner. During these segments the researcher transcribed and mapped interviews, and organized observations and artifacts. Phase two of the data collection began after the end of the June workshop. All existing data were considered when developing the follow-up interview protocol. After committee approval was granted in November 2018, follow-up interviews were collected throughout the end of the year.

Existing data from the program evaluation includes observations, artifacts, and interviews. Over 110 hours of field observations were recorded in a field notebook. Observation notes were recorded during the time the researcher was present for the workshops. These times did not exclude meal time and free time. Attending all workshops and observing free time activity’s and meals was essential to gain insight into the immersive nature of the workshop experience. Artifacts collected consisted of pictures of lessons and materials used in the lessons along with hand-outs and completed assignments provided by program leaders. Over 15 hours of interviews were collected during various points throughout the experience for administrators, teachers and program leaders. An open mind was maintained for possible patterns and themes that could lead research to a new direction. All possible variables presented during the data collection were considered to produce the most accurate evaluation of the impact of the workshops.

**Instruments and Measures**

The instruments in this study consist of four structured interviews for participating teachers, two structured interviews for participating administrators, and three structured interviews for the program leaders. Peer debriefing between the primary researcher and the leadership team existed before additional interviews took place to ensure protocols were aligned
with objectives, provided multiple perspectives, and avoided conflicts of interest. There was also a protocol in place for the field note observations taken during each workshop. The conceptual framework outline (Table 1) aligns each research question to the instrumentation used to answer it. This alignment identifies different viewpoints, establishing triangulation between the interviews, observations and artifacts collected, and providing structure for credibility (internal validity) of the study.

The journals were artifacts used to support many of the claims throughout chapter four. Most activities and reflection assignments were recorded in the journals. All of the teachers were provided journals when they arrived in December. These were white, blank journals that were easy to carry. They had a plastic sleeve to protect against weather. Teachers were allowed to establish ownership with their journals by designing the cover themselves (Appendix N). The program leaders asked teachers to use the journals to model reflection in learning. Teachers submitted the journals to be photocopied during each workshop. If there was something personal in the journal that teachers did not want seen, they were asked to cover the material with paper before they were photocopied. This submission process was only enforced in March. Teachers were asked to photo-copy their own journals after the PD ended, reducing the rate of submissions. Journal entries were de-identified and transcribed for use in this study.

**Interview Protocol**

This section describes the interview procedures for each interview. During the year of December 2017 through December 2018, program leaders were interviewed three times, teachers were interviewed four times, and administrators were interviewed two times. All interviews that occurred on the GSMIT campus were conducted during the workshop experience at the convenience of the teacher teams and were designed as semi-scripted, informal one-on-one
conversations. These took place during arrival of teams and during downtime. The program leaders, including the NPS ranger were interviewed at their convenience. Administrator interviews were collected in a pre/post semi-scripted informal manner. Because the administrators had the least face-to-face interaction, they were interviewed via email and phone for the pre-interview and via face-to-face or email for the post-interview. If a teacher was not present for the workshop, they were contacted via email for response collection. All face-to-face interviews were conducted in a private room, were audio recorded with permission of participants, and were similar for each participant group.

**December.** In December, program leaders and teacher teams were interviewed on site and the administrators received an email the following week with a series of questions. Many of the questions were similar for all types of participants. All three program leaders participated in this interview as a group, and the NPS ranger participated individually. The group interview lasted about 30 minutes, and the NPS ranger interview lasted about 10 minutes. Teacher team interviews lasted between 10 and 20 minutes. The program leaders and teachers were interviewed in teams for similar reasons. In order to establish a collective view of the intentions of the workshops, the faculty were interviewed as a group because they planned and performed the workshops as a group. The NPS ranger was interviewed separately because they needed to depart early for obligations outside of the realm of this study. Teachers were interviewed in teams because the intentions of the workshop series were to locate schools that were interested in experiential, outdoor instruction, followed by the identification of teachers to support the instruction reform. This decision was made based on the co-design aspect of the program. There were no intentions for teachers to complete any assignments or assessments without conversation and feedback from the other teachers involved at their schools. Although individual
teachers existed, entire school instruction reform was the focus of the program, therefore schools, or teacher teams were addressed together. The group interviews were also most convenient for the participants. Administrators were interviewed via email or phone because this kickoff meeting only lasted part of a day and there was not enough time to interview them face-to-face at the GSMIT. The interview protocol for the program leaders, teacher teams, and administrators are located in Appendix C. These questions were meant to establish a broad understanding of the individual perceptions of experiential learning, and instruction in outdoor spaces, define challenges, and gather impressions of expectations for the workshop experience.

**January.** Interviews were not collected in January. Due to winter break and the beginning of a new semester, it was not considered beneficial to interview the participants again until they had experienced one full workshop meeting and the teachers had completed assignments.

**March.** In March, program leaders and teacher teams were interviewed on site. For the program leaders, the March interviews were conducted separately lasting about one hour each. This separate interview allowed the researcher to explore the unique perspectives of each individual. These interviews only included the two primary program leaders. It excluded the NPS program leader because this person was not able to join for the majority of the January workshop as a consequence of the January 2018 government shutdown. Additionally, the other program leader was excluded because of schedule conflicts that existed during January and March. Teacher interviews were based on field observations collected during the previous workshops and on interests of the program leaders. They were planned to be short, check-in interviews lasting from 5 to 15 minutes. The interview protocol for the program leaders and teacher teams
are located in Appendix D. These interview questions were meant to establish an understanding of progress and to scope out the perceived usefulness of the experience thus far.

**June.** In June, administrators who attended the workshop experience were interviewed on site. Four administrators were interviewed at their convenience during the June workshop. These interviews lasted between 20 and 40 minutes. Those who were not present during the final workshop were emailed the questions. This second interview was intended to gather information on the noticeable growth the teachers and the schools had made. The protocol is located in Appendix E. Teachers and program leaders were not interviewed because the scope of this study required further approval for additional interviews. Teachers and program leaders would be interviewed during the fall 2018 school semester.

**Follow-up.** Follow-up interviews were conducted with program leaders and teachers. The program leader interviews were conducted on the GSMIT campus at the convenience of the participants. Only the two primary leaders were interviewed for two reasons. First, the other program leader had schedule conflicts and second, this was consistent with the March interviews. The NPS ranger was contacted via email three times and did not reply to set a date for the interview. A final email was sent with the interview protocol and a request for answers and there was still no response. Each primary program leader was interviewed separately because of availability and the interviews lasted between 35 and 75 minutes.

The teacher follow-up interviews were conducted at the convenience of the teachers. Two teacher teams were interviewed separately because of schedule conflicts. I visited school one, two different days to conduct interviews with teachers during their planning periods. School three was interviewed on the GSMIT campus because their school was visiting with a group of
students. This team constituted a separate interview because one of the teachers had moved from school two. During the interview with this teacher, I was careful to work in some comparison questions. Three teacher teams were interviewed in a group setting. I visited schools four and six during a time that both teachers were available. I was not able to meet face-to-face with school two, however, they responded via email together. School five did not respond to any of my contacts therefore, a follow-up interview for this school does not exist. Although some of these teachers were interviewed separately and some as groups, all responses were reviewed in the context of responses from schools, not individuals. The teacher follow-up interviews lasted between 20 and 45 minutes. The protocol for the program leaders and the teacher teams was developed using earlier interview structure and the information gained from collected data. These interviews were intended to scope out the overall experience, including personal growth testimonies, perceptions of different activities and assignments, and an understanding of progression. The interview protocol is located in Appendix F.

**Video stimulated recall interviews (SRI).** SRI’s were conducted with seven willing teacher participants. Researchers have used this stimulated recall in PD opportunities. Although many teachers are not usually in favor of videoing themselves then producing reflections, this self-assessment has been powerful in assisting teachers with making connections between their routines and student thinking (Berliner, 2004). Targeted excerpts from the archived videos were used to develop open-ended probes (Nguyen et al., 2013). The researcher watched each video and chose aspects of the video that highlight the use of the skills demonstrated by the professional development leaders during the workshops. These aspects were different for each video and were specific to the teachers’ instruction. The open-ended probes were intended to initiate a conversation to gain an understanding of the teachers’ thinking and justification of
actions during teaching. Ideally, the teachers would refer to the workshop experience during the SRI. To begin the SRI, each teacher was asked to watch the video. As they were watching they were prompted to pause the video and discuss any thoughts they had as they arose. Teachers were audio recorded as they were participating. A generic interview protocol for the SRI’s is located in Appendix G.

An issue presented itself during the data collection. The researcher did not have access to all of the videos required by assignments, limiting the response rate for the SRI’s. Access to videos from nine teachers was provided. Of those nine, the primary researcher met face-to-face with seven teachers. After conducting follow-up interviews with these teachers, the were asked to participate in an SRI. All seven agreed to participate resulting and a 50% response rate in concordance with the initial number of teacher participants. Most of the video reflections submitted were videoed between the kickoff meeting and the March workshop.

Field observation protocol. Before each workshop began the North American Association for Environmental Education (NAAEE) K-12 Learning Guidelines for Excellence was reviewed. This document describes the essentials of Environmental Education (EE), a vision of the future and grade specific guidelines for teachers. This document was chosen based on the premise that the GSMIT is an EE center, therefore their pedagogy closely aligns with EE content. Also, the traditional method for teaching EE is through outdoor, experiential instruction (NAAEE, 2010). All field observation notes were recorded in the same notebook and were organized in a similar fashion.
**Data Analysis**

The data collected were analyzed holistically to answer the research questions in this study. Collected data outlined in the conceptual framework (Table 1) corresponds to the research questions. Description of data analysis for each research question follows. Existing data included artifacts, observation notes and interviews from December, March, and June workshops. Additional data included the follow-up interviews and stimulated recall interviews collected after June. Observation field notes were mapped for alignment with grant goals (Appendix I). Interviews and journal responses were transcribed. When interviews were transcribed, an alias was assigned to each participant to protect their identity and maintain confidential material. Names were chosen based on places or animals associated with the GSMIT campus, nature, and GSMNP history. Program leader names are: Abram, Nan, Scout, and Wren. Teacher names are: Cade, Sparrow, Dorsey, Spruce, Luna, Lily, Doc, Sal, River, Sierra, Raven, Oakley, Fox, and Woods. Administrators are identified by ‘school (number 1-6) administrator’ with the number representing the school the administrator is employed. For example, the administrator from school one would be identified as ‘school one administrator’.

**Research Question One**

This question was answered using the grant document, application artifacts, and December kickoff interviews from program leaders and teachers. The grant document was explored to define the intentions of the Cit. Sci. 2.0 workshop series. Applications were used to form case outlines of each schools’ demographics and resources (Appendix B). Interviews were used to provide evidence of the intentions of the program leaders.
Research Question Two

Question two was answered using the observation field notes, all interviews collected, and various artifacts including the grant document, journals, and handouts provided to the teachers by the program leaders. Expert reviews aligned the documented observation notes to the grant goals, producing a total count of activities aligned to goals, and percent of agreement through inter-rater reliability (IRR). Further explanation is provided in chapter four. The delivery of the goals and objectives were supported through all forms of data collected. Activities and assignments were described using the observation field notes and were supported with interviews and artifacts. To determine the most mentioned activities or assignments, a word search was performed with all interviews and journal entries using Microsoft Word.

Research Question Three

The third research question was answered using interviews, field notes, and artifacts. Determining the impact of teachers required a review of the strategies that made this program unique. To analyze the impact of the length of the workshop series, a journal prompt was used. Each answer to the journal prompt was organized into topics based on the review of literature and the teacher’s perceptions of challenges. This organization provided a structure for timelines that were also supported by interviews. Further description is provided in chapter four. A comparison of teacher perceptions of administrator support was described by graphing the ratings provided using Microsoft Excel and interviews were used to support the graph. An increase in the use of outdoor spaces was determined using responses from December, March, and follow-up interviews. Submitted video reflections were watched and pieces of the videos were chosen based on the instructional pedagogies provided by the program leaders. These were used during stimulated recall interviews providing additional evidence for teacher impact.
**Coding.** To determine if there was a change in teacher understanding of experiential, outdoor instruction, excerpts from related kickoff and follow-up interview questions were coded. During the kickoff interview, teachers were asked what experiential learning meant to them. Then they were asked what outdoor, experiential education meant to them during the follow-up interviews. The faculty were asked to define experiential learning and outdoor education during the kickoff interviews as well. To determine if there was an influence on teachers’ perspectives, the faculty interview answers were inductively coded to start a list of codes since they would be teaching teachers based on their expert understandings. The corresponding faculty answers were carefully read to locate code words or phrases. Then the code words were collapsed into like phrases or words. For example, “learning by doing” and “experiencing” was collapsed into the code “learning through experience.” To further support the process, a definition was located for experiential learning and for outdoor education. According to Ford’s *Outdoor Education: Definition and Philosophy* (1986, p. 2), outdoor education is “education in, about and for the out-of-doors.” “Experiential education is a teaching philosophy that informs many methodologies in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge, develop skills, clarify values, and develop people's capacity to contribute to their communities” (Association for Experiential Education, n.d.). Adding this deductive coding process provided a way to compare faculty responses to widely accepted definitions.

ATLAS.ti was the software used during this coding process. Eight codes were located within these definitions after collapsing them into similar existing codes. Three deductive codes were unique, clarify values, focused reflection, and teaching philosophy. The codes from the definitions were collapsed into the codes from the faculty interviews because the interview
words and phrases are less formal and similar to the context of the teacher interviews. For example, “engaged with learners” was collapsed into “student centered” and “education 'in', 'about', and 'for' the outdoors” was collapsed with “anything that is outdoors.” Fifteen codes were established and nine of them occurred within both the inductive and deductive coding process (Figure 1).

![Figure 1. Establishing codes.](image)

Listed are the codes that were established with the number of times they were mentioned by the faculty or in the definitions. Gray bars indicate codes that were present in the inductive and deductive process (faculty interviews along with definitions). Orange bars indicate codes that were only located using the inductive process (faculty interviews) and blue bars indicate the deductive process (definitions).
After establishing the codes, all teacher kickoff interviews and follow-up interviews were coded. An additional code was added to track the number of times teachers mentioned words or phrases that did not match the existing codes, resulting in 16 total codes. This process is explained further in chapter four.

**Reliability and Validity**

Credibility of this research was maintained through triangulation of interview responses, artifacts, and observations. Overlapping interview questions between the teachers, administrators, and the GSMIT faculty also grounds credibility. Questions were re-visited throughout each interview protocol to provide a means of comparison of answers over time. Peer debriefing between the primary researcher and the GSMIT leadership team occurred before additional teacher and administrator interviews took place to ensure protocols were aligned with objectives, provided multiple perspectives, and avoided conflicts of interest. Extensive discussion of instruments and measures provides possibility of transferability with similar subjects with dependable results. All findings are based on participant responses. This can be confirmed by documented sound recordings of interviews and original observation field notes. Participants were interviewed at their convenience but within the working time frame of each workshop meeting. Professional interaction between the researcher and the participants was maintained throughout the study. Taken together, trustworthiness was assured throughout the data collection and interpretation process through logical, traceable, and triangulated documentation in order to establish this study dependable and credible. Subjectivity related to potential bias that may affect this study’s interpretations is addressed in the following section.
CHAPTER IV
RESULTS AND DISCUSSION

The Cit. Sci. 2.0 project was evaluated to address the three elements of curricular design and implementation. Research questions one, two, and three correspond to the planned, delivered, and received curricula respectively. Specifically, this project addressed the following questions:

1) What were the intended goals for the workshop series developed by the Great Smoky Mountains Institute at Tremont faculty?

2) What methodologies were implemented by the Great Smoky Mountains Institute at Tremont faculty to meet the intended goals of the workshop series?

3) How did the experience of the workshops impact the participant teachers?

This chapter is organized to address each research question directly. However, in many cases, data overlap addressing multiple research questions. Consequently, the results of this study will be accompanied by a brief discussion. Chapter five, traditionally reserved for discussion of results, will assume the role of describing the overarching big picture themes of the project.

Question One

The GSMIT is positioned with unique expertise to provide high quality outdoor, experiential education opportunities to people of all ages. Their expertise includes that in experiential and environmental education, training and inspiring teachers and students, and the capacity to design and carry out citizen science research, including research related to regional
watersheds. The GSMIT has designed and hosted teacher professional development opportunities for 50 years. They focus on educating their visitors on environmental stewardship that is local to the community and relevant to all. From past research on these professional development opportunities, they have come to understand that teachers need more than knowledge and resources in order to successfully implement materials and ideas learned in PD. They also need to be provided training in a long-term sense to increase confidence in outdoor, experiential teaching methods (Walker et al., 2015). The GSMIT is dedicated to increasing the quality of its professional development opportunities through transforming the educational experience for teachers, and in turn, students. Research question one explored the intended goals established by the GSMIT faculty for the Cit. Sci. 2.0 program. Data used to answer this question were collected from grant documents, school applications, and interviews from the December kickoff meeting. Results for research question one are organized into two categories: analysis of grant documents, and strategic recruitment of participants. Each section is supported by interviews.

**Grant Documents**

Through their efforts to transform their PD opportunities, the Great Smoky Mountains Institute at Tremont was awarded a grant from the National Parks Foundation. This grant was awarded based on certain stipulations. First, the GSMIT was required to work with the Great Smoky Mountains National Park Service. Second, the PD program designed by the GSMIT faculty was to contain a citizen science unit based on watersheds that must be implemented in local schools. Both requirements were easily attainable for the GSMIT faculty since they are located within the Great Smoky Mountains National Park and they use citizen science research
for the streams located on their campus. The citizen science data they collect is used to predict trends within the Little River watershed basin. By way of this NPF grant, the Citizen Science 2.0 workshop series was born.

Aside from the NPF requirements, the GSMIT faculty developed three main goals that are supported by their teacher professional development conceptual framework: knowledge, collaboration, reflection, and practice. This framework was located on handouts provided to the teachers and is found in various forms across the campus. These goals are the foundation for the intention and design of the PD workshop series. The goals listed below will be referred to throughout each research question in efforts to further explain decisions made by the program leaders regarding the PD series (Appendix A).

Goal 1: Teachers and school district leaders gain a better understanding of the value and power of experiential learning and citizen science.

Objectives

a) Develop a network of teachers, administrators and schools who will engage in the Great Smoky Mountains National Park for place-based learning and citizen science.

b) Connect teachers with the latest research on brain-based science teaching and learning.

c) Engage teachers with specific tools, methods, and practical experience for student-centered learning they can take home and use in the classroom year-round.

d) Increase teacher confidence by engaging them in hands-on lessons they can use in school.
e) Engage teachers in Tremont Institute’s nationally recognized Cooperative Teaching model to develop their skills to facilitate high quality environmental education with their students.

Goal 2: Teachers understand and feel confident using local, accurate, in-depth content on water, watershed, and related environmental issues.

Objectives:

a) Engage teachers in linking water/watershed issues to TN Academic standards aligned with Next Generation Science Standards (NGSS) and the Tennessee Environmental Literacy Plan (ELP).

b) Use current data and monitoring techniques to demonstrate accessibility of tools and resources.

c) Train 6 Teacher Teams from 6 schools (2 teachers from each school) on relevant, hands-on citizen science projects that contribute to their understanding of water and watershed issues while engaging students in authentic scientific research. The teacher teams will attend all planning meetings, park visits, and the full residential workshops.

d) Build a support network for the teachers and schools by seeking one to two administrators from each school to participate in the stages of planning, implementation, and future thinking.

Goal 3: Each Teacher Team develops a student-centered curriculum unit using a planning framework, such as UbD, to addresses water and watershed issues, and culminates in a community project.
Objectives

a) Tremont Institute and park staff will create an effective toolkit that guides teachers through the process of design and implementation.

b) Facilitate brainstorming sessions during each workshop that result in moving each school’s curriculum unit plans forward, with specific goals and assignments for each of the three workshops. Teachers implement curriculum units in schools.

c) Community citizen science projects implemented.

A collective focus can be depicted from the three main goals. The overarching intention of the workshop series is to provide teachers and school district leaders with a better understanding of outdoor, experiential learning and experience with citizen science that is focused on watersheds. It is important to note that the last objective in goal three is outside the timeline of this study. The program leaders guided teachers in creating the citizen science projects, however the implementation of the community projects is not required until spring 2020. These grant goals are the backbone of this study and will be addressed throughout the remainder of chapter four.

Selecting the Sample

In summer 2017, a call was announced for schools in Blount, Sevier, Loudon, and Knox counties in Tennessee to submit an application for the workshop series developed by the GSMIT. The application forewarned the recommended time commitment, investigated access to outdoor spaces, support, and inquired the perceived needs of teachers. Most importantly, the questions on the applications considered the goals of the workshop series. Application questions are located in Appendix H. The program leaders reviewed the applications and selected six schools that host
various grade levels from Knox and Blount counties to participate. According to application entries, the shared interest of these schools was to provide their students with interdisciplinary activities in an outdoor setting that supported the environment and scientific literacy, particularly conservation for the community.

The selected schools contained elementary schools that fed into middle schools and then into high schools. This feeder school selection was not perfect for this workshop series. The Blount counties schools did not have a middle school participating, only an elementary and high school. Knox county had two elementary, one middle, and one high school participating. The concept of having students begin their outdoor, experiential learning opportunities in elementary school, then continue through middle and high school was intended to reduce the novelty of this type of learning experience as they progressed to higher grades. The GSMIT faculty were asked why they chose schools of all grade levels. Wren stated, “…to find schools that would create a pathway of experience, so that each student would have the opportunity to be involved on more than just one occasion. So we would have multiple touchpoints with each student” (Personal communication, December 10, 2018).

Each of the schools had access to some sort of outdoor area; even those located in the heart of the Knoxville metropolitan had access to an outdoor space on their campus. Some of the schools had established or were in the process of establishing walking trails and outdoor classrooms. According to the applications, five schools had direct access to a body of water on their school campus. This body of water could include, lakes, ponds, streams, and even ditches. It is important to note these schools were chosen to participate in this program because they reported their struggle in using their outdoor resources fully. The GSMIT faculty prepared to produce teachers “…that are comfortable utilizing outdoor space, teachers that inspire students to
also be inquisitive and to have a sense of discovery in the outdoors” (Scout, personal communication, December 2, 2017).

In an effort to build a support network for teachers, the program leaders wanted to include administrators in the training experience. If the teachers have the knowledge to explain to the administrators how outdoor, experiential learning fits into the curriculum and standards, “then the administrators will be more supportive in letting them [the teachers] take the students elsewhere [outside of the classroom] and to expand upon the experiential learning” (Scout, personal communication, December 2, 2017). Administrators were required to answer a few questions on the application. All claimed they understood the workshop series design and supported the teachers with implementation, substitutes, and designated planning times. Half of the administrators expressed they had more than two teachers who wanted to be involved either in the training, with implementation, or both.

Along with the active support of an administrator, a minimum of two teachers were required to participate. Two of the schools had three teachers dynamically partaking in the training while the other four had two teachers participate. The GSMIT faculty referred to this component as co-design. The intention was to help provide a supportive environment within the school to help teachers implement their gains from the workshop series. This support and sustainability was planned because “…when teachers have gone back to their schools and try to infuse a new cultural aspect, and there’s only one of them, it feels much harder…So establishing a peer network…was a big part of the program” (Nan, personal communication, December 11, 2018).

Additionally, the application prompted teachers to express at least two needs that they had. This question was meaningful when planning activities for the meetings. It was also
prompted throughout the course of the workshop series with intentions to guide the facilitators to make decisions that best fit the needs of the participants. Before the workshop series began, the GSMIT faculty knew that the teachers struggled with certain items and they intended to address these throughout the professional development experience. Perceived needs and challenges were collected from applications and from the December kickoff interviews. The application had a dropdown selection menu under the respective question. The possible answers were used to organize the needs of the schools. The challenges mentioned in the interviews were coded according to the items of the dropdown menu. Table 3 lists the perceived need and/or challenge along with the number of schools that directly expressed an issue with them.

Table 3

<table>
<thead>
<tr>
<th>Need/Challenge</th>
<th>Number of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time set aside with teaching team</td>
<td>5</td>
</tr>
<tr>
<td>Connection to standards</td>
<td>4</td>
</tr>
<tr>
<td>Resources and content support</td>
<td>4</td>
</tr>
<tr>
<td>Lesson plans/Unit development</td>
<td>3</td>
</tr>
<tr>
<td>Teaching practices/methodology/activity ideas</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

“Time set aside with teaching team” referred to the ease of availability of teachers to work together on a weekly basis. Five schools reported having issues with this. Four teachers reported necessity of “connection to standards.” In other words, it was important that every outdoor teaching experience be connected to learning standards for their course. Four schools
expressed needs for resource and content support for teaching outdoors. Three schools reported a need in lesson planning and unit development strategies for outdoor instruction. All six schools reported need for assistance with teaching practices/methodology/activity ideas. Note that this category also included practices related to classroom management such as time to implement the non-traditional instruction and student behavior concerns that were expressed during the kickoff interviews. The “other” category included expressed needs that did not fit into the categories preceding it in the drop-down menu. Because the application drop-down menu is vague, as it was only intended to provide a quick snapshot of school needs, more specific questions about schools needs and challenges were asked during the December interviews. The interviews reiterated and added to the knowledge of each schools’ perception of needs and/or challenges.

Summary

Research question one established an understanding of the intended goals for the workshop series. The grant goals were established by the program leaders, and they were used to evaluate the progress of the workshop series. Focus of application questions adhered to the fundamental goals of the workshop series. All questions pertained to the use of experiential or outdoor education and abilities or challenges associated with this type of pedagogy.

The selection of the sample aligned to the grant documents by meeting goal 1 objective A: develop a network of teachers, administrators and schools who will engage the Great Smoky Mountains National Park for place-based learning and citizen science; and goal 2 objective D: build a support network for the teachers and schools by seeking one to two administrators from each school to participate in the stages of planning, implementation, and future thinking. Further discussion on alignment of the GSMIT program leader’s methods of practice with grant goals is considered under research question two.
Question Two

Research question two explored the methodologies implemented by the Great Smoky Mountains Institute faculty to meet the intended goals of the Cit. Sci. 2.0 program. Data used to answer this question were collected from alignment of the grant goals and field note observations provided by science education experts, field note observations for the entire workshop, and faculty and teacher interviews ranging from December kickoff interviews (fall 2017) to follow-up interviews (fall 2018). The presentation of results corresponds to the grant goals and objectives. The workshop facilitators planned sessions and assignments to specifically address the needs/challenges in Table 3. They also provided experience with outdoor lessons that used authentic scientific research related to watersheds. Further account of these learning opportunities will be described after an explanation of the grant goal alignment.

Grant Goal Alignment

To determine whether the methodologies implemented by the faculty met the goals of the workshop, the goals were aligned to the observation notes taken throughout the workshop series. This process included three expert reviewers responsible for establishing a total count of activities aligned to the grant goals.

Field notes. As described in the field observation protocol, each workshop series was observed and field notes were recorded. Prior to each workshop experience, the researcher reviewed the NAAEE K-12 Learning Guidelines for Excellence. This document established a mindset for observing instruction at the GSMIT. After each workshop meeting the observation field notes were mapped. For the map used in the alignment, the activity name was listed in the first column, the second column provided a description of the activity, and the third column
provided a notes section for the experts to use (Appendix I). These data along with a list of the grant goals and objectives were provided to the experts.

**Expert reviewers.** Three expert reviewers were asked to explore the mapped activities and to determine which goal the activities best matched. Each of these experts have experience in informal science education, and all three are familiar with the GSMIT programs as they have visited The Great Smoky Mountains Institute at Tremont on multiple occasions. This team of external evaluators aligned the goals to the field notes using an established code. The goals were numbered 1, 2, and 3 and the objectives signified using letters. For example, the code 1A would indicate an alignment to goal 1, objective A; A signifying the first objective associated with the goal, B signifying the second objective, and so forth (Figure 2).
Figure 2. Example of coding process for the grant goal alignment.

The two columns nearest the left are the field notes and the three columns nearest the right are the codes provided by the three reviewers.

**Inter-rater reliability.** Each expert read the mapped observation field notes and aligned the data to the objectives of the grant. If a field note did not align to any specific objective, it was left blank (Figure 2). This task was completed twice to prevent overlooking alignments and to check for consistency. This was completed on the experts’ own time then submitted to the researcher. Next, a total count of the number of incidences that the objectives aligned was recorded. These numbers are represented under the ‘total count’ column in Table 4. For grant
goal 1, objective A, (1A) experts collectively determined an alignment to the mapped observation notes 57 total times. This total count was separated into the amount of times a single reviewer identified an alignment, two reviewers identified an alignment, and three reviewers identified an alignment of the same objective with the same activities, establishing inter-rater reliability. For example, 16 of the mapped observation activities were identified by two reviewers to align to objective 1A. Additionally five of the mapped observation activities were identified by three reviewers to align to objective 1A (Table 4).

Percent agreement was determined by multiplying the number of times an alignment was identified by the number of reviewers for items that shared alignment agreement. For goal 1A, five (times an alignment was determined) was multiplied by three (three reviewers in agreement); then 16 (times an alignment was determined) was multiplied by 2 (two reviewers in agreement). These products were then added together, in this case resulting in the number 47. Forty-seven was the number of times multiple experts agreed on the alignment of the grant objectives with mapped observation activities. These numbers were divided by the total count, in this case 57, to determine the percent agreement between the expert reviewers. In other words, for objective 1A, of the 57 incidences that reviewers determined an alignment to mapped observations, 82% were identified by multiple reviewers. There are only 10 incidences when a single reviewer determined an alignment of objective 1A to the mapped observations. Table 4 represents the alignment produced by the experts. It will be described throughout the remainder of research question one.
Table 4

*Expert Alignment of Mapped Observation Notes to Grant Goal Objectives*

<table>
<thead>
<tr>
<th>Objective</th>
<th>Total count</th>
<th>1 reviewer</th>
<th>2 reviewers</th>
<th>3 reviewers</th>
<th>percent agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Develop a network of teachers, administrators and schools who will engage Great Smoky Mountains National Park for place-based learning and citizen science.</td>
<td>57</td>
<td>10</td>
<td>16</td>
<td>5</td>
<td>82%</td>
</tr>
<tr>
<td>1b Connect teachers with the latest research on brain-based science teaching and learning.</td>
<td>11</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>45%</td>
</tr>
<tr>
<td>1c Engage teachers with specific tools, methods, and practical experience for student-centered learning they can take home and use in the classroom year round.</td>
<td>55</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>84%</td>
</tr>
<tr>
<td>1d Increase teacher confidence by engaging them in hands-on lessons they can use in school.</td>
<td>27</td>
<td>17</td>
<td>10</td>
<td>0</td>
<td>74%</td>
</tr>
<tr>
<td>1e Engage teachers in Tremont Institute's nationally recognized Cooperative Teaching model to develop their skills to facilitate high quality environmental education with their students</td>
<td>21</td>
<td>13</td>
<td>8</td>
<td>0</td>
<td>76%</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
<th>Count</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>Engage teachers in linking water/watershed issues to TN Academic standards aligned with Next Generation Science Standards (NGSS) and the Tennessee Environmental Literacy Plan (ELP).</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>83%</td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>Use current data and monitoring techniques to demonstrate accessibility of tools and resources.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td>Train 6 Teacher Teams from 6 schools (2 teachers from each school) on relevant, hands-on citizen science projects that contribute to their understanding of water and watershed issues while engaging students in authentic scientific research. The teacher teams will attend all planning meetings, park visits, and the full residential workshops</td>
<td>18</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>67%</td>
<td></td>
</tr>
<tr>
<td>2d</td>
<td>Build a support network for the teachers and schools by seeking one to two administrators from each school to participate in the stages of planning, implementation, and future thinking.</td>
<td>16</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>3a</td>
<td>Tremont Institute and park staff will create an effective toolkit that guides teachers through the process of design and implementation.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td>Facilitate brainstorming sessions during each workshop that result in moving each school's curriculum unit plans forward, with specific goals and assignments for each of the three workshops. Teachers implement curriculum units in schools.</td>
<td>11</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>3c</td>
<td>Community citizen science projects implemented.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

Total count is the sum of the total number of times the objective was identified across all raters. Inter-rater reliability provides a breakdown of total counts to include incidences of a single reviewer’s mark per activity, an activity marked by two reviewers and activities that received consensus of all three reviewers \( [(1Rx1)+(2Rx2)+(3Rx3)]=TC \)
**Total count of activities aligned to goals.** The alignment of the professional development activities and program goals revealed 3 of the 12 objectives had not been addressed. Of the nine objectives that had been met, 5 had been met at greater than 70% inter-rater reliability, 3 had been met at 50 to 70% inter-rater reliability, and 1 objective had been met at less than 50% inter-rater reliability.

The first goal was met in its entirety throughout the workshop series. Each of the objectives for goal one were represented on multiple occasions. The second goal was also met in its entirety, although objective C did not get any counts from the reviewers. This count could be limited by error in the observation note description. The use of current data and monitoring techniques to demonstrate accessibility of tools and resources was evident during the citizen science sampler activity, stream ecology activity, and soil testing experience (each will be discussed further). Goal three has not currently been met in its entirety because the experience is still on going. Objective A and part of B were met before the last day of the June workshop series. Objective C of goal 3 is outside of the scope of this study; plans to meet it are presently underway.

This expert alignment provides structure for discussion of the pedagogical strategies and instructional practice associated with each workshop series. Pedagogical strategies and assignments used to meet each of the goals and objectives is described in reference to each goal, respectively. Methodologies implemented by the program leaders to meet the goals will be described in respect to the goals.

**Goal One**

Goal one emphasizes the pedagogical strategies and assignments that were provided to the participant teachers. These were used to lead teachers to a better understanding of
experiential learning. The alignment resulted in all objectives in goal one being met at greater than 70% IRR, except for objective B which was met with 45% IRR. Reason for low IRR on objective B can be contributed to error in observation field notes. The GSMIT faculty used various pedagogical strategies and assignments to meet goal one; explanation will be organized respectively. Goal one follows:

Goal 1: Teachers and school district leaders gain a better understanding of the value and power of experiential learning and citizen science.

Objectives

a) Develop a network of teachers, administrators and schools who will engage in the Great Smoky Mountains National Park for place-based learning and citizen science.

b) Connect teachers with the latest research on brain-based science teaching and learning.

c) Engage teachers with specific tools, methods, and practical experience for student-centered learning they can take home and use in the classroom year-round.

d) Increase teacher confidence by engaging them in hands-on lessons they can use in school.

e) Engage teachers in Tremont Institute’s nationally recognized Cooperative Teaching model to develop their skills to facilitate high quality environmental education with their students.
The first objective of goal one was met when the program leaders selected the sample. This process was discussed under research question one. What the GSMIT faculty did to meet objectives B-E will be discussed in the following sections.

**Pedagogical strategies.** As mentioned before, the program leaders strategically modeled many of the same activities multiple times throughout the experience. They would model the activity within different situational contexts and in different instructional spaces. An example of a lesson they modeled in December and again at each subsequent meeting was a lesson called *I notice, I wonder, it reminds me of.*

*I notice, I wonder, it reminds me of.* This lesson was the first official activity during the January workshop to model effective experiential teaching strategies. It places focus on observation skills. The first time *I notice, I wonder, it reminds me of* was used, it was conducted outside in the friendship circle. The friendship circle is the smaller of two campfire arenas. These arenas are shaped like small, circular huts that have only one entrance/exit. They have tiered benches on the inside. These benches are part of the structures walls and they are three levels high. Due to the hut like appearance, the benches form a circle and there is a fire pit in the center. About sixty students could fit into the friendship circle. Usually, the instructor stands at the entrance/exit to teach; this is where all instructors were standing for this activity. Location of the friendship circle in comparison to the rest of the GSMIT campus is positioned on the map in Appendix J.

For example, a program leader, acted as the teacher while participants acted as students. Before releasing the teachers to do the activity Nan discussed parameters and a return call. Teachers were asked to stay within a certain distance from the friendship circle and were asked to return when they heard a coyote call that would be announced by the GSMIT faculty. The
parameter and return call are normal management strategies used by the GSMIT; they were intentionally modeled for the teachers. Teachers took their journals to any chosen place within the parameters, drew an object they were interested in, then wrote what they noticed, wondered, and what it reminded them of. The faculty modeled the return call giving their best impression of a coyote howl. Teachers then came back to the friendship circle and shared their findings. The faculty modeled interested expressions and positive voice when the teachers explained their findings. After completing the lesson, the teachers were asked to return to “teacher mode” and they discussed how they could use this activity in their classroom.

This activity was revisited the first day of the January workshops. The GSMIT faculty placed sticks and hand lenses on tables before the teachers arrived. The tables were large enough for two to three adults to sit at and were out for every workshop meeting. This provided an area for the individual school teams to gather for all indoor experiences. After a few introductory discussions, the teachers were asked to remove everything except the materials present when they walked in. These materials were the sticks and hand lenses. The program leaders prefaced the activity by reminding teachers they were to act as students during the activities. They discussed use of new vocabulary and demonstrated how to use the hand lenses. This demonstrated that teachers should not assume students can use tools without direction, including seemingly simple tools like hand lenses.

First, teachers were asked to blurt out “I notice” phrases in their group. Then, teachers were asked to switch back to “teacher mode” to discuss how they can use this in their classroom. Observation and inference activities along with vocabulary building from “I notice” to “I observe” for more advanced grades were mentioned. Nan mentioned many times during this activity that students should be allowed to do the exploring to reach technical terms, such as
making the transition to use the word observe instead of notice. Next, teachers switched back to “student mode” to blurt out I wonder phrases in groups. After switching back to teacher mode, one teacher shared how they had used this already in their math classroom. After modeling this version of the I notice, I wonder, it reminds me of lesson, it became something that was embedded into the workshop curriculum. The leaders taught it a couple of times and then blended it with all other activities.

_I noticed, I wonder, it reminds me of_ was the first lesson modeled in this workshop series and was the second most referred to lesson throughout the study. Using the navigation tool in Microsoft Word, activities were entered into the search engine and the number of locations were reviewed and counted within interview and journal transcripts. This activity was mentioned 17 times during interviews and 10 times in the journals. According to one of the workshop leaders, this is the first big step when using experiential education techniques. “Once they [teachers] can be confident at becoming better observers and become aware of the world around them, they can help model that for their students” (Wren, personal communication, March 15, 2018). According to the program leader, the GSMIT often uses this activity, to lay a foundation for learning other experiential learning routines. All teachers reported using a version of this activity in the March or follow-up interviews. Some schools have even embedded into their curriculum. Sal mentioned, “…not every day, but multiple times a day that we do some sort of I notice, I wonder… I mean it is so embedded in our lessons and it's so effective” (personal communication, November, 13, 2018). He even noted that it helps meet standards. “One of the biggest things…that really helps engage with the standards and makes that connection, is we always start with an I notice, I wonder” (personal communication, November 13, 2018).
Luna incorporated this activity into math content with protractors. “They [5th grade students] had never seen one [a protractor] so we did the, I notice, I wonder, it reminds me of… even though we couldn't go outside” (personal communication, March 16, 2018). Sparrow incorporated it into reading and language courses, “I use it with pictures often and introduction of new topics. It’s very good to let students explore a new topic” (personal communication, December 11, 2018). Doc used this activity in her SPED courses when reading books (personal communication, November 13, 2018). Although many elementary teachers immediately incorporated this activity into their courses, secondary teachers were more hesitant to use it. They liked the idea but modified it to use higher level vocabulary. They made the point that students will not be asked a question on a test with the vocabulary words notice and wonder, instead it would be observe, explain, and justify. The teachers explained, “Instead of saying I wonder, saying like, ‘What are some questions you have now that you're looking a little closer at this?’ (Sierra, personal communication, November 13, 2018). “I'll ask them questions like ‘What do you observe?’ ‘How do you know?’ ‘What's the evidence?’” (River, personal communication, November 13, 2018). When asked to describe an accomplishment the teachers were most proud of, Sal mentioned a story about the use of the I notice, I wonder activity and then described how it organically turned into a more in-depth conversation between the students.

One of the first times we went out, we were walking around and I was asking the questions. We did a little exploration. We came back and shared what we noticed and what we wondered. But then one of the students found a little puddle, just a really average, just regular puddle. And so I don't know what caught their attention. I think there was a worm, like an earthworm or something. And they got so excited. One student
saw it and they started calling the other ones, and before we knew it they were all huddled. I mean this puddle was maybe a foot long. It was really small, nondescript, just average puddle. They were talking about life cycles of insects, going on and what did they notice. They were asking each other questions, talking about water cycles, just all the stuff that they've learned in science. And I had nothing to do with it. It was so organic. It just happened, just them talking to each other and asking each other questions. It was wonderful. It was so fun to watch. And I literally stepped back, after I was getting in there too. I literally stepped back and just watched it happen. It was great. We could've stayed there for an hour just looking at that little puddle. Just looking at the surface nothing was really going on. But as they looked closer little water bugs were running around. They saw little bitty critters and oh, what stage is that? And what is it going to turn into? Just great questions (personal communication, November 13, 2018).

**Student mode and teacher mode.** Throughout the entire workshop series, teachers were encouraged to participate as a student. This pedagogy is effective in professional development when teachers participate as students they are actively learning (Dare et al., 2018; Zhang et al., 2015). When teachers place themselves in the situation of a learner, the knowledge gained can be more powerful than if teachers were simply fed information through lecture (Darling-Hammond & Bransford, 2005). Each time they would participate as students, it would be followed with a group discussion as teachers. In the beginning of the series, the GSMIT faculty leaders would alert teachers when they needed to act as students or teachers. Soon, these alerts were nonexistent. The teachers quickly realized when student mode or teacher mode were appropriate.

During the face-to-face follow-up interviews, when teachers were asked how they felt about acting as students during the learning experience, all of them said they enjoyed it and it
was beneficial in some way. “We were actually doing the work. I think that was beneficial, more so than just sitting there listening about the process” (Woods, personal communication, December 10, 2018). Most teachers mentioned gaining an understanding of the process of learning experientially. “I know if I struggled with something, that’s a place where they [students] are going to struggle, and I might not have realized that had I not have gone through it” (River, personal communication, November 13, 2018). Wren, a program leader, experienced participating in a workshop that similarly separated teacher mode and student mode. She said it impacted the decision to use it in the designed workshop series.

It [student mode] worked for me and it kind of shook me up and brought my brain back to this place where I recognized that this is a very effective way to learn, it was more meaningful than to have those metacognitive kind of discussions [teacher mode] afterwards about how you would apply it in the classroom or on the trail or whatever (personal communication, March 15, 2018).

**Norms.** The program leaders asked teachers what a norm was. While writing responses on the board, they asked teachers to further describe their responses. Norms are rules designed to build a class culture and are more effective if introduced at the beginning of the year. Establishing and practicing norms for outdoor learning is beneficial to the learning process. Using the ideas from the teachers, a discussion about norms continued. Teachers were encouraged to take small steps toward conditioning students to learn outside of the traditional classroom and to establish a set of norms that would translate from indoors to outdoors easily. After the discussion, teachers were directed to establish the norms for the workshop. “Don’t yuck someone’s yum” was one example given. Other examples including “safe place, brave place” and “step up, step back” were already a part of some of the teacher’s classroom norms. These
norms would be a live document that could change throughout the program. They were revisited during the March workshop. This discussion was placed at the beginning of the program so the faculty could refer back to the norms throughout the experience. It also demonstrated a way to promote student ownership while establishing rules for a course.

**Cooperative Teaching Model.** Teachers were also encouraged to participate in the GSMIT’s cooperative teaching model. When schools visit, a naturalist is responsible for teaching the students. Usually one naturalist is responsible for each group of students. The groups can contain up to 15 students. The cooperative teaching model provided an opportunity for teachers to share the teaching responsibility with the naturalists. If schools decide to partake in this opportunity, attendance fees are reduced.

In March, a visiting school was on campus while the workshop was in session. One morning, teachers were allowed to divide into two groups to observe this school and the cooperative teaching model. One group participated in a geology hike and the other group participated in a stream physics lesson. After observing these school groups for about an hour, teachers returned to meet as a group again. Through a debrief discussion with the GSMIT faculty, teachers revealed they were able to see many of the techniques they had been taught during the workshops demonstrated in a real situation. A couple of teachers expressed excitement about the cooperative teaching model and planned to gather materials to begin preparing before the workshop experience was over.

In June, a naturalist worked with Abram, a program leader, to conduct an activity that illustrated the cooperative teaching model. The activity was called zoom, zoom, zoom. The teachers were asked to choose an object, draw it, move half the distance from it, draw it, then
move as close as possible to it and draw it again. Each perspective change was announced with an animal call. The naturalist led the activity as he would if students were participating and Abram acted as a teaching assistant, as a teacher would, all the while the teachers acted as students. Demonstrating the cooperative teaching model provided an example for what the teachers would be expected to do when they visit the GSMIT with a group of students.

**Formative assessments.** The GSMIT faculty modeled formative assessment strategies for outdoor experiential learning and used those same strategies as embedded assessments for the program. These assessments provided an understanding of teacher thoughts and/or progress throughout the PD experience. These formative/embedded assessments included a quick write, different versions of turn and talks for group discussion, question and answer sessions, a mind pie, an improvised skit, transitions and even the concluding activity. The reflections are also a means of embedded assessment and will be discussed further in a later section.

**Quick write.** This activity was the second activity teachers were exposed to in December. Administrators and teachers were prompted to brainstorm what they see four to six years from now in their teachers, students, and the community. Ideas were written on a dry erase board then discussed as a group. The *quick write* brainstorm lasted three to five minutes then schools were asked to share their visions. Over 30 items were mentioned on the dry-erase boards. The items ranged from an increase in test scores, regular outdoor classroom usage, increased excitement and involvement in learning, collaboration with schools and community, and environmental accountability. This assessment was modeled to provide an example of a formative assessment that can be used in the classroom.

*Turn and talk.* Two of the *turn and talk* sessions practiced were a thought swap and a discussion activity called *one cent, two cents.* These sessions were incorporated throughout the
workshop series. For the thought swap, the teachers made two parallel lines facing each other. The faculty asked questions, teachers had 30 seconds to talk about the question with the person they faced. Then one person from the end of one side went down the middle to the other end of the line. The teachers scooted down to realign and the process was repeated. For the *one cent, two cents*, teachers were asked to get into groups to discuss perspective shifts. Each group contained four teachers who all faced each other, forming a square. One teacher talked for one minute and then the other teachers were could add anything they wanted to the conversation for one minute each. Then they rotated for 30 additional seconds each to add anything they want it to the conversation. One group discussed *community* and another discussed *administrative support*. After debriefing this activity, teachers noted that they could use this as debate protocol for an assignment. This activity also modeled providing students time to think and process before sharing their ideas. Teachers pointed out this may be good for introverts because all students were required to share for a brief amount of time, it also teaches children to learn to share space in a conversation.

*Question and answer.* This questions and answer (Q&A) session was not typical. For this embedded assessment, questions were written on large posters then placed on different tables. Teacher groups were to go around and answer the questions using markers, then rotate. The questions were, how could the GSMIT and/or NPS support you and your school in implementing more student driven outdoor, experiential education opportunities on a regular basis? And the other was, design an implementation guide for teachers taking students outside for the first time. From this session the GSMIT program leaders were able to inquire support ideas and were able to assess the activities and content teachers thought was most important thus far. This session was conducted in January. For the support question teachers asked for activities that correlate to
standards (this was addressed in March) and for resources that were easily accessible. Under the
guide for teachers taking students outside, teachers mentioned establish norms, use models,
expect chaos, start small, and encourage curiosity and reflection, all were aspects of the PD
program.

Mind pie. In January, teachers were instructed to gather five rocks, five seeds, and five
leaves. There was a pie chart drawn on poster paper with questions about the workshop and
instructions on it. As the teachers returned, they read and followed directions. They were
prompted to read all of the questions in the pie pieces and place a seed on the material they
needed to grow in, leaf on the material they were comfortable with but still needed practice, and
then place a rock on the material they were 100% confident in. Teachers were confident that the
workshop had been the best balance of outdoors, hands-on, discovery, direct instruction, group
work and fun. They also reported they had made a professional connection through the workshop
experience thus far. All but two teachers indicated they were not comfortable with the amount of
time they connected with their teacher team prior to the January workshop. After discussing the
different parts of the mind pie, teachers were asked to find a better way to organize the data. This
modeled further uses for the assessment strategy.

Improvised skit. This skit was presented on the last day of the January workshops.
Teachers were asked to do a skit or mini-presentation on something they learned from the
experience so far. One teacher mentioned they were nervous about this in a reflective writing but
the faculty thought it was the most powerful activity they had asked the teachers to do at that
point. “I would say the biggest highlight, was their [the teachers] improv presentations…there
was some nervousness. The way that they pulled their little vignettes together just, it blew
everybody away, and I think they surprised themselves how well they did” (Wren, personal communication, March 15, 2018). According to Nan, the activity was a way to provide critical feedback in a way that was not judgmental. After each teacher group presented, the faculty “…had the whole group [teachers] give them [presenters] things they did well, what could they do differently if they had more time, or what would you do differently if it was applied to your classroom” (Nan, personal communication, March 15, 2018).

Transitions. In addition to modeling activities and assessments, the GSMIT workshop leaders modeled transitions. These transitions could be used to extend a lesson when students are walking back to the classroom from an outside lesson or to transition between topics. Turn and talks were used multiple times throughout the workshop experience. During one turn and talk, Nan was transitioning the teachers from a break to a structured learning session. She asked teachers to stand in a circle and turn to someone standing by them to discuss what they do before they introduce something new.

During a workshop session that occurred after lunch in March, Nan quietly wrote the word adventure on a dry erase board. She then asked for teachers to give other words that describe the word “adventure.” As teachers were coming into the room and getting seated, they began calling out words. Nan wrote the announced words around the word adventure then she changed it to science and asked if the announced words still describe science. This led into a discussion of standards. In June, the leaders used the word “ecosystem” in the middle of a dry erase board. This activity was used to transition teachers from an outdoor activity to an indoor learning session.
In June, Abram led the teachers to Girl Scout Island, a popular area for outdoor learning at the GSMIT. Before the group began the hike to the learning space, Abram asked teachers what they would do if they had unlimited teacher resources. On the way to Girl Scout Island the teachers walked in two parallel lines and talked about their ideas. After arriving, teachers described to the whole group that they would take a trip to the GSMIT, take more hikes, go on more field trips, and go on more overnight trips. This *walk and talk* was performed between many of the transitions between activities.

Each time there is a sharing discussion like a *turn and talk* or a *walk and talk*, it is followed with a short group discussion. These transitions were used to model management strategies that could reinforce on task behavior while moving from one learning space to another. These transitions can also be used to guide student focus onto a new topic. Transitions were modeled regularly during this workshop series; the ones described were demonstrated the most frequently. The program leaders also used some of the embedded assessment strategies described above to transition between learning topics.

*Teachers lead and conclude.* Teachers led the last activity in the PD program. This time was set aside to share with administrators a favorite, short activity they took away from the experience. This embedded assessment provided program leaders with an idea of the activities that teachers were most interested in and willing to use in their pedagogy. One school demonstrated story telling. This activity has not been previously discussed in this study, but the GSMIT uses story telling often when introducing a topic to students. It is also used during camp fire activities. The story the teachers told was about something negative that happened at their school when a teacher who was not participating in the workshop series took their class outside.
After the incident, the teachers were encouraged by the administrator’s response. The administrator understood this same incident could have happened indoors, so he encouraged all of the teachers who had interest in taking students outside to learn to “fail forward” and continue to try.

Furthermore, one group of teachers shared a popular transition activity. They wrote the word “Tremont” on a dry erase board and asked for everyone to provide a word that described it. They then replaced Tremont with the word “school” and asked if any of the words needed to be taken off or anything added. Another group asked for everyone to get into a circle and describe the experience in two words. They used words like “hopeful,” “challenged,” “motivated,” “paradigm shift,” “outdoor science,”, and “leading change.” And finally, one group used the mind pie assessment. They titled the mind pie ‘this workshop has…’ and drew 6 parts in the pie. Rocks represented strong confidence, sticks represented mid-confidence, and leaves represented low confidence. The mind pie suggested the teachers were inspired to get out of their comfort zone and were more prepared to start the school year with more outdoor instructional experiences.

Most assessments the faculty used had two purposes; first, to model formative assessments that worked well with experiential learning. Second, to gain an understanding of teacher thoughts and/or progress. These embedded assessments provided an outlet for the leadership team to gain an understanding of what teachers expected or needed and modeled an effective experiential learning assessment for the teachers to modify for use in their classroom.

**BEETLES curriculum.** The program leaders mostly used non-lecture pedagogy with the teachers during the workshop series. There were a couple of times in January and in March when
the leaders used a lecture format with the teachers. These sessions were designed using the BEETLES curriculum. This curriculum was adopted by the GSMIT in 2014 after the primary program leader participated in a BEETLES curriculum training. It combines research-based approaches and tools to improve outdoor learning experiences. When referring to the GSMIT’s use of this curriculum, Nan said, “the BEETLES model gave us more language...” providing more organization to the GSMIT’s existing curriculum (personal communication, March 15, 2018).

The GSMIT faculty led a lecture that was inspired by the BEETLES curriculum. Questioning techniques and types were discussed. Most importantly, teachers were reminded that students come to the classroom with prior knowledge. In March, a constructing understanding lecture was held providing ideas and materials that would help teachers assist students in their progression from observations and questioning to data collection and analysis. This curriculum best meets goal one objective B: connect teachers with the latest research on brain-based science teaching and learning.

Additional strategies. One part of the January morning program was completed outdoors. This took place on the second workshop day in January and lasted about one hour and thirty minutes. Snow and ice covered the ground from the storm that passed through a few days before. The GSMIT faculty began the first activity at the bottom of a set of stairs about 20 feet outside of the front door. Nan asked the teachers to gather around a tree. She then asked them to observe the tree and say two words describing it. She allowed about 20 seconds of silence then began with saying two words about the tree. Each teacher took a turn saying two words about the tree. After the activity, the leader asked if anyone had questions about a word someone had said.
Transitioning effortlessly between student and teacher mode, teachers immediately began thinking about how this activity could be used to introduce something new. A brief discussion on introverts verses extroverts was raised by one of the teachers. They announced, this activity made it easy to include all students equally.

Next, the teachers walked down the sidewalk only about five steps and walked into snow covered leaves. The wooded area they were standing in was approximately 400 square feet and was surrounded by concrete. The faculty led another observation activity with the teachers. They were asked to choose a tree, stand away and look up at it, then walk half way to it and look strait at it, then get as close as possible to it and look at it. The faculty used an animal call to alert teachers to transition between the observation modes. After this activity, teachers were asked to quietly stand in two lines, parallel to each other. Then, while walking to the next activity site, teachers were asked to discuss how they could use the activities in their classroom. This was one of the walk and talk transitions modeled for the teachers.

During the December kickoff meeting and the January meeting, the GSMIT faculty were careful to choose easily accessible areas for activities. The outdoor spaces described above were in view of the activity center entrance; the building that was primarily used during the workshop series. These areas represented an outdoor space that most schools can access. Program leaders were asked during the March interview why they chose these spaces, one noted “we want them to realize that this is the reality that they'll be seeing at school too… you can still find a lot even within close proximity to buildings” (Wren, personal communication, March 15, 2018). The primary leader explained:
There's sort of a fairy tale effect that happens when you're here in the park, and the closest thing to resembling their school is [the activity] building and the processes that happen in the building. So we wanted to be very close to rocks and concrete and cars, but also close to nature too… There were a couple activities that we actually do on the dirt, in the woods, on these little patches, and we chose to just because we wanted them to see that right next to the concrete or even coming up out of the concrete, there's stuff (Nan, personal communication, March 15, 2018).

**Assignments.** Participants were assigned homework that mostly consisted of structured reflections including video and journal reflections. An example of assignments provided via email before the January workshop is located in Appendix K. These assignments were designed to provide documentation of teacher progress throughout the workshop series. Assignments used to meet goal one are described further.

**Solo sit/reflection.** During the December kickoff meeting teachers and administrators convened for less than a day. At this time, all participants were engaged with practical experiences for student-centered learning that they could modify and use in their classroom year-round. After introductions, the GSMIT faculty moved strait into expectations for the workshop. Teachers would be taking small steps toward practicing, rethinking, and improving instruction. After a couple of outdoor activities, all were released until January. Before participants left the campus, they were asked to find a place outside to do a solo sit for four to five minutes. *Solo sits* are a part of the assignments required of the teachers throughout the program. Ideally participants would return to the spot they chose for their solo sit during each meeting. Or, if at home or their school, they would find a designated reflection spot that was outside.
In January, the GSMIT faculty introduced teachers to the art of journaling. The leaders wanted teachers to view a journal as a creation instead of a place to compile prompted thoughts. “There's something different that happens in the brain when you journal, when you have to actually put pen in hand and do it. It's totally different than being on an electronic platform. It makes all the creative centers pulse” (Nan, personal communication, March 15, 2018). To begin the introduction, teachers were asked to take a piece of nature from the sticks that had been placed on the tables. These were the same sticks used in the second Ice, I wonder, it reminds me of activity. The program leaders purposely referred to this a piece of nature to model an activity that would guide students to reaching technical terms. Most teachers chose lichen from all of the sticks as their piece of nature. All sticks had a plethora of lichen on them, and it is very easy to take lichen off the sticks. Teachers were prompted to find a quiet place in the room and to record in their journal. They were asked to describe their piece of nature in a drawing and to label or describe it as much as possible. The program leader reiterated, the idea of the drawing was to express data and information not art or random thoughts.

After a few minutes journaling, the teachers were asked to bring their piece of nature and drawing and stand in a circle. They were then prompted to place the piece of nature in the center of a circle, then place their data (drawings) around the nature piece. Drawings did not have names on them. Next, they were asked to try to match the nature piece with the drawings without saying a word. After the group thought all pieces were matched, the teachers were asked to verify correct pieces of nature were matched without talking. A few removed the nature piece from their journals and then others re-matched them. After all pieces of nature were matched and everyone could talk, questions about unique pieces spilled out of everyone’s mouth. Switching
back into teacher mode, this activity was debriefed with a sharing of how it could be used in a classroom and with different content. This activity modeled how teachers could use journals in an experiential learning environment, how to emphasize observation skills, and how to prompt questions from the students.

The solo sit/journal reflection was the most referenced activity during the study. It was referenced a total of 39 times, 37 times positively and 2 times negatively in interviews and journal submissions. This count was determined using the navigation tool in Microsoft Word. The words “solo sit” and “journal” were used in a word search in all teacher interview and journal transcripts. During the March interviews, most teachers had already integrated this activity into their curriculum, Woods had talked to his administrator “about, possibly using school funds to buy some cheap journals for the kids next year” (personal communication, March 16, 2019). One teacher decided it would be great to use in an out of school program; they recorded the following in their journal while they were participating in a solo sit.

As I walked up here [solo sit spot] this morning, I realized that journaling would benefit the students tremendously. Making observations and drawing conclusions is a big part of STEM thinking and incorporating the journaling practices that we learned here will help the students with that thinking. (Luna, journal entry, March 17, 2018)

Teachers expressed an attachment to their journal and the ownership that it provided. “I love that you do your own book cover and all that stuff, it gives you ownership in it. And I'd like to do that instead of the traditional journals that we’ve done in the past [in their class]” (Oakley, personal communication, March 16, 2018). One teacher was fortunate enough to receive a grant that was used to provide her classes with personal journals. However, a couple of teachers were
not receptive of the journaling. Sierra reported in a follow-up interview, “I felt like I was being forced to pull something out of myself every time we were supposed to do a solo sit,…so it was almost more stressful for me, because I'm not really a writer” (personal communication, November 13, 2018). Sparrow reported she “tried this (solo sit) with my 8th graders and it didn’t work. Students did not take it seriously and would not focus” (personal communication, December 11, 2018). Then there were teachers who did not get the response they wanted the first time but continued to implement it. Doc started her students “out with 30 seconds…then we did a minute, then two, and five, eight, and I think we went up to 11” (Personal communication, November 13, 2018). Fox described how she used solo sits in her classroom. She asked her students to choose a tree on the school grounds and asked students to draw it and “describe the bark, because when we come out here you're going to have to find your tree.” She then described how her student’s perception of observation and reflection changed:

It opened up a lot of conversations at first that they [the students] thought it was weird. Like I'm going to sit with this tree, meet this tree. I'm like come on, just try it, and then now they're like, "Can we go do a solo sit with our tree now? I really want to see how it changes, how it's changed," so I'm interested to see, when we come back from break and take them back out there, what has winter done to your tree? Things like that, and then in the spring, when it starts popping out, and one person said, "I can't wait to come back and see my tree when I'm a senior. This is going to be my tree," and I'm like, "I had no idea that it was going to have such a profound effect," so yeah, I did like the solo sits (personal communication, December, 10, 2018).
One of the program leaders described a solo sit as a way to make students slow down, think, and process what they have learned.

You have the time to sit quietly and observe and process things internally that you're learning, that you're discussing, so the concept of a solo sit, essentially, is very important to kind of reduce a lot of that noise. But then added on to that is the importance of reflecting with specific prompts and writing down your thoughts and sort of processing on paper is very important to help kind of work through things, to solidify the things that you learned (Wren, personal communication, March 15, 2018).

Reflection was a major piece of the workshop series. Teachers were asked to visit their journals after most evening meetings adjourned. It was highly suggested these reflections be done alone during a solo sit. This reflection piece provided the GSMIT faculty with a form of embedded assessment and provided teachers with an outlet to digest the information presented to them.

The workshop series ended with reflection during a hike to the local Spruce Flats Falls. On the way to the falls, the GSMIT leaders demonstrated ways to encourage students to drink water; like a toast to nature. They also stopped at different places to discuss the usual hiking procedures when students are present. Once everyone reached the falls, there was a time to relax and reflect. On the way back, the program leaders stopped about halfway through the hike in an open area and debriefed the workshop series. Again, teachers were asked to reflect as they took turns summarizing the entire experience with one word. The final activity teachers participated in was a solo hike. Everyone walked back to the activity building, with approximately 20 yards between them, so that they could not see each other on the winding trail. During these moments, teachers were encouraged to think about all the have learned and all they will implement in their
classrooms, however, they were not asked to meet in a group to discuss. The solo hike was a personal closing reflection.

**Site map.** Teachers were assigned a site map inventory that was to be completed between the kickoff meeting and the January meeting. This document carried discussion during the January workshop meeting and allowed the GSMIT faculty to assist in the development of the citizen science projects. Participant teacher groups were asked to evaluate the outdoor learning space at their schools. The assignments required them to draw a school site map highlighting their outdoor resources, then describe natural phenomena, limitations, materials, support, and ideas for use. An example is provided in Appendix L.

For the natural phenomena, teachers listed what was drawn on their maps, for example; trail, creek, greenhouse, garden area, and outdoor classroom. Limitations included outside teaching materials, alignment to standards, support from other teachers, green spaces made then abandoned, not enough class time, managing students, stinging insects, proper clothing, poison ivy, no railings on bridge, and weather. Limitations (negative aspects) were more prominent in the assignments than the accessible natural phenomena (positive aspects).

In January, teachers participated in lessons outdoors and in collaborative discussions on the potential of available outdoors spaces. The outdoor lessons could be adapted to all content and grade levels, were intended to model surroundings that are similar to outdoor spaces at schools, model time management strategies, and the previous snowfall provided a model for weather adaptation.

Finally, before the March meetings, the GSMIT faculty visited the schools to conduct professional evaluation and coached teachers and administrators on aspects that were overlooked in their available outdoor space. One elementary teacher stated:
...before I came here, we just went outside and took tests...but then a couple of weeks ago we went outside for adjectives and I did all the stuff that they [the GSMIT faculty] had me do like go find an item that relates, bring it back and talk about it. Having the kids be more like the teacher in a discussion led lesson instead of ‘lets just go sit outside’ (Spruce, personal communication, March 16, 2018).

When teachers began this assignment, they placed most of their focus on limitations instead of what they had available to them. After visiting one of the schools, a program leader described a personal conversation with the teachers,

“We were like, ‘oh my gosh, this is amazing,’ and they were like, ‘you think so?’ and I’m like, ‘yeah, do you see...you’ve got mayflies, you’ve got dragon fly larva. You don’t see any of these things?’ They were like, ‘no’. All those teachers could see were things the kids could get hurt on, opportunities for misbehavior.” (Nan, personal communication, March 15, 2018).

This assignment revealed a noticeable perspective shift within the teachers. This perspective shift was specific to the teacher’s views of the natural phenomena within their schools’ available outdoor spaces. Change in perceptions of outdoor spaces were more apparent after the GSMIT faculty evaluated the space. In March, teachers provided testimony of a more coherent understanding of how to use the natural phenomena that was available in their school’s outdoor spaces.

*Video reflections.* Teachers were also asked to submit individual videos of their instruction and reflect on them. This assignment was adapted from the National Boards Certification program. Its purpose was to help develop professional practices through the process
of reflection. This assignment was used to assess the transferability and usefulness of workshop training into classroom activity. Teacher reflections of videos were prompted with questions such as: (a) What did you do well? (b) What can you do better? and (c) What is one piece of constructive criticism you would give to yourself? These reflection prompts were not submitted to this study, only the videos. These videos were used in a stimulated recall follow-up interviews that will be discussed further under research question three.

Goal one was met through the pedagogies and assignments mentioned above. Some of the strategies mentioned above overlap with goals two and three; however, they best fit intentions for goal one. Most of the objectives for goal one were met by the end of the January workshop, with exception to objective E, which was met in March. To further emphasize unique aspects of goal one, the I notice, I wonder, it reminds me of activity, modeling and practice of formative assessments, demonstrated use of journals for reflection and data collection purposes in all content areas. The site map inventory assignment were among the most powerful experiences of the workshop series. The reflections and site map inventory assignment also contributed to a perspective shift that is further supported in research question three.

Goal Two

Teachers were provided strategies that led to increased confidence in using science and engineering practices and current data and monitoring techniques. These strategies included information on the newly released Tennessee State Science Standards, in addition to time to plan, practice, and reflect on the use of them within outdoor instruction. Related activities in coherence with practice with citizen science pedagogy provided an impactful experience. The structure of goal two will be organized by objective A-C. The alignment resulted in all but one of the
objectives in goal two being met. Objective D was met when the program leaders selected the sample and was discussed under research question one. Goal two follows:

Goal 2: Teachers understand and feel confident using local, accurate, in-depth content on water, watershed and related environmental issues.

Objectives:

a) Engage teachers in linking water/watershed issues to TN Academic standards aligned with Next Generation Science Standards (NGSS) and the Tennessee Environmental Literacy Plan (ELP).

b) Use current data and monitoring techniques to demonstrate accessibility of tools and resources.

c) Train 6 Teacher Teams from 6 schools (2 teachers from each school) on relevant, hands-on citizen science projects that contribute to their understanding of water and watershed issues while engaging students in authentic scientific research. The teacher teams will attend all planning meetings, park visits, and the full residential workshops.

d) Build a support network for the teachers and schools by seeking one to two administrators from each school to participate in the stages of planning, implementation, and future thinking.

Objective A. According to the alignment objective A was met at 83% IRR. The Tennessee Science Standards are the standards described by objective A. There were many documented activities that suggested teachers were engaged in these new standards. During the first morning meeting in January, the teachers were engaged in activities outdoors. After program leaders
addressed general classroom management, they turned the focus to two primary concerns of teachers; meeting academic standards and time management. Teachers were transitioning between outdoor activities on the snow-covered ground. They were walking in two parallel lines, participating in a walk and talk. As the program leaders approached an open area, the teachers were asked to form a circle. At this point, the time and standards concerns that were expressed by the majority of the teachers in the application and kickoff interviews were directly addressed. The leaders asked teachers to name excuses they have said for not going outside. After time and standards were mentioned a couple of times, they were directly addressed. The program leaders challenged the teachers to move past those excuses, then a discussion began to unfold. One teacher even took the time to share a testimony of a recent math activity and assessment that she taught outdoors. She emphasized that the students finished the assignments with extra class time to spare, so they were allowed to enjoy some quiet reflection time.

One reason the teachers were concerned about the standards was the Tennessee Academic Standards for Science were new to the teachers. Many had not seen them yet. These standards were required to be implemented for the first time in the fall of 2018. When planning this workshop, the GSMIT faculty were aware of this major change for science teachers and they planned a time to specifically address the new standards. During the afternoon of the second day of the March meeting, teachers began working with the new standards. Not all teachers taught science, but all teachers were asked to participate in the activity because the science standards are generally the most convenient to link to watersheds and water related issues.

One of the GSMIT leaders gave a history about standards and a short introduction discussion was held. Teachers then divided into their teams to work. They were given a science and
engineering practice from the new standards and were asked to quickly design a lesson with it. The science and engineering practices (SEP) include: 1) asking questions and defining problems, 2) developing and using models, 3) planning and carrying out controlled investigations, 4) analyzing and interpreting data, 5) using mathematics and computational thinking, 6) constructing explorations and designing solutions, 7) engaging in argument from evidence, and 8) obtaining, evaluating and communicating information (Tennessee Academic Standards for Science, 2017). Each team shared their lesson ideas. Then the teachers moved outside to work on designing lessons for a couple of the new standards. They were asked to take two pictures using their phones, of either habitat or adaptation. These standards are present in the Tennessee Academic Standards for Science for all grade levels. The teachers spent about five minutes separately taking pictures. Then they gathered back and chose their favorite picture, presented them to each other, and spoke about how they could use the object in the picture to teach multiple ideas about habitat or adaptation.

Next, a program leader handed out a piece of paper that had crosscutting concepts (CCC). These include 1) pattern observation and explanation, 2) cause and effect relationships, 3) scale, proportion and quantity, 4) systems and system models, 5) energy and matter conservation, 6) structure and function of systems, and 7) stability and change of systems (Tennessee Academic Standards for Science, 2017). She asked which of the CCC’s best fit the individual ideas the teachers had just presented. Each teacher spent a few minutes deciding then they presented their thoughts to the group once again.

Last, the four Disciplinary Core Ideas (DCI) were discussed. These DCI’s provide organization of content and include 1) Physical Science, 2) Life Science, 3) Earth and Space
Sciences and 4) Engineering, Technology and Applications of Science (Tennessee Academic Standards for Science, 2017). The GSMIT faculty had printed the standards for each DCI and then cut the standards into individual strips. This made it easier for teachers to grab one or two standards while saving paper resources. At this point, teachers were asked to work in their teacher teams. The teacher teams chose standards, used the CCC’s and SEP’s and pictures they had worked with to develop a lesson using the standard(s). Teachers disbursed to a quiet place for about 20 minutes to do this. Then everyone gathered one more time to share how to use standards and the components of the cross curricular concepts and science and engineering practices.

One group incorporated multiple standards and integrated reading, math, and science. Teachers verbally appreciated this activity. Sal mentioned, for his elementary classes “it makes it easier to look at a science standard and incorporate it into a reading standard as opposed to the opposite”, which is what he had always done before (Observation notes, March 17, 2018). This was the first time some of the teachers had seen the Tennessee Academic Standards for Science and within one afternoon they had planned a lesson that incorporated SEP’s, CCC’s and DCI’s. Additional time to work more on lessons was allowed later in the evening after a discussion about Wiggins’ (1998) UbD planning strategy. Program leaders encouraged teachers to begin working on lessons that link to water shed and water related issues, however, this was not a strict requirement.

Although teachers still had concerns about standards during the follow-up interviews, the language of the responses changed. Between the December kickoff interviews and the application responses, all of the schools referred to foreseen challenges with standards and time
management. After January, time concerns for implementing outdoor, experiential lessons was not further mentioned as a challenge. Furthermore, the teachers were more focused on “how to incorporate the outdoors and standards” or “which standard to focus on…” in January (Spruce and Oakley, journal entries, January 2018).

Time management and standard concerns were addressed in January and practiced in March. After practicing, teachers seemed more at ease with the new standards. According to the follow-up interviews, only two teachers mentioned concern with efficiently meeting the standards when outdoors. One group of high school teacher teams still struggled with “how to get those state tested courses outside more” (Woods and Fox, personal communication, December 10, 2018), Insinuating they do teach courses that require standardized testing outdoors, but they would prefer to go out more often. Another high school teacher team seconded this “…biology and AP environmental science, the curriculum is so broad, and I still do not take students out as much as I would like, because I feel I have to be in the classroom teaching” (Sierra and River, personal communication, November, 12, 2018). Their subjects that were not tested, Wildlife and Ecology, were reported to be simple to take outside. An elementary teacher team said, “We have learned from experience, it [tying science and engineering practices into a lesson] gets easier each time we implement a lesson” (Luna and Spruce, personal communication, December 11, 2018). By the end of the workshop series all teachers were comfortable with time management and standard implementation for experiential, outdoor education.

Objective B. Objective B was not met according to the alignment. Again, this is a result of observation field note error as reviewers did not have access to enough details of the activity. When teachers were engaged in the citizen science activities, they were collecting and
monitoring data using various resources. These scenarios were not adequately described in the observation field notes to signify the use of current data and monitoring techniques to demonstrate accessibility of tools and resources.

Each teacher group was tasked with designing a citizen science project to be completed on their school grounds. These projects were required to include data collection for the local watershed. These units were to be completed after the workshop experience ended in June. To prepare teachers for this project, the GSMIT leaders exposed them to some of the citizen science lessons they use on campus. Aspects of citizen science were introduced in January and expounded upon throughout March and June.

In January, the program leaders introduced citizen science through a historical timeline and its uses on the GSMIT campus. Then, teachers were led in a full CS activity. This activity was modified from the BEETLES curriculum to best fit the resources at the GSMIT, particularly Tremont’s learning cycle. This learning cycle (Figure 3) portrays information in a personal, local, and relevant way that invites students to explore, wonder, create, reflect, and share. This cycle had been provided to the teachers in a folder during the workshop experience. The program leader prefaced the activity by informing the teachers they would be engaged in a full citizen science lesson that is regularly conducted on the campus with school groups. The entire activity usually lasts between 2 and 3 hours. It was important that the teachers understood it was not a good idea to start with the whole experience they were about to embark on. Instead they were encouraged begin with pieces in their class then build up to the full experience when comfortable. “Citizen science is a great tool for learning science, it empowers student scientific literacy” (Wren, personal communication, March 15, 2018).
Outside, the leader established boundaries for the teachers. They were bound by the road, driveway and gravel on two sides. Minimal supplies were provided, only a small, clear box that had a magnifying lens in the lid. Little instruction was given, teachers were shown the boundaries, then simply told to go find a critter. Teachers explored for about 15 minutes. They were pulling up sticks and turning over rocks and scratching through leaf litter to explore. After finding a critter, teacher groups were asked to get to know their object and record interesting data in their journals. These observations led to a sharing session called the *cool critter convention*. For this part of the activity, half of the teacher groups stood in a circle while the other teachers visited them to ask questions about the critters “on display.” Then the groups swapped roles. Journals were used a final time to record questions for later discussion. To debrief this activity, the boundaries, instruction provided, and supplies were discussed. Some teachers said they would have preferred more instruction and others preferred the minimal amount. The program leader emphasized the importance of the amount of instruction given and how it relates to individual groups of students.
On the last day of the January meeting, the faculty demonstrated a second CS activity that is used often on campus. It could also be easily modified at a school that has access to a water source. The activity is called stream explorations or stream ecology, depending on the age of the students. Stream ecology is more advanced and contains more instruments and mathematical practices for data collection. During this activity, the faculty demonstrated the cooperative teaching model as Wren led half of the group with abiotic factors while Nan led the other half in searching for macroinvertebrates in the river. This activity is an example of the overlap between grant goal objectives. Goal one objective E was demonstrated along with goal two objective B. Teachers would be collecting data and recording the data using tools available to them. These tools included, nets, buckets, hand lenses, identification charts, and small insect/critter boxes.

Before splitting into groups to compete the activity, the faculty introduced the activity with a discussion about watersheds and related content to model accessing prior knowledge and constructing understanding. All of the data collected could be entered into a citizen science data collection platform called Hands on the Land. Entering the data was demonstrated indoors. Teachers were encouraged to use this platform for the unit they would be designing for their school. Wren expressed the importance of teachers seeing the whole process because designing a CS unit and entering data into an established data base is a requirement of grant goal 3. “We wanted them to understand how to do it and how readily it could be done with relatively few tools” (Wren, personal communication, March 15, 2018).

Two of the schools involved in the workshop experience did not have direct access to a water source. Therefore, in March, the faculty demonstrated other CS projects for these schools. The leaders called this demonstration of these projects the citizen science sampler. These activities are also common on campus. The teachers divided into three groups of four. Each
group was led by a program leader. The groups participated in a sample of the activity for 20 to 30 minutes then rotated to the next activity and repeated the process. Nan, Wren and Scout all led a different activity. The activities consisted of lichen monitoring, snail monitoring, and terrestrial macroinvertebrate monitoring.

After the CS sampler, teacher teams were asked to develop questions that may prompt exploratory investigations. These scientific questions were discussed as faculty visited teacher groups. Faculty specifically asked teachers whether their questions were testable or non-testable. After these discussions, teachers were asked to form three larger groups and decide on a testable question that could be used to develop a lesson. Program leaders continued to visit the teacher groups to discuss and approve the questions chosen. Teachers were then asked to develop a research plan that could be completed in 15 to 20 minutes at the GSMIT with the resources that were used in the citizen science sampler. After the research plans were designed, each group taught the other groups their activities. Finally, after teaching the three lessons, the groups that designed the activity were asked to analyze the data collected while they were teaching and present it. Much like they would have their students do in the classroom. The purpose for this was to model how to incorporate full inquiry and student led investigations into the classroom.

In June, the faculty focused on activities that revolved around stream ecology and soil. After the teachers arrived for the June workshop series, they participated in a stream investigation. Before this investigation began, the naturalist, who was demonstrating the cooperative teacher model alongside the program leaders, was able to model a way to handle an unforeseen teachable moment. Before getting into the water to explore, Nan was modeling how to catch salamanders and other macroinvertebrates. During her instructions, a teacher quietly pointed out a small snake to the naturalist because they were concerned. The naturalist provided
an example of how to turn this opportunity into a teachable moment. Nan’s instructions stopped and then all focus was on the snake that was now in the naturalist’s hands. The naturalist allowed teachers to touch and even smell the snake while he discussed the role snakes play in the environment, then he released it at a further distance from the area of the activity. After this moment, Nan finished the instructions and the activity was back on track. While in the water, teachers collected macro-invertebrates and were prompted to ask questions that would spark student curiosity. After collecting some macroinvertebrates, teachers gathered to discuss then were asked to return the invertebrates.

On the second June workshop day, all activities seemed to revolve around soil. There were no activities that were specific to collecting data to enter into a CS database, instead there were suggestions provided. Faculty demonstrated bringing the outdoors inside by discussing ecosystems then having the teachers separate soil into living matter and decomposing matter. After this, teachers headed outdoors for an activity called decomposition mission. Groups were asked to locate different objects and place them in order of least decomposed to most decomposed. Many of the teacher teams used leaves and gumballs from the forest floor. For example, leaves were ordered from those that may have recently fallen from a tree, to leaves with holes in them, to leaves that only consisted of veins. There was a clear change in color from green, to yellow, orange or red, then to brown.

Consistent with the soil topic, faculty began modeling activities that demonstrated erosion. Teachers were asked to use natural materials to prevent a pile of dirt in a paint tray from sliding when water was poured on it. This activity lasted about 20 minutes. A water can was used to simulated rain and the group with the least amount of dirt at the bottom of the tray won. Last, during the final evening session of the workshop series, teachers gathered around a table to use
soil testing equipment. Teachers had been asked to bring their own soil from their school or their house to test. They were shown how to use the soil testing equipment. While exploring the equipment, teachers brainstormed and discussed how to use the equipment in their classrooms. This was a very organic and relaxed conversation.

**Objective C.** The alignment suggested, objective C was met at 67% IRR; this objective is broad and is technically met through the entire performance of the professional development series. All lessons contributed to the objective. As described above, six teacher teams (at least two from each school) participated in citizen science projects that contributed to their understanding of water and watershed issues while engaging in authentic scientific research. Teachers also visited two areas of the Great Smoky Mountains National Park. Foremost, all meetings for the workshop were hosted at the GSMIT, which is located in the GSMNP. Second, teachers took a trip to Cades Cove. Cades Cove is about a 25-minute drive from the GSMIT. This cove is a historical landmark in the Great Smoky Mountains National Park. It hosts millions of visitors each year, resulting in the necessity of a stronger effort to preserve the natural habitat of the cove. While visiting, the teachers met with two national park rangers, sampled water for E. coli, and discussed how this monitoring technique could be used in a classroom. Then the group walked to a campground to remove unnatural rock dams. These activities were used to model how teachers could involve their classes with environment sustainability in the Great Smoky Mountains National Park. The broad scope of this objective leads to a broad explanation of how it was met which will be further summarized throughout this chapter.

Goal two was met using different pedagogical strategies related to the Tennessee Academic Science Standards and citizen science that led to teacher understanding for using local, accurate, and in-depth content on water related issues. Some of the strategies mentioned above
overlap with goals one and three, however, they best fit intentions for goal two. Further explanation of overlap will be address within discussed strategies for meeting goal three.

**Goal Three**

Goal three is mostly outside of the scope of this research, but aspects of each objective were met. The alignment suggested only objective B of goal 3 was met. Instead, objectives A and part of B were met. Part of objective B and objective C is in progress and is outside of the scope of this study. Discussion for how goal three was otherwise met will be structured using the objectives. Goal 3 follows:

Goal 3: Each Teacher Team develops a student-centered curriculum unit using a planning framework, such as UbD, to addresses water and watershed issues, and culminates in a community project.

**Objectives**

a) Tremont Institute and park staff will create an effective toolkit that guides teachers through the process of design and implementation.

b) Facilitate brainstorming sessions during each workshop that result in moving each school’s curriculum unit plans forward, with specific goals and assignments for each of the three workshops. Teachers implement curriculum units in schools.

c) Community citizen science projects implemented.

**Objective A.** The afforded tool kits were not clearly recorded in the field notes that were used for the review of alignment. Before the June workshop meeting, teachers were asked to submit a resource request list. This request was suggested to coincide with the plans for the CS curriculum unit they would plan. The program leaders viewed the requests and ordered resources
for the teachers. Each teacher team had a pre-determined budget for these resources. These toolkits were provided as a gift on the last day of the workshop series. They consisted of materials that were requested by the teacher groups. Items in kits included nets, hand lenses, specimen identification guides, soil testing equipment, and observation containers. Each school that participated in the follow-up interviews reported at least one teacher using the resources during the fall 2018 school semester. Two of the schools reported other teachers, not involved in the workshops, using the resources as well.

**Objective B.** According to the alignment, objective B was met with 45% IRR. This objective must be viewed in two parts because only one part of it was met within the scope of the workshop series. Part one: Facilitate brainstorming sessions during each workshop that result in moving each school’s curriculum unit plans forward, with specific goals and assignments for each of the three workshops, and part two: teachers implement curriculum units in schools. Part two was not met within the workshop series. It was intended to begin implementation in the spring of 2019. To say the entirety of part one was met is a stretch. The GSMIT faculty did provide brainstorming sessions during the March and June workshops, however the program leaders were never explicit in these sessions being used to move the CS units forward. There were no exact assignments for each of the three workshops that clearly related to the unit plans. All activities and brainstorming sessions for planning were directed toward general lesson plans.

The only time a brainstorm activity was specifically set aside for moving the teacher team unit curriculum forward was during a night session at the March workshop meeting. UbD was discussed, however, implementing it in curriculum planning was not strict. While teachers were working on this assignment, program leaders were absent from actively assisting teachers. One teacher group became frustrated saying “screw this format, it [UbD] is confusing, let’s just plan
the way we know how to plan” (observation notes, March 17, 2018). UBD was not revisited again in the entirety of the PD program. With this said, UBD was not a required planning framework to use when planning the units, it was only suggested.

Each teacher team did begin brainstorming a student-centered curriculum unit to address water related issues but the finalization of this unit was to be completed outside of the scope of this study. A tool kit was provided during the June workshop, meeting objective A, however, objective B was not fully met. Brainstorm sessions only occurred during two workshops, as opposed to all three and only one of those sessions specifically requested teacher teams to think about the CS units. Although brainstorm sessions were present, there was no evidence of these sessions moving each of the unit plans forward. Goal three was not fully met for two reasons. First, part two of objective B and objective C were not within the bounds of this study. Finally, evidence for meeting the first part of objective B only existed in two of the workshop meetings, more specifically in the March workshop meeting than the June meeting.

The GSMIT faculty intentionally revisited the components of the workshop that were most important to them. For example, the I notice, I wonder activity was revisited every workshop meeting. Each time, it was altered to best fit the content or context of the topic. This repetition was intentional, especially for the pedagogical strategies that the program leaders were introducing to the teachers. This scaffolding of the learning was made evident by the GSMIT faculty:

> Once you practice a routine or a series of words that is now something you want the student to take hold of and use, you make it more casual. It's now integrated. It's no longer this new thing…. it's a tool. It may not be as noticeable to some of the folks taking
the workshop, but we're real intentional about what we've done and then how we follow-up on that (Nan, personal communication, March 15, 2018).

This overlap in pedagogy is contributed to the structure of the presented results for research question two. These scaled workshops were intentionally planned so teachers would learn different ways to practice the pedagogies and develop an understanding of them, leading them to feel more confident and understand the power of experiential, outdoor education. The length of the Cit. Sci. 2.0 program afforded the luxury of this scaffolded structure. Length, along with other unique aspects of this program will be explained under research question three. Scaled pedagogies and assignments that overlapped for goals one, two, and three include: the I notice, I wonder activity, the Cooperative Teaching Model, formative assessment for outdoor spaces, transitions for changing from indoor to outdoor spaces, reflection/journaling, site map inventory, and citizen science lessons. To further emphasize the contribution of goal three, the tool kits provided produced a convenience in encouraging other teachers at the schools to participate in outdoor instruction. Encouraging these teachers to buy-in to this type of instruction also benefited the participating teachers in additional support for taking their students to visit the GSMIT as further described in research question three.

Summary

Overall, the program leaders did deliver a curriculum that aligned to the planned curriculum. Goals one and two were fully met. Only one part of an objective related to goal three was not met. Although the leaders facilitated brainstorm sessions for teacher teams to plan their CS curriculum unit, these sessions were not evident in all three workshops as the planned curriculum suggested. Additionally, there was no evidence that the unit plans were moving
forward during the program meetings. Furthermore, the program leaders did not include the teachers in activities or assignments that were outside the framework of the planned curriculum. This provides evidence that all components of the Cit. Sci. 2.0 workshop series were thoughtfully planned, corresponding to the grant goals.

**Question Three**

Although I have discussed some of the impacts the Cit. Sci. 2.0 pedagogical strategies have had on participant classroom instruction, research question three will dive into more specific outcomes as related to the impact of the delivered curriculum. The impact of the workshop experience is explained through two aspects, support provided by the GSMIT and growth in understanding and confidence of the teachers. Research questions one, two, and three are closely linked, in that the grant goals (question one) were used to plan the program (question two) and within that plan, the program leaders aimed to provide teachers understanding and confidence for outdoor, experiential education and CS related to watersheds while establishing a support network for implementing this instruction (question 3). Impact of the support provided and evidence of the program affecting teacher confidence in implementing experiential, outdoor pedagogies will be delivered respectively in this section.

**Support Provided**

The program leaders planned to sustainably impact teachers by supporting them three primary ways. The length of the Cit. Sci. 2.0 PD program, the inclusion of multiple teachers and administrators from each school, and financial and material resources were all predetermined means of support for the teachers involved in the program. Each of these support tactics will be explained in this section.
**Program length.** The length of the workshop series impacted teacher confidence in implementation of the practices modeled in a scaled manner, providing more practice and reflection. It also established a perspective shift made evident by the site map inventory assignment. The entire training experience lasted nearly six months with ten days of face-to-face training meetings and various meetings through email and school visits. As mentioned in research question two, the pedagogies used by the GSMIT faculty were used repetitively to increase normality and comfort in experiential, outdoor instruction. The length of the workshop allowed the program leaders to track implementation of the knowledge gained during the PD. Teachers began expressing comfort with the top challenges mentioned in research question one (Table 3) during the March workshop series. This meeting occurred over three months after the initial kickoff meeting. At this point, teachers had four days of face to face training and a little over two months to implement new practices in their classrooms.

Practicing pedagogy decreased teachers’ perceived challenges that were mentioned before the PD began. During the March PD meeting, the teachers began expressing comfort with the top challenges mentioned in December, time management concerns, linking outdoor lessons to standards, student behavior management, and the teachers’ ability to successfully utilize resources in the outdoors. When asked for a challenge that teachers faced when taking students outdoors between December and March, only two of the schools mentioned they continued to struggle with time. For both of these schools, the time issue was not a lack of ability to plan, it was an internal issue within the schools. One school was an elementary school and the other a high school.

The elementary school teachers were only allowed twenty minutes a day to teach either social studies or science. Many of the instruction at the GSMIT is modeled through the lens of
science, therefore, the teachers struggled with getting students in and out during the allowed twenty minute time frame. These teachers did use the instructional strategies in other subjects like English and mathematics. One of the teachers used their outdoor space for an adjective lesson. Another used the experiential learning pedagogy indoors and received credit for their progress. The quote below is from an email that was sent by Luna, a 5th grade mathematics teacher to the GSMIT on March 7th, 2018.

First, I just want to say the culture of my classroom has totally changed. By coming to Tremont and learning how to start open ended questions, and learning myself, that it is okay for students to have the wrong answer and work through that productive struggle, I have had a breakthrough in my career…I would like to say it is partly me, but training my kids to learn from each other, and having them coach each other has made such a difference.

This school had also lost weeks of instruction time due to widespread flu cases and snow days. So, at this point in the PD, time management may have been an issue made responsible by pressure from with-in the unfortunate school culture. Fortunately, the 20 minute time slot did change for the 2018 - 2019 school year.

The high school found interruptions to be a challenge for time to teach outdoors “…whether it’s three sick days, four snow days, drills…we have lost so much class time…going outside is an extra loss of class time, even though it’s effective. It’s worth it, but it is a loss of time” (River, personal communication, March 16, 2018). Although only two schools continued to mention struggling with managing the time it takes to teach outdoors, half of the schools mentioned student apathy as a new challenge for them. Students reportedly complained about the weather, or getting dirty, or actually having to participate as opposed to sitting and listening to
the teacher lecture in a familiar environment. This new concern was alleviated with more practice. According to various follow-up interviews, students complained less often with more exposure to experiential, outdoor instruction.

The length of the workshop provided program leaders with the ability to assess teacher impact through reflection. Reflection components included prompted journal reflections and video reflections. Video reflections will be discussed in a later section of this chapter. For now, the journal prompt that provided evidence of teacher impact from the length of the program will be described.

At the conclusion of the first day during the January meeting, the GSMTP faculty asked the teachers to locate a blank page in their journals and to draw a vertical and horizontal line down the middle of the page. These lines divided the page into four sections. At the top of each section teachers were asked to respectively write the word(s) know, don’t know, excited about, and nervous about. Then the teachers were prompted to write at least one answer to the following questions in the respective section (a) What do I know? (b) What don’t I know? (c) What am I nervous about? and (d) What am I excited about? (Appendix N). This reflection was based on teacher’s personal views of their own practice and was revisited during the March and June workshop meetings. During the follow-up interviews, teachers were asked the same question. They were asked to say the first thing that came to mind when the phrases were called out by the interviewer. By December 2018, 13 of the 14 teachers were actively participating and 10 of the 13 accepted interviews. Answers to each section of the prompt have been reduce to a timeline represented in the following tables.
For each prompt, the researcher collected all responses and categorized them based on the topics that were mentioned. Each prompt provided such broad answers, resulting in different topics associated with the prompts. Therefore, all prompts: *know, don’t know, nervous about,* and *excited about* are analyzed separately. The topics organizing the categories are based on the challenges and needs that were perceived by teachers early on, and how the majority of the teachers answered the prompts. Although there is no strict coding protocol for these prompts, all responses contained vocabulary related to the organizing topics. For example, the topic for what teachers know about outdoor, experiential instruction only includes responses that mention instruction related to experiential learning or instruction in outdoor spaces. Conclusions from each prompt are based on the number of answers provided during each workshop and the follow-up interview prompts. In other words, there were four different occasions that teachers were asked to provide answers to this journal prompt. Each of those occasions are represented with the number of times topic was mentioned and the percent of response during each prompt. Percent of responses was used because of the varied amount of response for each prompt. The answers to the “know” section of the journal prompt were categorized into 3 topics: outdoor experiential instruction, activities presented at the GSMIT, and other (Table 5).
Table 5

*Journal Prompt - Know*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Outdoor experiential instruction</th>
<th>Activities presented at the GSMIT</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Phrases</td>
<td>“We now feel comfortable getting our students outdoors.”</td>
<td>“I know norms on how to take kids outside.”</td>
<td>“Don’t give up.”</td>
</tr>
<tr>
<td>I know “of the value of experiential learning”</td>
<td>“I know norms on how to take kids outside.”</td>
<td>“Student’s want to know why they are learning.”</td>
<td>“Make it [lessons] relevant.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Outdoor experiential instruction</th>
<th>Activities presented at the GSMIT</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>January (30)</td>
<td>4</td>
<td>13.33%</td>
<td>2</td>
</tr>
<tr>
<td>March (3)</td>
<td>3</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>June (2)</td>
<td>1</td>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>Follow-up (10)</td>
<td>7</td>
<td>70%</td>
<td>2</td>
</tr>
</tbody>
</table>

Answers to the “know” section of the journal prompt. Blank spaces represent no response. The total number of responses is in parenthesis beside the month.
The timeline above demonstrates the responses for what teachers know about their own practice trended toward being more specific to outdoor, experiential education. In January, teachers mentioned general items they knew about teaching more often than specifically referring to outdoors or experiential learning. In March, all responses mentioned connecting and constructing learning through experience, however, this concept was fresh on the teacher’s minds as it had been embedded in the activities presented at the GSMIT during that meeting. Because the phrases were more specific to learners constructing understanding through experience than mentioning an activity by name, these responses were placed in the outdoor, experiential teaching topic timeline.

There is also attrition in responses made. In January for the first prompt, teachers tended to make a list of what they knew. This is the reason for the high number of responses from 14 different teachers. In March and June, teachers were asked to record these responses in their journals but were not given a set time to do this. It was more of an encouragement at the end of the day instead of direct instruction with time provided to complete the specific task. Those who did record responses in their journals only jotted down one item, instead of a list of items. These two reasons may contribute to the low response rates in March and June. Information presented in the following tables related to this prompt was equally impacted by the low response rates in March and June.

Information about what the teachers don’t know is included in Table 6. Responses were categorized into five topics: standards, classroom management, financial support, school buy-in, and other. Each of these topics are respectively related to the concerns expressed in the
applications and December interviews (Table 3) connection to standards, teaching practices/methodology/activity ideas, resources and content support, and other.
Table 6

*Journal Prompt - Don’t Know*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Classroom Management</th>
<th>Financial Support</th>
<th>School Buy-in</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Phrases</td>
<td>“Still concerned with how this meets my standards.”</td>
<td>“How to do activities with large groups.”</td>
<td>“How will I get materials?”</td>
<td>“Getting other teachers on board.”</td>
<td>“I am not sure how to always provide opportunity for students to build on prior knowledge, especially at their own pace.”</td>
</tr>
<tr>
<td></td>
<td>“How to get those state tested courses out more.”</td>
<td>“How to manage behavior with taking them [students] outdoors.”</td>
<td>How am I going to make it all happen financially?”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Time management.”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>January (29)</td>
<td>7</td>
<td>24.14%</td>
<td>12</td>
<td>41.38%</td>
<td>1</td>
</tr>
<tr>
<td>March (3)</td>
<td>2</td>
<td>66.67%</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>June (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Follow-up (12)</td>
<td>3</td>
<td>25%</td>
<td>1</td>
<td>8.33%</td>
<td>3</td>
</tr>
</tbody>
</table>

Answers to the “don’t know” section of the journal prompt. Blank spaces represent no response. The total number of responses is in parenthesis beside the month.
To summarize, teachers’ responses to the “don’t know” part of this reflection prompt revealed concern for classroom management that seemed to be mostly alleviated during the March workshops. As mentioned in research question two, management concerns were directly addressed at this time. The concern for standards was addressed during this time as well, however, concern for teaching state tested courses outdoors and for integrating high school social science continued to exist. As noted in the table, all three of the teachers who still had concerns about meeting standards using outdoor, experiential instruction were high school teachers who taught state tested subject matter. Each of these teachers noted they take these students outside for learning experiences, it just did not happen as often as the other courses they taught. Further questioning with these teachers during the interviews led to evidence that these teachers are taking their students outside, just not as often as they would like. Teachers who did not teach a course that was state tested seemed more comfortable teaching outdoors. Furthermore, as teachers began planning a field trip to the GSMIT with students, their concern for financial support and colleague buy-in grew.

To continue with a similar tone, the “nervous about” prompt will be addressed next. There is a similar trend with the comments about standards and classroom management except more teachers admit to being nervous about classroom management instead of not knowing how to handle it. The most intriguing data in Table 7 is the teachers were nervous about failing in the early part of the PD program. Eight comments about failing were recorded in the January prompts. After March, teachers were not concerned about failing at all.
### Table 7

**Journal Prompt - Nervous about**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Classroom Management</th>
<th>Failing</th>
<th>School Buy-in</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Phrases</td>
<td>“How to tie in standards.”</td>
<td>“Having the time to do it really well.”</td>
<td>“What if I fail?”</td>
<td>“Getting others on board.”</td>
<td>“Sunday’s improve activity.”</td>
</tr>
<tr>
<td>“Some kid getting hurt because they are doing something crazy.”</td>
<td>“Failing my students.”</td>
<td>“Bringing it back to school.”</td>
<td>“The students liking it as much as I do.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January (28)</td>
<td>4 14.29%</td>
<td>7 25%</td>
<td>8 28.57%</td>
<td>5 17.86%</td>
<td>4 14.29%</td>
</tr>
<tr>
<td>March (2)</td>
<td>1 50%</td>
<td>1 50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 100%</td>
</tr>
<tr>
<td>Follow-up (10)</td>
<td>2 20%</td>
<td>6 60%</td>
<td></td>
<td></td>
<td>2 20%</td>
</tr>
</tbody>
</table>

Answers to the “nervous about” section of the journal prompt. Blank spaces represent no response. The total number of responses is in parenthesis beside the month.
When teachers recorded what they were excited about, they mentioned encouraging their students to learn, outdoor, experiential teaching, learning something new and other items that involved using the activities presented by the program leaders. Table 8 portrays the items mentioned organized by the four topics.
Table 8

*Journal Prompt - Excited about*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Encouraging Students to Learn</th>
<th>Outdoor, experiential teaching</th>
<th>Learning Something new</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example Phrases</strong></td>
<td>“I am pumped about finding new ways to excite and motivate students to explore new ideas and to construct relevant and lasting lessons.”</td>
<td>“Using outdoors to teach.”</td>
<td>“Learning new tools.”</td>
<td>“Driving I notice, I wonder into all the science lessons.”</td>
</tr>
<tr>
<td>“Getting out of the classroom.”</td>
<td>“Sharing ideas and information with one another.”</td>
<td>“Getting feedback.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January (24)</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>33.33%</td>
<td>20.83%</td>
<td>25%</td>
<td>20.83%</td>
<td></td>
</tr>
<tr>
<td>March (3)</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>66.67%</td>
<td>20.83%</td>
<td>33.33%</td>
<td>20.83%</td>
<td></td>
</tr>
<tr>
<td>June (2)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Follow-up (10)</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>10%</td>
<td>40%</td>
<td>10%</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>

Answers to the “excited about” section of the journal prompt. Blank spaces represent no response. The total number of responses is in parenthesis beside the month.
The topics represented show that teachers remained excited about encouraging students to learn through experiential, outdoor education throughout the entire Cit. Sci. 2.0 program. Teachers also mentioned learning something new. Most comments associated with gaining new knowledge mentioned collaboration with other teachers. This component will be discussed further as another means of support provided by the program leaders.

Aside from the confirming topics within the “know” and “excited” about timelines, the “don’t know” and “nervous about” timelines provide evidence that the length of the Cit. Sci. 2.0 program was beneficial in supporting teachers. The number of time management concerns about standard usage in outdoor instruction was fewer in the follow-up interviews. Additionally, the context of the concern changed from how to connect the standards to outdoor instruction to how to get the standardized tested subjects outside more often. Teachers also gained knowledge for managing classrooms in outdoor spaces. This confidence was most noticeable after the March workshops. Fear of failure was also alleviated after the March workshop series. This information alone suggests the length of the program impacted the teachers. If the program had only lasted for one or even two meetings, the gains described in these timelines may not have been reached. The timelines above also represent teacher perspective shifts occurring during and after the March meeting. Teacher perspectives changed from focus on the general pedagogy for outdoor instruction to focus on buy-in from colleagues and logistics of planning and supporting a school trip to the GSMIT.

The site map inventory (discussed in question two) was an assignment that contributed to the perspective shift outlined in the “don’t know” prompt timeline above. This assignment was the
first evidence of perspective shift. Program leaders asked teacher teams to draw a map of the outdoor resources available on their school campus. They also answered a series of questions (Appendix L) about their outdoor spaces before they met again in January. Teachers shared their outdoor resources with each other and participated in modeled lessons. Between January and March, the GSMIT faculty met with each school to discuss the resources available from their perspective, guiding the final shift in teacher perceptions of their outdoor spaces.

Teachers were not opposed to the length of the workshop series. The meetings were something they looked forward to. One teacher said the length of the workshop was the most beneficial aspect of the experience “…having long-term, multi-visit(s)…you can actually implement something at your school. Because had it been only one weekend or a one day thing, I'm not sure we would've actually pulled off…our aquatic macro invertebrate count” (Dorsey, personal communication, November 11, 2018). The length of the experience alleviated challenges, established a perspective shift for available outdoor spaces, and provided more practice and reflection for teachers.

**Co-design.** In addition to the length of the workshop, the program leaders predetermined the requirement of at least one administrator and two teachers from each school to commit to the program. This aspect of the PD series was referred to as co-design. “I'm not sure that [the aquatic macro invertebrate count] would have happened so successfully if I didn't have the support of Cade [the math teacher] and Sparrow [the reading teacher] or through a one day thing” (Dorsey, personal communication, November 11, 2018).

When the program leaders designed the workshop series, they planned for all schools to have at least two teachers actively involved in the program. Teachers would work together during workshop meetings and at their school to support implementation of the pedagogical
knowledge offered by the GSMIT. Before the kickoff meeting, teachers were asked if they had ever participated in a workshop with a similar design. No one had, in fact, only one group of teachers had planned and taught courses together. Other teachers had planned curricula with other district members or had been exposed to this level of collaboration in graduate school.

After the follow-up interviews were conducted, it was determined this same school was the only school that continued to regularly plan together. They were the only group that taught the same courses making it much easier to have the same planning goals. However, other teachers continued supporting each other with the curriculum unit they were asked to plan, and with setting goals to teach outdoors.

The GSMIT faculty invited a large range of teachers to participate in this program and were especially interested in what the teachers thought about combining elementary, middle, and high school teachers. “We decided that since this was a pilot program, and we have curriculum and programmers and educators that work at all levels….we wanted to make it more open, because we just weren't sure what we were going to get” (Nan, personal communication, December 11, 2018). Elementary teachers liked the different perspectives they gained from the higher-grade level teachers. Sal mentioned “it was great to see how different levels teach the same standard” in reference to the Tennessee Academic Standards for Science lesson introduced in March (Sal, personal communication, November 13, 2018). Middle school teachers liked the connection. They were able to talk with teachers who would be preparing students for entering their schools and get more insight on how they needed to prepare students for high school. However, high school teachers felt the wide range of grade levels to be random, although they said it was “interesting to hear different perspectives” (Fox, personal communication, December 10, 2018). Still, teachers found inspiration in the feeder school design. “I think getting to meet
other teachers that are trying to do the same thing is very powerful…other people are trying this and they're having struggles and failures as well, so it's nice to have that co-work” (Cade, personal communication, March 16, 2018).

Follow-up interviews also uncovered a lack of collaboration between the schools after the June workshops. However, teachers who attended the workshop series tried to encourage others in their own school to go outside. One school had exceptional success in this. Many of these teachers who wanted to follow the outdoor, experiential learning trend attended a fall workshop hosted by the GSMIT. Another school had multiple science teachers on board, yet others mentioned this sort of pedagogy was not well-received by teachers from their school.

The GSMIT’s experience in conducting workshops revealed teachers who attend workshops without supporting co-workers tend to fold under pressure and fail to fully implement the experiential practices modeled at the learning facility. This workshop series was the first encounter for the GSMIT to host multiple teachers from the same school to increase the likelihood of implementing knowledge gained during the workshop series. This design has been determined a success through the testimonies of the teachers, the program leaders, and the school administrators.

Administrator support was also an intentional design of the workshop. One of the program leaders hoped this “would include supporting them [teachers] in having time to meet together on a regular basis and making that a priority. Giving the teachers the time and flexibility to go outside with their classes and to think outside the box” (Wren, personal communication, December 10, 2018). During the June interviews with administrators, all mentioned they noticed teachers outside more often. “I have noticed there's been a lot more classes, and teachers getting outside” (School one administrator, personal communication, June 20, 2018). However, as this
administrator was observing the teachers at the June workshop, he realized “they're all worried about getting administrator buy-in (School one administrator, June 20, 2018). This visiting administrator goes on to explain his realization of teachers needing confirmation that administrators are on board with the concept of outdoor instruction.

Hosting administrators during a teacher professional development was a new concept for the GSMIT. To further explore the teacher’s views of administrator support, they were asked to rank their administrators on how well they feel supported to implement what they will take/have taken away from the experience during the December and follow-up interviews. The teachers were asked to verbally rank on a scale of 1 – 10, 1 being the least supported and 10 being the most supported. Administrators received collectively higher rankings in the follow-up interviews as illustrated by orange marks in Figure 4.
Figure 4. Teacher ratings of administrator support.

Ratings from all fourteen teachers are present. The x-axis represents the teachers and the y-axis represents a scale from 1-10. Blue marks represent responses from December. Orange marks represent responses from the follow-up interviews. The marks with the black border are not comparable to each other.

Overall, administrators supported teachers in implementing knowledge and practices gained during the PD experience. Five of the teachers rated their administrator with below average support (1-4) during the kickoff interview. Two of the teachers that responded with a ranking of two said the support looked like a 10 but felt like a two. Unfortunately, these teachers did not participate in a follow-up interview. Teacher 10 did not participate in the kickoff interview and provided a low ranking during the follow-up interview via email. This teacher did not explain the reason for the answer then proceeded to agree that their administrator does encourage them to teach outside. Ratings that identified administrator support at or above
average (5-10) included eight from the December interviews and nine from the follow-up interviews. There is also a visible trend of higher ratings existing from the follow-up interviews.

To further explain the data in Figure 4 teachers 7-9 and 12-14 only provided one answer. Teachers 13 and 14 were not present for the December kickoff interview and teachers 7-9 and 12 did not participate in the follow-up interview. Eight of the fourteen teachers responded to this question during both the December and follow-up interview. Teacher five moved schools between interviews, therefore, these answers can only be used to analyze the overall teacher perceptions of administrator support. This leaves seven pre and post rankings that can be compared. Only two of those rankings showed drastic change in teacher perception. Two teachers (3 and 4) increased their perception of administrator support by five and six points. These higher rankings could be a result of teachers working closer with administrators as a consequence of the program design. Additionally, lower rankings in the pre-interviews could be a result of possible reservations about the novel experience and an unclear understanding of what experiential, outdoor education is.

The remaining comparable points of data show teachers rating administrator support lower in the follow-up interviews than in the kickoff interview. These decreases were no more than two points lower than the original ratings. Further investigation for teacher perceptions of administrator support were investigated through the follow-up interviews. Each of the ten participating teachers were asked to define administrator support.

To clarify what teachers defined as support, they were asked what administrator support meant to them during the follow-up interview. Teachers collectively defined administrator
support as reinforced trust to take students outdoors and perform their teaching in an experiential manner then to receive praise for their efforts. This praise included emotional, financial, and critical encouragement. Sal described administrator support as receiving feedback and “…knowing that we can go make requests and feel pretty confident that they are going to support it, that they are going to allow us to do some somewhat unusual things with just experiential learning” (personal communication, November 13, 2019). One of the teachers was promoted to a behavior administrator position in the fall of 2018, providing a unique perspective, as he continued to teach a smaller course load. He described administrator support as actions not just emotional encouragement like “you can do that…but them securing funding to help make things possible” (Woods, personal communication, December 10, 2018). Another teacher specifically defined administrator support concerning outdoor education as “creating that culture where we go outside, that’s who we are” (Dorsey, personal communication, November 11, 2018).

All teachers reported they were encouraged by their administrators to go outside. “Our administration creates that culture where you feel safe to go out.” (Woods, personal communication, December 10, 2018). Administrators reported helping teachers brainstorm time management ideas and develop permission slip protocol. Many of the administrators have led the schools in progress toward creating shade areas around the school grounds along with study spots for students, outdoor classrooms, and gaining rights to a local urban wilderness area. In June, administrators were asked if they had received any pushback or criticism from their superiors to implement outdoor, experiential education and CS opportunities. Each administrator replied that their superiors were interested and supported the ideas.
The aspects of the co-design were beneficial in the implementation of pedagogy modeled at the GSMIT. Further positive opportunity for resources can be contributed to through the established communities of practice.

**Resources.** After March, the classroom management concerns improved in the reported replies, but teachers expressed concern about financial support and colleague/school buy-in. To preface this concern, as a part of the participation agreement, teachers and administrators were to organize a trip to the GSMIT with students. It was up to the schools to decide when and how many students would attend. This agreement contributed to the concern for colleague buy-in and for financial support. Although a stipend was provided to the schools to help pay for students to attend the GSMIT, it did not pay for every student’s attendance fees. Especially those with large school groups. Buy-in from other teachers was ideal for a further financial support.

Each fall, the GSMIT hosts three Teacher Escape Weekends. These events are three day, two night workshops that teachers are encouraged to attend. “If a teacher attends any teacher workshop here, that counts towards them coming back free and having a discount for their students” (Wren, personal communication, December 10, 2018). According to the primary program leader, four schools attended the workshops. One of the schools brought 10 teachers with them to TEW and was excited to have all but one of those teachers join them on the two night, three day trip to the GSMIT with 71 students. Excited for the schools’ accomplishments, she said,

Most of the teachers that work at our school were not comfortable taking the kids anywhere outside before we started this project. They wouldn't have even, like, most of
the time, they don't even like going on the playground. Now, we have people outside
doing things, looking at things (Doc, personal communication, November 13, 2018).

The primary program leader also confirmed, five of the schools planned overnight trips to the
GSMIT for the 2018-2019 school year. Many of them raised money for the students to go, and they plan to continue this trip in coming years.

When we started, no one [teachers and students] wanted to come. I had to basically beg, plead and promise my left arm to get them here, because nobody wanted to be outside. Now…the fifth-grade teachers are going to take it over, and that is part of my vision, that it becomes something that our school does. You do it in fifth grade. You go on a field trip to Tremont. You go to an overnight learning experience. It's not just a field trip. They're learning the whole time, all the time. (Doc, personal communication, November 13, 2018)

Resources were also provided through the tool kit, described in research question two. The financial resources available provided all schools a jump start to plan their first field trip to the GSMIT. This field trip experience also served as a path to encourage buy-in from colleagues through the TEW offer. The length of the workshop provided enough time for teachers to develop a perspective shift then begin thinking about how to involve other teachers at their school in experiential, outdoor instruction. Through support of the other teacher(s) and administrator involved in the program, many schools were able to begin an outdoor instruction culture shift within their school. Additional explanation on the teacher growth in understanding and confidence will be explained in the next section.
Growth in Understanding and Confidence

Contributions to teacher growth in outdoor instruction can be identified through effective professional development practices modeled by the program leaders and the evolution of use of outdoor spaces at schools. Additionally, evidence collected from the stimulated recall interviews can support claims of teacher growth in understanding and confidence. Results in this section will be organized respectively.

Effective professional development. The GSMIT faculty used many different teaching practices during the professional development series. These practices, mentioned in research question two, were modeled for the teacher by the program leaders. Teachers were encouraged to modify them to fit their teaching styles and content. During the March interview and follow-up interview, teachers were asked what the most powerful experience was to them. Recorded responses revealed meeting other teachers with common passions was mentioned four times, reflection and journaling was mentioned six times, and general instruction methods were mentioned seven times. All of these components are aspects of effective professional development programs (Darling-Hammond & Bransford, 2005). Most of the instruction methods mentioned by teachers included the *I notice, I wonder, it reminds me of* activity, meaningful questioning practices, and hands-on activities. When discussing the teaching techniques presented by the faculty one of the teachers explained their excitement in learning experiential teaching practices; “It is important for us to be here, to learn how to do this. Because [we] love that [hands-on activities], so our kids are going to love it. Versus sitting and listening to a lecture about ecosystems and adaptations” (Luna, personal communication, March 16, 2018).

To gain a better understanding of the acceptance of the workshop requirements, teachers were asked which homework assignment they would drop from the experience. The March
interviews concluded 9 of the 14 teachers said they would drop the videos, yet claiming they understood the necessity of it. This assignment was disliked because of the effort it took to have someone video them and the complications in submitting the videos. “Yes I saw improvements…but it’s a lot to try and fit in” (Cade, personal communication, March 16, 2018). Additionally, the videos were not addressed in the January workshop resulting in teachers questioning their efforts.

I think the video reflections I would drop because I don’t feel like we’re using them, I feel like they could be very useful. I mean, we’ll see what we do this time [March] with it, but last time [January] we did nothing with it. I understand the purpose of it, so I think its use could be helpful, but otherwise I think it’s just busywork. (Fox, personal communication, March 16, 2018)

The purpose of the video reflection was to help develop professional practices through the process of prompted reflection. This assignment was used to assess the transferability and usefulness of workshop training into classroom activity. These videos were also used in a stimulated recall follow-up interview that will be later described to support claims of teacher impact.

Even with the persistent challenges that existed, teachers reported they were more confident during the March interviews. When teachers were asked if their confidence in outdoor instruction had improved, ten teachers reported increased confidence, three teachers reported they were already confident with taking students outside, and one teacher reported their confidence had not improved. The teachers who reported more confidence mentioned the ability to allow students to purposefully explore, create structured, focused lessons, prompt students with intentional questions and try new things. Each of these strategies were modeled in all of the
Cit. Sci. 2.0 workshop meetings. These teaching practices also led to more prevalent use of the outdoor spaces at the participating schools.

**Evolution of outdoor space use.** During the kickoff interview, teachers were asked what experiential learning meant to them. Then they were asked what outdoor experiential education meant to them during the follow-up interviews. The GSMIT faculty were asked to define experiential learning and outdoor education during the kickoff interviews as well. As described in chapter three, these interviews were coded. Figure 5 describes the understanding of teachers with respect to the faculty and formal definitions.

![Figure 5. Teacher definitions for outdoor, experiential education.](chart)

The blue bars represent the established codes determined in figure 2. The orange bars represent the number of times the codes were mentioned during the kickoff interviews and the gray bars represent the number of times the codes were mentioned during the follow-up interviews.
All teachers confidently provided answers during the follow-up interviews. For the kickoff and follow-up interviews, teacher descriptions of outdoor, experiential education were very closely related to the definitions provided by the faculty and the widely accepted definitions. Overall, experiential, outdoor education was described as learning through experiences and making personal connections while outside. During the follow-up interviews, words and phrases that mentioned “making personal connections” was mentioned more often than in the kickoff interviews. It was also mentioned more often than “learning through experience” during the follow-up interviews. Teachers did not mention any outdoor words or phrases during the pre-interview, but it was mentioned three times during the post-interview. This was undoubtedly a result of the way the questions were phrased. The pre-interview separated the ideas of experiential education and the outdoor aspect. This was done to gain a better understanding of the outdoor experience each teacher had. Although this may be a limiting factor, teachers understand the outdoor aspect refers to teaching outdoors. Therefore, focus was placed more on their understanding of experiential education.

Teachers did not mention in any interview that outdoor, experiential education is broad, neither did they mention it as a teaching philosophy or way to clarify values. Focused reflection was not mentioned by the faculty but was mentioned by teachers one time in the pre-interviews and twice during the post-interviews. Teachers also mentioned items that were not matched with the codes. These included application or hands-on (four times) and more engagement (three times). Furthermore, teachers mentioned students gain ownership, enjoyment, and companionship. They also see more retention and commented that this type of instruction is more valuable than a book.
There was a slight change in teacher definitions between pre and post-interviews. In December 2017, most teachers believed experiential learning was learning through hand-on experience; specifically experiences that include watching others, developing process skills, going outside, measuring, and applying knowledge. In the fall of 2018, teachers perceived experiential learning as making personal connections through experience, specifically student ownership, reflective practice, and companionship. This altered definition is further supported through observation notes of teacher discussions during activities. While teachers were discussing how to modify the instruction modeled by the GSMIT leaders in their own classroom, they mentioned uses for discussion or reflection and uses for establishing an experience as opposed to using it to teach students to only improve skills such as observe or measure within an outdoor space. This also provided evidence of understanding that may be contributed to increased instructional use of school outdoor spaces.

During the December, March, and Follow-up interviews teachers were asked how many times they had taught outside. These responses were recorded and organized into Table 9. The ranges of time provided correspond to the teacher responses. Responses provided in December represent the number of teachers who taught outside before the workshop began. Responses provided in March represent the number of teachers who used outdoor spaces between the time the program began and the time of the March interview. Finally, the responses provided during the follow-up interviews were with respect to the fall 2018 school semester.
Table 9

*How Often Teachers Taught Outside*

<table>
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<th>December</th>
<th>March</th>
<th>Follow-up</th>
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<td>Once a week</td>
<td>Every 2 weeks</td>
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<td>2</td>
<td>3</td>
<td>7</td>
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There is a noticeable increase in teachers taking students outside from before the workshop series began to after it ended. Before the kickoff meeting in December, half of the teachers said they rarely teach outside, and two of them admitted they had no experience teaching outdoors. Two elementary teachers said they try to teach outside once a week.

There was a span of about 12 weeks between the kickoff meeting and the March workshop meeting. During this time, all but one teacher had taken their students outside, ten of the fourteen had taught outside three or more times despite snow day delays.

Ten teachers were interviewed during the later end of the fall semester, mid-November to early December, providing 12 to 15 weeks for teachers to practice implementing knowledge gained from the workshops. During these interviews 60% of the teachers were teaching outdoors every two weeks, or more often. This is a 24.29% increase compared to the 35.71% teachers who were teaching this often to begin with.

It is important to note, although there are five teachers teaching outside at least every two weeks in the beginning and six in the end, these are not the same teachers reporting. It is also
worthy to note the definition of outdoor instruction changed for these teachers during the experience. According to interviews, teachers mentioned using an outside classroom or outdoors space as they would an indoor classroom in December; then began to actually use the outdoor spaces as a teaching tool after January. By March of 2018, all participating teachers taught students outdoors and by the fall of 2018 all ten of the teachers interviewed reported teaching students outdoors regularly. Teachers who reported taking their students out multiple times a week have courses that allow such flexibility with curriculum. Doc stated, “We go out almost every day. We have a walking trail and I teach special education, so I have a little bit more leeway than most” (personal communication, November 12, 2018). When asked how often they teach outside, a team of teachers replied sarcastically, “Um, whenever it's sunny.” They added an explanation to this statement.

I mean, especially for wildlife. I mean-Well different units, like the tree identification unit, we're outside every day for a week. Then when we get to map and compass, we're outside every day that it's nice, and that took roughly a week. Trapping unit is a two to three week unit. Again, weather dependent. So we're outside as often as we can until the unit's done. (River and Sierra, personal communication, November 13, 2018)

When asked to share their favorite experience or accomplishment pertaining to their teaching outdoors, teachers shared with excitement. Most of them mentioned aspects that highlighted a cultural shift in students. In fact, 8 of the 10 teachers interviewed in fall 2018 spoke of memories that demonstrated a progression in students who were not originally comfortable outside. Most mentioned student apathy. At first, students did not want to get too cold or too hot
or get dirty, then after watching the activity or cautiously participating, students began to participate fully. A high school teacher described student buy-in:

I think at first when we took them outside they were very, "I don't want to get in the creek. It's too cold. I don't want to do this," but I had a lot who brought shoes and were like, "Okay. I want to do this." Now, when the other kids saw what they were pulling out of the creek and we're looking at it they were like, "We want to go too," so I think I saw that they were more engaged and willing to do it after maybe the second or third time of going outside. (Fox, personal communication, December 10, 2018)

One teacher mentioned the class discussions were “some of the best discussion we had all year” (Woods, personal communication, December 10, 2018). Another school mentioned an accomplishment that highlighted this sort of cultural shift.

We took all the kids outside to look for the macro invertebrates. It was well organized, we had support, we had help. Other teachers helped and supported students. So I'm proud of that because again, kids who didn't do anything, who haven't done anything all year took part in that and they enjoyed it and they were smiling and laughing and they still learning at the same time. (Dorsey, personal communication, November 11, 2018)

Other teachers started an outdoor clothing closet for students to use if they were afraid of getting their clothing dirty. This closet was filled with donated shoes and clothes. Another mentioned a circumstance where they were able to encourage a student to pursue a degree.

I have several students that are always so excited to go outside. One of them is a girl who struggles in her home life and frequently misses school. The last time we were in the garden planting for pollinators, she was asking me “Can you get a job to do this stuff? I’m not smart enough for other subjects but I want to do something like this?” Through this I was able to
encourage her that she could pursue agriculture, gardening or any kind of science if she wanted to be outside and work with plants (Sparrow, personal communication, November 11, 2018).

One teacher even mentioned their prominent memory was stepping back and watching her students “going in circles having no clue how to use a compass” (Sierra, personal communication November 13, 2018). Teachers were proud of these memories as they validated their efforts to reinforce content with meaningful experiences.

Teachers also reflected on their long-term visions for experiential outdoor instruction. One school plans to make use of their newly renovated outdoors space; “I would love to do something like that and get the kids involved, data entry and monitoring water quality. We've already started doing that, and I've got another biology teacher who's on board” (Fox, personal communication, December, 10, 2018). Another envisioned experiential, outdoor education as an expectation of the school culture “…that fully supports it and that sixth, seventh, and eighth grade are doing different aspects of it…so that by the time they get to eighth grade they have this well-rounded understanding of their environment in place” (Dorsey, personal communication, November 11, 2018).

**Stimulated recall interviews.** Further evidence to support claims for growth in teacher understanding and confidence in teaching in outdoor spaces using experiential education pedagogy is outlined in the SRI’s. Teachers who agreed to participate were asked to watch a clip from one of their submitted video reflections. While watching, they were encouraged to pause the video and comment on their instruction with relation to the workshop. Seven teachers participated in a video SRI.
SRI’s shift focus to determine what elements of instruction have resilience/longevity. These interviews highlighted a use in teaching methodologies that were modeled at the GSMIT. All seven teachers either used the exact pedagogy modeled or used a modified version of the techniques modeled by program leaders. Observation activities, like the *I notice, I wonder*, were prevalent. Five of the teachers referred to using many of the observation teaching methods during the SRI’s. Modified versions of the techniques included experimental design using household supplies to make boats then testing their ability to float in the creek at the school, an outdoor math relay race, and the use of an activity that required students to order natural objects form least to most decayed to intentionally support a discussion about disagreement.

When the teachers were asked if they would change any of the instruction techniques they used in the videos, most mentioned changing some things, then saying it depended on the group of students. For example, one of the lessons showed a group of students that had clearly been outdoors multiple times. The teacher confirmed this group had been outdoors for instruction at least four times, pointing out one student had boots on at the creek “and they are like at home and they know exactly what to do and they are perfect with it” (Sparrow, personal communication, December 11, 2018).

Another teacher submitted a video of an indoor lesson on photosynthesis. Although many of the pedagogies used at the GSMIT were used in the submitted video, it did not take place outside. This video was the first submitted by this teacher and when asked if she would change anything in the instruction she replied: “Yes, I actually have already changed this. I re-taught this photosynthesis lesson last week. We actually went outside and discussed the processes though an outdoor lesson. I could tell the students were able to make a better personal connections” (Fox, personal communication, December 10, 2018). These SRI’s support the claims of the impact of
effective professional development practices through documented use of outdoor, experiential instruction.

To further support claims of impact, teachers were asked to share how the workshops impacted their educational philosophy. Those who participated in the follow-up interviews reported the workshops did influence their teaching styles. “It [the experience] has given me more tools that I can use to encourage student thinking and engagement” (Sparrow, personal communication, November 11, 2018). For some teachers, this experience was a confirmation that students should be outside learning. Teachers also mentioned they are more aware of the process of experiential learning, how it is a process that encourages students to want to learn. One teacher specifically explained how his questioning philosophy had changed as a result of the Cit. Sci 2.0 program.

Students ask questions and even if I don't have the answer or don't know, I'll try to help guide them to the answer if I know it. Or we'll just find it together. So I think that's one of the biggest things is just asking questions, seeking answers on our own, finding out how to seek answers. And I think that's kind of the biggest issues that some of our students face is how to find information. How to find answers on their own. I think a lot of them are used to if they say I don't know, they're given the answer. Or if they get it wrong they're given the answer. And it's kind of a crutch for them. So in fact my planning partner, the other science teacher, we've been talking about that we need to kind of really get that gradual release of having them find the information, how to do research. So that's one thing that we're really focusing on is asking good questions and finding the answers for themselves. (Sal, personal communication, November 13, 2018).
Summary

The experience of the delivered curriculum impacted the teachers’ use of experiential outdoor instruction through various support strategies and professional development pedagogy. The length of the professional development provided enough time for teachers to become comfortable with the pedagogical techniques provided at the GSMIT resulting in an increased use of outdoor instructional spaces. More specifically, the Cit. Sci. 2.0 program was able to sustainably influence the traditional classroom experience for participants. Thorough summaries and linkages concerning each research question are described further to conclude this chapter.

Summary of Findings

Each research question corresponds to the planned, delivered, and received curricula. A summary of what the Cit. Sci. 2.0 program intended to accomplish, how those intentions were accomplished, and the impact it had on the participating teachers will be presented in this section.

Question One

The established goals for the grant and participant applications described lay the foundation of the intentions of the GSMIT faculty. These intentions or goals were found to align with the pedagogical strategies used by the program leaders during the workshop experience. The grant proposal included a statement that best summarizes the intentions for the workshops: “Our teacher workshops will provide scientifically accurate, relevant and accessible information while simultaneously introducing teachers to research-based teaching techniques that are student-centered” (Appendix A). The faculty had similar training in their career, reporting: “…this type of education is impactful and…helps them [participants] to be better learners and observers…”
(Nan, personal communication, December 2, 2017). Each goal had a purpose to provide schools with a better understanding of outdoor, experiential learning while highlighting citizen science. When selecting the sample, the program leaders required the co-design aspect of the PD. This part of the program asked for participation of multiple teachers and at least one administrator from each school. A program leader described the excitement around these features:

The beauty of having an administrator, pulling them out of their space and giving them time to think in their ways, and the teachers, and then having them collaborate together, we're just giving them a space that they don't have. When you get those, cool things happen. Unexpected things happen. (Wren, personal communication, December 2, 2017)

The faculty were thoughtful when designing the applications. They required teachers to provide a snapshot of needs and/or challenges that they face, or think they would face when working toward experiential, outdoor instruction curriculum reform. These perceptions were used when structuring activities to help alleviate foreseen pressure for teachers. Understanding the intentions to set goals, define challenges, and provide instruction, contributes to a more intense look into the activities and other methodologies used to carry out their goals.

**Question Two**

The method of delivery for the Cit. Sci 2.0 program revolved heavily around experiential education in outdoor spaces. To meet the goals of the grant, the program leaders used pedagogical strategies including switching between student and teacher mode, establishing norms, modeling the Cooperative Teaching Model, formative assessments for outdoor instruction, and observation and questioning activities that could be modified for all grade levels and content. They also used assignments heavily associated with reflection practices, these included structured video and journal reflections, and a site inventory map which was determined
to be a driving force for the noticeable perspective shift that occurred in March. Further
contribution to this perspective shift were the specific tackling of time and classroom
managements strategies for outdoor instruction in addition to activities associated with the newly
implemented Tennessee Science Standards. CS activities were a focus of the March and June
workshops. Program leaders encouraged integrating the observation and questioning instruction
skills into lessons that encourage collecting and monitoring CS data. Most CS activities that were
modeled were associated with regional watershed issues and monitoring techniques. The I notice,
I wonder, it reminds me of lesson and journaling/reflection were the top two activities of the
program that were modified and incorporated into classrooms regularly.

Furthermore, the delivery of the program aligned to the intentions of the program leaders,
with one exception. The program leaders did not plan brainstorming sessions for each workshop
(goal three, objective B), and there was no evidence that the unit plans were moving forward
during the program meetings. The pedagogical strategies mentioned in question two overlap
with question three and vice versa. The strategies described within each question are the best fit
of organization for the discussion of the results of this study. The following summary of research
questions three will continue the discussion of results described within this question.

**Question Three**

The grant goals were used to plan the program in which the GSMIT aimed to provide
teachers understanding and confidence for outdoor, experiential education. Evidence supporting
impact of the received curriculum include building supportive environments through co-design
and increased use of experiential, outdoor instruction. Support was provided, not only by the
GSMIT faculty, but also by the predetermined structure of the teacher teams and involvement of
the school administrators. The length of the program adequately provided time for teachers to be
completely immersed in the GMSIT learning cycle: invite, explore, wonder, process, reflect, and share. Teachers were invited by the program leaders to explore, wonder, and process pedagogy during the December and January meetings. By the March meetings, teachers were actively reflecting on their instruction and beginning to share the pedagogies with other teachers at their schools.

To further validate impact, teachers were asked if this PD experience met their expectations during the follow-up interviews. Seven of the 10 teachers interviewed in fall 2018 said they did not have any specific expectations and were open to the PD experience. Aside from preferring more personal feedback from the program leaders and possibly separating elementary and secondary schools at different times, there were no evaded expectations. Instead, most were surprised and thankful for the amount of information they received and were validated within the established support system to continue teaching outdoors. “Actually, to be honest, my expectation was that I wasn’t going to get that much out of it, so it definitely far exceed those…expectations” (Sal, personal communication, November 13, 2018). This program and all of the aspects associated with it, successfully provided instructional changes and shifts in school culture toward more acceptance of instruction in outdoor spaces. Evidence shows it changed the way teachers teach and changed teacher perceptions of what a successful learning environment contains. Doc concluded her follow-up interview by saying, “I never expected it [the PD program] to be able to change the way that I actually teach, versus some things [other PD], you just go and then never change what you do” (personal communication, November 12, 2018). Additional conclusions and implications are discussed in chapter five.
Linkages across Research Questions

Emphasizing the scope and depth of the research, many of the findings overlap establishing a broader impact. Factors that contribute to the broader impact result from the thorough methodology to deliver the intended goals of the workshop series. These include, requesting and addressing perceived needs and challenges, the length of the workshop, and the pre-established support structure.

To begin this professional development, the GSMIT faculty requested perceived needs and challenges of the teachers in relation to experiential, outdoor education. These needs, described in chapter four, highlighted concerns for student behavior management and time management in outdoor instruction. Additionally, the teachers expressed concerns about linking outdoor instruction to standards. These were addressed through the design of the workshop. The most powerful experiences included general instruction methods/instructional strategies and pedagogy, and reflecting/journaling. More specifically, the I notice, I wonder, it reminds me of activity, modeling and practice of formative assessments, demonstrated use of journals, and the site map inventory assignment were among the most powerful experiences of the workshop series.

The workshop design also included long-term engagement from the teachers. The know, don’t know, excited about, and nervous about reflection prompt that was revisited throughout the experience in addition to March teacher interviews provides support that the length of the workshop helped establish a perspective shift. Teachers expressed more confidence in implementing outdoor instruction while using various management strategies presented by the GSMIT faculty. This provided a broader impact for the implementation of standards in outdoor
instruction as well. During the follow-up interviews, all teachers reported taking students outdoors for learning more often than when the workshop series began. Alleviating these perceived concerns through the planned and delivered curricula allowed the teachers to shift their focus on encouraging other teachers to participate in outdoor instruction, in addition to, planning a school trip to the GSMIT.

The site map inventory assignment described in question two also contributed to a perspective shift that is further supported in research question three. This assignment required the teachers at each school to work together to evaluate the outdoor space on their school campus, practice pedagogical strategies and develop plans for using their space. The GSMIT leaders supported the schools through their visit and evaluation of the outdoor space. This collaboration of the teachers, administrators, and experts (the GSMIT faculty), resulted in finding that various support structures contribute to teacher implementation of what is learned during a PD. This assignment in itself is specific to non-traditional teaching spaces, however the delivery of the assignment (model, practice, and reflect) with the pre-established support structures may contribute to increased implementation across all PD experiences.

Unintended Results

Two findings that were exposed during this study could contribute to increased implementation of knowledge gained during PD opportunities. These two findings not specific to outdoor instruction are required administrator support, and participation in student and teacher mode. The administrators were only asked to attend the first and last workshop, be available for phone calls, and visits and support teachers in implementation. Although some of the administrators were unavailable for the last workshop, they all supported teacher implementation
through encouragement. In addition to this encouragement, many of the administrators
demonstrated an investment in getting students outdoors by helping teachers brainstorm ideas for
time management, developing permission slip protocol, creating shade areas and study spots for
students, creating outdoor classrooms and gaining rights to a local urban wilderness area.

As described in chapter four, the teachers were asked to participate as the learner in
“student mode” then debrief the learning experience in “teacher mode”. Asking teachers to act as
students during a PD comes with challenges. Many times the teachers hold back from completely
immersing themselves in the role of the learner. The GSMIT faculty are experienced at asking
teachers to do this. Through observations, an effective protocol for this was revealed. First the
GMSIT leaders were deliberate in asking the teachers to switch back and forth. This switching
began to be recognized by the teachers during the January meeting and effortless transitions were
made throughout the rest of the experience. In addition to deliberate requests, the GSMIT faculty
modeled the “becoming the student” actions. The faculty got in the dirt and very close to nature,
placing their nose on a tree to observe it very closely. They acted silly as a student may do in this
learning environment. This encouraged the teachers to let go of their professional teacher
mannerism and become the learner. Many times the teachers were observed expressing silly
student behaviorisms when transitioning into “student mode”. This accomplishment may have
been affected by the length of the PD because there was time for the faculty to establish this
transitioning as a norm. However, the deliberate request of the transitions and the modeling or
demonstration of how the teachers should be completely immersed in the learning experience
provided grounds for an effective protocol that can be used to encourage teachers to act as the
learner during a PD.
CHAPTER V
CONCLUSION AND IMPLICATIONS

Chapter five, traditionally reserved for discussion of results, will assume the role of describing the overarching big picture themes of the project. Summaries for each research question were described at the end of chapter four. Overarching conclusions and implications will be arranged in reference to chapter two.

Science and Engineering Practices

Experiential, outdoor education is heavily influenced by environmental education and science practices (NAAEE, 2010). A new version of science standards had been recently adopted in Tennessee. These standards support interdisciplinary science instruction through inquiry-based learning across disciplines (Chowdhary et al., 2014; Pratt, 2013). According to the kickoff interviews and applications, four of the six schools were concerned with connecting outdoor instruction to the standards. The science and engineering practices within the new Tennessee Science Standards helped teachers relate science across content while encouraging the use of outdoor space resources. Teachers were introduced to and worked with these standards, developing lessons to use in their classrooms and across disciplines. They also participated and developed citizen science lessons that modeled a full inquiry, student led experience. Practice with inquiry instruction, one of the greatest challenges for teachers (Chowdhary et al., 2014;
Chun Lee et al., 2018; Zhang et al., 2015), may have contributed to higher self-confidence in experiential, outdoor instruction.

A review of the literature determined, schools and teachers neglect experiential, outdoor instruction, based on; time constraints, limited space, classroom management, misinterpreting what their students are capable of, and comfort in a narrowed curriculum from standardized testing (Berliner, 2011; James & Williams, 2017; Walker et al., 2017; Whitworth & Chiu, 2015). As a result of this workshop series, teachers grew more confident in all of these reasons for neglect. However, high school teachers who taught standardized tested subjects reportedly took their students out less than they did in other courses. This result leads to the suggested consideration of locating or developing outdoor curricula that align to the main units of these nationally tested courses. Time constraints, limited space, and classroom management concerns were alleviated by or during the March workshop experience. The use of effective PD strategies and the pre-established support structures may have contributed to this improvement.

**Effective Professional Development**

Professional development is more effective when instruction is modeled by the PD leaders then practiced and reflected on by the learners (Dare et al., 2018; Zhang et al., 2015). This cycle, similar to the collaborative inquiry and reflection model, was associated with every activity and assignment within the PD demonstrating effective pedagogy for a professional development (Todd-Gibson, 2017). Scaffolding instruction, reflection, and collaboration are all effective PD practices (Dewey, 1916; Schon, 1983; Vygotsky, 1978). Further effective PD strategies are: (a) informed pedagogy based on learning theories, (b) intensive, sustained and ongoing support, (c) focus on content and curriculum, (d) rich, active learning, (e) collaboration
with teachers preferably from the same school and other schools, (f) a connection to teachers’ current practices, routines and learning goals, (g) alignment with district and state standards, and (h) organized school conditions for implementation after the PD experience (Darling-Hammond & Bransford, 2005). Most of these strategies were implemented by the program leaders. Strategies used by the program leaders that are most evident are scaffolded instruction, reflection, and collaboration. Many of the activities were presented in multiple ways throughout the program experience. The activities repeated the most (i.e., I notice, I wonder and journal/reflection) were also reported to be the most implemented.

Most of the pedagogical experience revolved around active learning and coherence with others (Zhang et al., 2015). The program leaders provided opportunities for teachers to actively learn experiential, outdoor instructional strategies and incorporated collaboration into every perceivable aspect of the program. This instruction is supported theoretically by situated learning, suggesting learners create knowledge as they interact with the environment and with each other to achieve a desired goal (McLellan, 1996).

Effective professional development should provide space for teachers to reconsider how they teach (Roseman et al., 2017). The program leaders were successful in this, and it is evident in the perspective shift that was noticed in March. This was accomplished through assessing the perceived needs and challenges of the teachers then teaching them what they needed to know based on their perceptions (Yang et al., 2018). As noted throughout chapter four, providing instruction based on what the teachers needed reduced outdoor instruction concerns for classroom management, meeting academic standards, and outdoor instruction strategies, and in turn allowed for more focus on implementation and improvement.
Support

The length of the PD experience also provided time for teachers to learn, attempt, and reflect on the pedagogies presented. This is considered a highly effective teaching strategy that results in long-term learning (James & Williams, 2017). Video reflections, a highly recommended form of reflection was used. These allowed teachers to build knowledge through experience and confront challenges that existed (Barnhardt & Van Es, 2015; Jacobs, Lamb, & Phillips 2010; Leatham et al., 2015; Stockero et al., 2017). This program also allowed for relationships to be developed through collaboration with teachers from the same schools and different schools and by encouraging more collaboration between teachers and administrators. When the administrators committed to this professional development program, they demonstrated a shared educational vision with the teachers. This likely built the trust and confidence of the teachers adding value to the administration leadership ability (Sergiovanni, 1990). This time and effort invested by the administrator possibly affected the investment of the teachers (Sergiovanni, 1990).

Follow-up interviews revealed teachers collectively defined administrator support as reinforced trust to take students outdoors and perform their teaching in an experiential manner then to receive praise for their efforts. Additionally, only one teacher group continued to regularly plan lessons together. This group taught the same courses, contributing to a convenience of planning conditions that other teacher teams did not have. Although regular collaborative planning was not maintained, over half of the schools reported encouraging other teachers outside of the PD program to teach students using experiential instruction outdoors.
The length of this program also revealed results that are supported by the literature. Teachers met for a total of seven days with over 50 hours of face-to-face contact before there was evidence of a perspective shift. It is suggested contact hours exceed 50 hours and consist of multiple face-to-face meetings and opportunity to work on the skills outside of the meeting times (Darling-Hammond et al., 2009; Valdmann et al., 2017). This confirms long-term PD reinforced through CoP’s can provide gains that significantly outweigh those of a one-and-done type of professional development model. However, it is suggested that program leaders follow-through and reinforce completion of all appointed assignments. The know, don’t know, nervous about, excited about reflection prompt that was to be completed in journals could have provided more robust evidence of the impact of this PD experience if the GSMIT faculty had structurally enforced teachers to complete and submit it, instead of passively encouraging it. This failure to follow-through also impeded the video reflection assignment. With this said, teacher impact was still noticeable with the evidence provided.

With these suggestions in mind, the use of the Cit. Sci. 2.0 program model can impact teacher instruction and promote reform in experiential, outdoor education. Generalization for other participant cohorts and for implementation in other programs or institutes is applicable with similar subjects. Outdoor instruction has the ability to incorporate and integrate all instructional content and at the same time it can provide practice for thinking and reasoning skills. With practice, this instruction provides teachers an ability to transform their instruction practices. In return, it increases students’ desire to participate in learning (James & Williams, 2017).
Transferring this Professional Development Model

In addition to the obvious ties to the literature, this study includes several unique aspects that expands PD design for outdoor instruction and challenges the generic PD design. These aspects include: the model, practice, and reflect cycle; provision via the tool kits; the long-term learning experience; the co-design aspect; the difference in teacher characteristics; the administration involvement; and support from the program leaders. The generic PD design refers to the one day learning opportunities that require only one teacher from the school and no administrator involvement. This design would contain little to no follow-up from program leaders. All of the unique aspects that evolved from this study can be transferred the traditional classroom. The model, reflect, and practice cycle has been effective in traditional classroom PD (Dare et al., 2018; Dewey, 1916; Schon, 1983; Todd-Gibson, 2017; Vygotsky, 1978; Zhang et al., 2015). This study expands its use for effective instruction in outdoor spaces.

Furthermore, various support structures defined in this study are transferable to the general PD design. Supporting teachers by providing resources to use in their classroom in addition to follow-up support from the program leaders established a relationship between the teachers and the faculty that allowed teachers to feel more comfortable in reaching out to the faculty if they had questions about implementing the material. To support this, it was observed that many of the teachers began asking for electronic versions of lessons presented at the GSMIT to use in their own classrooms. Some teachers also began reaching out to their community, and were confident enough in the shared educational vision of the faculty to ask for additional support during these occasional of outreach.

The co-design aspect, requirement of more than one teacher from each school to attend, presented a broad collection of teachers. Teachers were endorsed in various subjects and grades
ranging from kindergarten to 12th grade. A difference in teacher characteristics should be considered when teaching content or pedagogical strategies that is not targeted to certain teacher groups. This format allowed for this instruction to be implemented throughout the majority of the school districts in Blount and Knox County. Teachers were interested in the different viewpoints of their distant colleagues and they expressed comfort in knowing there were other teachers within their community that shared a similar passion for non-traditional instruction. Including this wide range of teachers also exposes students to multiple touch points for outdoor instruction. For example, teachers from an elementary school may use the experiential, outdoor instruction strategies from this professional development; then the exposure of this instruction could be carried on through the middle and high school teachers involved. Provided time, this unique aspect could maintain a shift toward increased instruction in outdoor spaces for all schools in a district. Requiring more than one teacher from the school to participate may increase the rate of implementation of the knowledge gained. Teachers in this study provided testimony of the unique support provided by other teacher(s) participating from their school. Many of them noted they may not have changed their instruction if they were the only teacher interested or passionate about this type of instruction.

In addition to the support from the GSMIT faculty and the pre-established CoP’s, the administrator involvement provided substantial support to the teachers involved. The administrator support extended beyond the intentions of the GSMIT faculty. Providing a route for administrators to show that they share an educational passion with teachers, empowers, enables and enhances the teachers to perform in that passion (Sergiovanni, 1990). Requesting administrator involvement for general PD opportunities for traditional classrooms, has the potential to increase the rate of implementation for the knowledge gained.
The mentioned aspects that may benefit a generic PD design are most likely effective through the inclusion of a long-term learning experience. One day PD experiences do not provide the time needed to establish the relationships that supported the implementation of the knowledge gained. Therefore, increasing face-to-face contact between the PD participants and the PD program leaders to establish a long-term PD experience is highly recommended for PD success.

**Conclusion and Implications**

This study provided a description of the value of the Cit. Sci. 2.0 PD by closely examining and aligning the goals of the program and the activities the program leaders used. According to this alignment and additional support from interviews, the program goals were all met with the exception of brainstorming sessions for the citizen science units occurring during all meetings. These goals also positively impacted teacher self-efficacy by reportedly improving confidence in experiential, outdoor instruction. Teacher understanding of instruction in outdoor spaces changed and they increased outdoor instruction.

Taken together, this long-term PD explored teacher’s perceived challenges and needs, then combined effective experiential pedagogy in outdoor spaces with required support from the participating schools in an effort to contribute to experiential, outdoor instruction reform. Long-term professional development that advocates for experiential instruction in outdoor spaces with a pre-established community of practice reinforced the outdoor PD experience, improved teacher confidence and eliminated barriers.

Implications of this study suggests using two or more of the unique aspects described above during PD experiences. The use of these aspects demonstrated increased implementation of the knowledge gained from this PD series and is transferable to other non-traditional PD
opportunities and traditional PD opportunities. In conclusion to this study and with support of other studies, it is highly recommended program leaders extend the length of PD opportunities to allow time for teachers to practice and reflect on the knowledge gained in a cyclic manner. Further support including resources and pre-established CoP’s are also deemed beneficial to increased implementation of knowledge gained. More specific to this study, supporting teachers who teach state tested subjects with a curriculum outline for ideas on how to teach the main units of the state tested subjects in an outdoor space may further support implementation of this instruction. Additionally, consideration for implementing a similar PD experience with other informal science institutions would add to the scope of this research.
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APPENDIX A

CITIZEN SCIENCE 2.0 GRANT PROPOSAL
Proposal to the National Park
Foundation, Citizen
Science 2.0

Equipping Educators to
Inspire Future Environmental Stewards

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WORK PLAN

PARK INFORMATION

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At Tremont Institute, the project will be managed and implemented by Education Director, John DiDiego, assisted by School Programs Coordinator, Jennie McGuigan, and Citizen science Coordinator, Tiffany Beachy.
PROJECT SUMMARY

GOALS AND OBJECTIVES

**Goal 1:** Teachers and school district leaders gain a better understanding of the value and power of experiential learning and Citizen science.

Objectives:
- Develop a network of teachers, administrators and schools who will engage Great Smoky Mountains National Park for place-based learning and citizen science. (Grant Priority #1 - Partners/teachers increase ability to support curricular goals using national parks as classrooms.
- Connect teachers with the latest research on brain-based science teaching and learning.
- Engage teachers with specific tools, methods, and practical experience for student-centered learning they can take home and use in the classroom year round. (Grant Priority #7 - Partners build capacity (more teachers and students served through cross-promotion and leveraging their individual and collective resources).
- Increase teacher confidence by engaging them in hands-on lessons they can use in school.
- Engage teachers in Tremont Institute’s nationally recognized Cooperative Teaching model to develop their skills to facilitate high quality environmental education with their students.

**Goal 2:** Teachers understand and feel confident using local, accurate, in-depth content on water, watershed and related environmental issues.

Objectives:
- Engage teachers in linking water/watershed issues to TN Academic standards aligned with Next Generation Science Standards (NGSS) and the Tennessee Environmental Literacy Plan (ELP).
- Use current data and monitoring techniques to demonstrate accessibility of tools and resources.
- Train 6 Teacher Teams from 6 schools (2 teachers from each school) on relevant, hands-on citizen science projects that contribute to their understanding of water and watershed issues while engaging students in authentic scientific research. The teacher teams will attend all planning meetings, park visits, and the full residential workshops. (Grant Priority #5 - Students experience stronger connection between classroom learning and real world application and problem-solving).
- Build a support network for the teachers and schools by seeking one to two administrators from each school to participate in the stages of planning, implementation, and future thinking.

**Goal 3:** Each Teacher Team develops a student-centered curriculum unit using a planning framework, such as ‘Understanding by Design’ (UbD), to addresses water and watershed issues, and culminates in a community project.

Objectives:
- Tremont Institute and park staff will create an effective toolkit that guides teachers through the process of design and implementation. (Grant Priority #8 - Park and partner facilities, services, programming and/or resources improved or expanded upon)
- Facilitate brainstorming sessions during each workshop that result in moving each school's curriculum unit plans forward, with specific goals and assignments for each of the three
workshops. Teachers implement curriculum units in schools. (Grant Priority # 11 - Expanded and improved systems for sharing resources between parks and schools.)

- Community citizen science projects implemented. (Grant Priority # 12 - A community of practice / community of learning is catalyzed for national parks and education partners)
Implementation/Delivery Method: “Equipping Educators to Inspire Future Environmental Stewards”

- We will develop an advisory committee composed of teachers, school administrators, NPS personnel, Tremont staff, and other partners.
- We will develop and facilitate a series of 3 workshops for 12 Teachers (Teams of 2 from 6 schools). Each team will receive a Teacher Toolkit and develop/implement a curriculum unit and community project.
- Participating schools will receive financial support to implement curriculum units and community citizen science projects.
- Participating schools will receive funding to assist with the cost of bringing students to Tremont Institute for residential programming.
- We will create an expanded network of partners, schools, educators & administrators, and potential donors to create a sustainable pathway for integrating ELPs, experiential learning, and citizen science in school districts into the future.

PARTNERS AND STAKEHOLDERS

Our target audience includes 5th – 8th grade teachers in Knox, Blount, Sevier, and Loudon Counties in East Tennessee. Our secondary audience is all of the current and future students impacted by the project.

Our assessment partner is Dr. Ryan Walker, Mississippi State University.

We will develop an advisory committee of stakeholders composed of teachers, school administrators, NPS personnel, Tremont staff, and other partners.

COSTS

Our main categories of expenses are: staff time to plan, prepare, and facilitate the workshop series; covering the cost of workshops for teachers; providing teacher stipends; creating Teacher Toolkits; providing monies to teachers for the development and implementation of their units and community projects; and teachers bringing their students for residential learning at Tremont Institute.
DETAILED PROJECT DESCRIPTION: EQUIPPING EDUCATORS TO INSPIRE FUTURE ENVIRONMENTAL STEWARDS

WHAT

Tremont Institute is uniquely positioned to provide high quality Experiential Education (EE) Teaching Skills to educators in a way that translates into environmental stewardship that is personal, local, and relevant to students’ lives and the community. This project is aimed at training and inspiring teachers in teaching methodology, and subject matter that is based on standards. We will also establish a local network of support for teaching experientially. We will create a toolkit for training and equipping teachers to develop interdisciplinary curriculum units and to design community projects (citizen science and/or stewardship projects) that are built around a need in their community.

With this grant award, Great Smoky Mountains National Park and Great Smoky Mountains Institute at Tremont will increase the quality of its Teacher Professional Development program and transform the education experience for local teachers and students.

PROFESSIONAL DEVELOPMENT SERIES

Tremont Institute will design, facilitate, and host three (3) EE workshops for in-service teachers at our site inside Great Smoky Mountains National Park. Each workshop will be a 3-day, 2-night residential experience, that provides about 15 contact hours for a total of 45 hours of training for teachers. The six teams of teachers will attend all elements of the workshops. To build a long-term network of support for the teachers and to ensure that the program has broader support within the district, we will aim for one to two administrators from each school attend a half-day of each workshop.

**Workshop 1**: This initial workshop will include some water/watershed content, Understanding by Design framework, Teacher Toolkits, modeling effective pedagogical techniques for teaching and learning, an introduction to citizen science, and the opportunity to practice techniques and collaborate with experts and peers. This will establish the topic relevance and increase their excitement level in teaching the subject matter, as well as the process of engaging their students in experiential education. Teachers will leave this workshop equipped to begin compiling lessons, assessing their communities, and building local support for their project.

**Workshop 2**: Teacher Teams will report on progress, share successes/challenges building their community networks, begin shaping their unit based on their initial assessments, and work with our Teacher Toolkits to give shape to their community citizen science project. They will also engage with the content and issues related to water/watersheds in the region. Teachers will leave this workshop ready to finalize their units and to use their Teacher Toolkit to inventory and organize their support network.

**Workshop 3**: Teams will share their final products, which will include plans for implementation and evaluation of the curriculum units and community citizen science project as well as their expected outcomes. Teachers will also gain exposure to tools and templates for grant writing and fundraising to generate sustainable community and financial support for the long-term future.

CURRICULUM UNITS – WATER AND WATERSHEDS

Each Teacher Team will develop a 2-4 week curriculum unit that addresses water and watershed issues, using the Understanding by Design methodology. These units will:

- include multiple lessons with common assessments to measure student learning.
- be interdisciplinary and aligned to TN standards (aligned to Next Generation Science Standards) for the appropriate grade level.
- link to the TN Environmental Literacy Plan
• incorporate the development of a Community Project (stewardship and/or Citizen science).

All curriculum unit planning templates and finished curriculum units will be made available for use (open source) by other teachers and educational institutions. The evaluation process will help hone this process as we go, so the resulting products will be more effective for teachers in the future.
COMMUNITY CITIZEN SCIENCE PROJECT

One outcome of the units will be a community project that addresses a local concern related to water and watersheds. As teachers and students complete the units, the community project will take its final form, inspired and shaped by the students’ and teachers’ experiences through their units. These projects will continue through the semester or year, with a plan for sustainability at the school and within the community, and with onsite consultations from The GSMIT faculty. Tremont Institute will continue to support teachers and schools with technical expertise and through the sub-grants, which will provide:

- Up to $750 for each school to fund their projects, for equipment, supplies, and materials.
- Up to $2,000 to support additional development for teachers and enrichment for students, by enabling a follow-up residential trip to Tremont Institute to reinforce lessons learned in their units as well as to reinforce the educational methods and delivery in Tremont Institute’s Cooperative Teaching Model.

TEACHER TOOLKIT TO INITIATE, DEVELOP, AND SUSTAIN COMMUNITY CITIZEN SCIENCE PROJECT

The Toolkit will be developed by Tremont Institute faculty and will include these components:

a.) Community Project Design: Includes templates for garnering stakeholders, conducting needs assessments, experimental design, scientific method, and evaluation.

b.) Generating support (Friends and Funds): Includes templates for basic fundraising/grant writing materials, marketing, and presenting proposals. This will also include strategies for keeping stakeholders engaged.

c.) Citizen science Projects-in-a-Box: These will include all resources, materials, and links for starting and maintaining a research project. Tremont Institute has recognized the need for tools such as these and this grant will give us the capacity to pilot them and to make them available to other teachers interested in starting community project.

WHY

WHY THIS PROJECT, GOALS, WHAT IS THE NEED?

The goals and priorities of the project were chosen due to need, relevance, and alignment with Tremont Institute’s capacity to increase environmental literacy as it relates to water and watershed issues.

We know experiential EE is effective in changing behavior. We know that Citizen science and stewardship projects immerse students and teachers in the subject matter and force them to grapple with the issues and concerns of their local environment. Research on our work with teachers in both school programs and teacher workshops has indicated that they need more than just resources – they also need training, capacity, and confidence to teach experientially (Walker 2015).

As stated above, we know from 45+ years of experience that from an educational standpoint, for teachers to plan and teach experientially, using EE, they need:

- More confidence and capacity, i.e. training and experience.
- More support, i.e. their administration, their district, and their community needs to value experiential education.
- More resources, i.e. materials and ability to get funding for projects.
- More opportunity for collaboration among teachers to share best practices.

Outcomes of this project are designed to address all of these needs, as we join forces with our partners in the national park service, and local school districts. Together, we provide:
• expertise in experiential and environmental education.
• expertise in working with, training, and inspiring teachers and students.
• capacity to design and conduct field research using Citizen Scientists.
• expertise and scientific research specifically in regional water and watershed issues.

Teachers need accurate content knowledge as well as training in pedagogy and delivery methods to tackle this complex content, but also to inspire themselves and their students so they realize that they can effect positive change. Our teacher workshops will provide scientifically accurate, relevant, and accessible information while simultaneously introducing teachers to research-based teaching techniques that are student-centered.
WHY EE TEACHING SKILLS AND COMMUNITY CITIZEN SCIENCE PROJECT?

Environmental Education Teaching Skills:
We believe we can achieve our long-term mission when more teachers are effective environmental educators. Tennessee science standards note that "It is the goal of elementary science to give background knowledge and age appropriate interaction with science as a platform to launch into deeper scientific thinking in grades 6-12" (tn.gov 2016). Integrated science is a core focus within middle school standards, which makes this shift perfect for a more hands-on educational context that can produce the deeper scientific thinking desired. Outdoor experiential education models are uniquely positioned to offer the type of “inquiry-based pedagogy” that middle school teachers have reported as being a valid strategy for teaching science.

Community citizen science project
When an environmental challenge is addressed through environmentally literate, motivated people working together, powerful outcomes in terms of the environment and personal transformation result. We have seen evidence of this through our Citizen science Projects (featured in the new report, Environmental Protection Belongs to the People - A Vision for Citizen science at the EPA, Dec 2016: https://www.epa.gov/sites/production/files/2016-12/documents/nacept_cs_report_final_508_0.pdf, and recognized in February 2016, by the National Park Service award for "Achieving Relevance through Public Participation and Resource Stewardship"). People who take part in these projects over time grow in their love and value for the places they monitor. These teams of people become eloquent spokespeople for and fierce defenders of the resource through their work on the projects. We would like to increase teacher capacity so they can oversee similar meaningful projects with their students at school. Using our experience with Citizen science, we are excited to put this type of citizen action into the hands of teachers as they develop and implement their Community citizen science project.

HOW

HOW WILL WE REACH EDUCATION GOALS/OBJECTIVES AND OUTCOMES IN THE LOGIC MODEL?
Together with Teacher Teams, we will work to increase environmental literacy by creating a new model for training teachers and working with school systems to establish effective EE training as a critical part of teacher in-service professional development in Blount, Knox, Sevier, and Loudon County schools. We already have connections with teachers in these counties but we want to deepen those relationships to increase overall education and environmental outcomes. We will build a network of stakeholders to support and advise the best way to reach our shared educational and environmental goals. We will design a new series of teacher workshops that both inspire teachers with effective methodology and engage them with complex but very relevant content.

We will create a Teacher Toolkit that enables curriculum design, project development, and capacity building, in addition to supplying resources for specific Citizen science projects which address water and watershed issues in East Tennessee.

We will support teachers in their work through embedded assessment built to inform not only the teaching practice but also their understanding of student achievement. This is a central part of helping teachers understand the power of a curriculum planning framework, such as the UbD methodology. They will experience first-hand how their new tools and practices lead to student growth and achievement.
WHO

THE TARGET AUDIENCE, NUMBERS AND ENVIRONMENTAL LITERACY NEEDS.

We have two audiences for this project: teachers and their students. First, our target audience includes 5th – 8th grade teachers in Knox, Blount, Sevier, and Loudon Counties in East Tennessee. Our goal is to identify a small cohort of committed teachers from these counties, totaling 12 teachers (2 teachers from 6 schools), who have the support of their administration to participate in each of the workshops and implement new curriculum units and community citizen science project at their schools. Second, our indirect audience consists of current and future students affected by the teachers, curriculum, and community citizen science project proposed. Great Smoky Mountains National park is the most visited national park, with a third of the U.S. population within a day’s drive; yet, many of the students taught by these teachers will likely never visit the park. We aspire to be an integral and indispensable component of teacher training in East Tennessee.

PROJECT ASSESSMENT

The nature of this project requires a multi-layered evaluation including: perceptions of all participant stakeholders, an assessment of content knowledge for teachers and students, and an evaluation of the delivered products. This robust evaluation requires engagement with grant activities beginning with the Advisory Committee meeting, and continuing with Teacher workshops, resource implementation at schools, and the subsequent student trip to Tremont Institute. Integrated evaluation activities will provide regular feedback to the leadership team to ensure that grant activities are aligned with the project goals and intended outcomes. Evaluation will employ both qualitative and quantitative measures to assess the impact of the workshops on participant teachers’ environmental education/civic engagement skills and the resulting diffusion of water and watershed knowledge into students and the local community. This evaluation overview will describe specific research methodologies in alignment with the individual goals and deliverables of the project.

GOAL 1: TEACHERS GAIN A BETTER UNDERSTANDING OF THE VALUE AND POWER OF EXPERIENTIAL LEARNING.

The evaluation team will observe and interview teachers during their workshop experience. Scripted interview questions will be derived from expectations established by Tremont Institute Leadership. Field notes will be collected from direct observation of Tremont Institute faculty interacting with participant teachers. Follow-up school consults will inform the transferability of these teachers’ newly acquired skills into their regular classrooms. Regular monitoring throughout the duration of the project will be maintained to triangulate impact on teacher enthusiasm within the established timeline of training activities and resource implementation.

GOAL 2: TEACHERS UNDERSTAND AND FEEL CONFIDENT USING LOCAL, ACCURATE, IN-DEPTH CONTENT ON WATER, WATERSHEDS, AND OTHER RELATED ENVIRONMENTAL ISSUES.

The evaluation team will work closely with the Tremont Institute Leadership to identify concept inventory items that align with the content knowledge expectations for this project. Using established assessment tools developed by the American Association for the Advancement of Science Assessment
Project (AAAS), the evaluation team will identify potential misconceptions prior to the Teacher Workshops. A post-workshop assessment as well as teaching observation will be used to assess growth in participant teachers’ content knowledge of related topics, and their success with engaging in local environmental topics.

**GOAL 3: EACH TEACHER TEAM DEVELOPS A STUDENT-CENTERED CURRICULUM UNIT THAT ADDRESSES WATER AND WATERSHED ISSUES USING ‘UNDERSTANDING BY DESIGN’ (UBD) METHODOLOGY.**

The evaluation team will observe teacher interaction with Tremont Institute faculty during the development of lessons and the implementation of the unit at schools. They will conduct interviews with target teachers to assess perceptions of the usefulness of individual interdisciplinary lessons within the unit, the embedded assessments, and the associated impact on student learning. Questions will be scripted to align with the overarching template defined by Tremont Institute Leadership. Student content knowledge will be assessed using pre and post AAAS concept inventories and unit assignments. During their visit to Tremont Institute, students will respond to a reflective writing prompt designed to make connections between their school experience with the participant teacher, the piloted unit, the community project, and their interaction with Tremont Institute faculty and residential programs/curricula.
TEACHER TOOLKITS

The resources provided in the toolkits will be evaluated for their usefulness to the teachers during on-site interviews and instructional observations. Each artifact will be evaluated independently based on the desired outcome as specified by the Tremont leadership team. A final summative assessment of the toolkit will inform the leadership team of the impact these resources can have as outreach to local schools and communities beyond informal experiential learning and the boundaries of the national park.

LOGIC MODEL, BUDGET & TIMELINE

Please see the attachments, including:

• Detailed budget
• Timeline
• Logical model
APPENDIX B

SCHOOL CASE OUTLINES
School 1

**County:** Knox

**Number of Participating Teachers:** Three

**Participant Teacher Endorsements:** Special Education K-12; English, Language, Arts; Science; K-8 Mathematics; Gifted and Talented K-12;

**Grades Taught:** 6-8

**Reason for Participating:** We wish to incorporate more interdisciplinary aspects of education. This would allow us to change the curriculum and work as groups. The curriculum would be developed into ways to create units that would allow more teachers involved in cross-curriculum teaching and bring teachers together. It would also encourage and support teachers to take students outdoors.

**Use of Experiential, Outdoor Education before Workshop:** Behind our school sits a nature preserve with 7 miles of trails. Our school also has two outdoor classroom seating areas with plans and funding for a native pollinator garden and teacher garden plots for class projects. Through the use of these outdoor spaces, teachers have taught science lessons using trees and aquatic macroinvertebrates to teach about dichotomous keys, doing various scavenger hunts, investigations using chalk to write on the ground, recess for 6th grade and gardening. Teachers also use these spaces to simply give students a pleasant place to learn or do a quiz and learning through interactive play when learning new skills. [One teacher] is working with an AmeriCorps volunteer throughout the year to do a nitrate study of a creek which is funded by a U.T. grant. We are also having a Smoky Mt. Ranger come to our schoolyard soon to help us create a monitoring terrestrial plot which can used for science grades 6-8.

**Perception of Needs:** Time set aside with teaching team, Resources and content support
Access to Water: Yes! We are also working with an AmeriCorps Volunteer to research run-off from our building and parking lot.

Title of Participating Administrator: Executive Principal

Teacher Pseudonyms: Cade, Sparrow and Dorsey

Teacher Follow-up Interview Participation: 2

Teacher Stimulated Recall Interview Participation: 3

Administrator Interview Participation: Pre and Post

Administrator Workshop Attendance: December and June
School 2

County: Knox

Number of Teachers: Three

Participant Teacher Endorsements: K-6 Elementary/all subjects (English, Language, Arts; Mathematics; Social Studies; Science)

Grades Taught: K-5

Reason for Participating: [This school] would like to participate in this workshop series as we have been involved in the creation of an outdoor trail for the past year and a half. Harnessing the power of local volunteer groups (local churches, parents, community leaders, teachers, and students) we were able to take a completed unused, overgrown space and create a clear-cut half mile trail for use by not only the school itself, but the surrounding community. Most recently (last Saturday), a local men's group installed enough benches for 35 students to sit in an outdoor classroom. Now that our trail is clear, mulched, and a basic outdoor classroom has been installed, it is time to start using the space... but we aren't sure how to transition our students into the outdoors. This workshop series will give us the tools to get our students outdoors! In addition, we work with predominantly lower income students who have oftentimes never been to the Smokies despite living just outside its entrance. Being able to bring students to the GSMIT would give them this opportunity in an educational manner. Besides, how can we expect our students to appreciate and take pride in the outdoors... if they are never in it?!

Use of Experiential, Outdoor Education before Workshop: We have already taken our students onto the trail for healthy hikes, leaf watching, and other sight-related activities. We have an after-school club called "outdoors club" where we work with Ijams Nature Center and
the Sierra Club to take the students on the trail for tree identification, leaf prints, and general hiking knowledge.

**Perception of Needs:** Connection to standards, Time set aside with teaching team

**Access to Water:** Yes

**Title of Participating Administrator:** Principal

**Teacher Pseudonyms:** Spruce, Luna and Sal

**Teacher Follow-up Interview Participation:** 3

**Teacher Stimulated Recall Interview Participation:** 1

**Administrator Interview Participation:** Pre and Post

**Administrator Workshop Attendance:** December (Administrator) and June (Counselor)

Note: Sal moved to school 3 after the workshop series.
School 3

County: Knox

Number of Teachers: 2

Participant Teacher Endorsements: K-6 Elementary/all subjects (English, Language, Arts; Mathematics; Social Studies; Science), K-12 Special Education, 7-12 history

Grades Taught: K-5

Reason for Participating: [This school] is a Knox County public school located in the heart of downtown Knoxville. We have a current enrollment of 635 Pre-K-Fifth grade students with 83% of those students being African American. [We are] a Title 1 school with 100% of students being served in the free and reduced lunch programs. In Tennessee alone it is reported that 87.9% of children eat vegetables less than three times daily. This impacts the overall health and wellbeing of entire population. By creating a program based upon citizen science on [our] school grounds and partnering with the GSMIT on teaching students how to use science within their own community to assist them in activities such as growing a garden or understanding the pollination cycle, we will assist both the school and the community with knowledge about sustainable living, school wide education programs, and increasing community involvement about the overall health and wellness of the community at large. We envision this program assisting the entire community not just the population at [our school]. We want our students to focus on the greater picture in life and teach them that they can do great things in the community.

Use of Experiential, Outdoor Education before Workshop: We are currently struggling within this area and would like to incorporate more into our teaching and learning but have yet to be successful at creating this within our urban school environment.
Perception of Needs: Teaching practices/methodology/activity ideas, Lesson plans/unit development

Access to Water: Yes

Title of Participating Administrator: Assistant Principal

Teacher Pseudonyms: Lily and Doc

Teacher Follow-up Interview Participation: 1

Teacher Stimulated Recall Interview Participation: 1

Administrator Interview Participation: Pre and Post

Administrator Workshop Attendance: December and June

Note: Lily deceased participation for reasons outside of the program and Sal from school 2 moved to school 3 after the workshop series ended.
School 4

County: Knox

Number of Teachers: 2

Participant Teacher Endorsements: Life Sciences (Biology, Advanced Placement Environmental Sciences, Ecology, Wildlife, Anatomy and Physiology)

Grades Taught: 9-12

Reason for Participating: [Our school] is blessed with an amazing class called Wildlife Principles. [A retired teacher] developed the curriculum and has taught the class for over 2 decades, but he is retiring after this year. We are wanting to continue this Wildlife program by incorporating new ideas and methods that allow more of our students and classes to get outside, use the wooded area we are fortunate to have, and become citizen scientists that contribute to something greater than our own campus. What we as teachers need to learn is what curriculum, opportunities, and online resources are available for teachers and students from the GSMNP that we can bring back and use.

Use of Experiential, Outdoor Education before Workshop: On [our] campus, we have a 3-acre wooded area where we conduct research and lessons- taxonomic, biodiversity, and population studies, live trap and release labs, tree identification, habitat availability, etc. This is used by the Wildlife classes every semester, by the ecology teachers, and wood lot is part of our identified specimens for the arboretum we are applying for. Just today, you all visited our school and started a long-term phenology study with [an] ecology class. This is exactly what we want to see our students and classes doing!!!!

Perception of Needs: Teaching practices/methodology/activity ideas, Lesson plans/unit development, Time set aside with teaching team, Resources and content support, Other:
Permission from School System for Field trips to a great watershed area close to school.

**Access to Water:** Not sure

**Title of Participating Administrator:** Head Principal

**Teacher Pseudonyms:** River and Sierra

**Teacher Follow-up Interview Participation:** 2

**Teacher Stimulated Recall Interview Participation:** 1

**Administrator Interview Participation:** Pre and Post

**Administrator Workshop Attendance:** December
School 5

County: Blount

Number of Teachers: 2

Participant Teacher Endorsements: K-6 Elementary/all subjects (English, Language, Arts; Mathematics; Social Studies; Science), Special Education

Grades Taught: K-5

Reason for Participating: Learn new ideas to enhance hands on implementation for all subjects, including how to use our wetlands more effectively. Teaching will benefit from the various ideas, methods and activities accumulated from this workshop series that include getting the students excited about the non-traditional settings and implementing these throughout the school. To help develop a citizenry that as voting adults will understand, appreciate, respect and help care for a clean, productive and scenic landscape, including native plants and animals, that provide for a high quality of life in our county and state. To help nurture this “conservation ethic” - - - respect for the land, this nature trail was routed through the naturally occurring forest, wetland, spring, and along [the creek] for us to see and to study.

Use of Experiential, Outdoor Education before Workshop: Our 2nd grade teacher, has previously taught 4th and 5th grades. We have CMS across the street. CMS and WBHS work collaboratively with us. We have a 16 acre wetland outdoor classroom outside our classroom doors. We have hosted a science day for the last 5 years which includes multiple community partnerships. We hosted another elementary school to participate in a field trip on our campus. Our teachers in all grade levels, currently use the wetlands for all subjects (reading outside, writing, math, science, and even history has been taught there.) We have recently added more of our informational signage/ marque to specific locations. This signage includes natural habitats, a
QR code, description of site/historical reference, etc. We have had professional development from Tremont, Blount County Soil and Conservation, etc. to enhance lessons for our teachers. We hosted Tennessee Outdoor Classroom Symposium & Tennessee Environmental Education Association with Tremont. We have worked collaboratively with Maryville College in facilitating professional development, and also they developed the map of our wetland plotting GPS coordinates.

**Perception of Needs:** Lesson plans/unit development, Time set aside with teaching team

**Access to Water:** Yes

**Title of Participating Administrator:** Principal

**Teacher Pseudonyms:** Raven and Oakley

**Teacher Follow-up Interview Participation:** 0

**Teacher Stimulated Recall Interview Participation:** 0

**Administrator Interview Participation:** Pre

**Administrator Workshop Attendance:** December
School 6

County: Blount

Number of Teachers: 2

Participant Teacher Endorsements: Biology and Social Studies

Grades Taught: 9

Reason for Participating: [We] would be interested in collaborating and implementing an inquiry approach to outdoor education. Our idea is to work in all disciplines to create socially and environmentally literate students. We are interested in learning how we can use our outdoor space as a classroom for students to explore their observations and develop questions and then be able to investigate those questions and how to relate these to the State Standards. We would love to work with our feeder schools so that the students will have a staggered learning experience.

Use of Experiential, Outdoor Education before Workshop: In Biology we have collected water samples from puddles outside and investigated what lives in them with microscopes. We have collected these areas and gathered data on what types of chemicals were in the water and if that lead to more or less biodiversity. I have had students to identify the trees around campus using a plant net app with their phones and discussed why these are important.

Perception of Needs: Connection to standards, Accessible outdoor space, Time set aside with teaching team

Access to Water: Yes

Title of Participating Administrator: Assistant Principal

Teacher Pseudonyms: Fox and Woods

Teacher Follow-up Interview Participation: 2

Teacher Stimulated Recall Interview Participation: 2
Administrator Interview Participation: Pre and Post

Administrator Workshop Attendance: December and June
APPENDIX C

DECEMBER INTERVIEW PROTOCOL
Program Leaders

- Introduction
  - Name?
  - How long have you been associated with Tremont?
- Ideas/understanding
  - What does experiential learning mean to you?
  - What does outdoor education mean to you?
  - How would you define classroom?
    - With that definition in mind, three years from now if you walked into one of these teachers’ classrooms what would you expect to see?
- Teachers
  - What do you think is the biggest challenge for teachers when implementing appropriate outdoor education at their schools?
  - What aspect of this project will help them overcome these challenges?
  - How do you think the workshop will help address any barriers between teachers and administrators?
- Personal
  - What was your initial impression of this project?
  - What is the value of modeling appropriate instruction?
    - What are some ways you will personally model appropriate instruction?
  - What challenges do you think you will face during the workshops?
**Teachers**

- **Introduction**
  - Name?
  - Which subjects are you licensed to teach?
- **(ideas/understanding)**
  - What does experiential learning mean to you?
  - Describe your ideal classroom?
- **(experience)**
  - Tell me about your experience teaching outdoors? (Location, Time…)
    - How often?
    - What was the focus? (objectives/goal)
    - What challenges did/do you face?
    - What value does this add to your instruction?
  - What do you want to get out of this experience? (expectations)
- **(support/past PD)**
  - On a scale of 1 to 10, 1 being the least and 10 being the most, how well do you feel supported by your school to implement what you will take away from this experience?
    - How well do you feel supported by your administrators?
      - How do you think the workshop will help address administrative support barriers?
  - How has your past professional development experience focused on co-design collaboration?
  - How often do you collaborate with each other?
    - Build?
    - Share?
    - How do you integrate your subject areas?

How difficult do you think it will be to integrate your subject areas?
Administrators

• Introduction
  o Name?
  o Which school are you representing?

• (ideas and understanding)
  o What does experiential learning mean to you?
  o What does outdoor education mean to you?
    ▪ Tell me about your experience teaching in the outdoors?
      ▪ How often?
      ▪ What challenges did you face?
  o What value do you think outdoor education adds to instruction?
  o How would you define classroom?
  o With that definition in mind, three years from now if you walked into these teachers’ classrooms what would you expect to see?

• (teachers)
  o In the past, what are ways you have encouraged your teachers to teach outdoors?
  o How often do you witness the teachers at your school teaching outdoors?
  o What do you want your teachers to get out of this experience?
  o What are some challenges concerning outdoor education that teachers have expressed to you in the past?
  o What challenges do you think the teachers will face during this experience?
    ▪ How do you plan to support your teachers during challenging times?

• (professional development)
  o What type of professional development do you typically offer or encourage?
  o What was your initial impression of this project?

• (support)
  o These workshops are designed to encourage content integration and collaboration between teachers. What do you think the benefits of this type of co-design will be?
  o How do you think the workshop will help address any barriers that exist between administrators and teachers?
APPENDIX D

MARCH INTERVIEW PROTOCOL
Program Leaders

- For the kickoff meeting you modeled a version of I notice, I wonder, it reminds me of. You modeled a different version of this with further discussion during the first workshop. (sticks on tables)
  - Why did you repeat this activity?
  - What are the benefits of repeating activities?
- You have instructed teachers to let students do the exploring and reach technical terms later.
  - Why do you think this is important?
  - Is there any specific research that you have encountered that has encouraged this?
- The first workshop heavily emphasized journaling and reflecting. (I think some teachers have filled their journals already.)
  - Why did you choose to incorporate this into your workshops?
  - Why do you think journaling and reflection is important for teachers to incorporate in the classroom?
  - Do you think you should incorporate more reflection?
  - How will this prepare teachers for teaching outside?
- During the first day of the first workshop you conducted activities near the building.
  - Was this planned with any specific intention in mind?
  - If so, what was your intention?
  - If not, what do you think some benefits or drawbacks of this choice may have been?
- During the kickoff meeting we discovered many obstacles the teachers were facing (time, standards…). How have you worked to alleviate these obstacles?
- Activities emphasized observations during the kickoff meeting until the evening program on the second day of the first workshop.
  - Why was so much time spent on teaching/how to teach observation skills?
- You emphasize “student” mode and “teacher” mode throughout the workshops.
  - Why is this important to you as the program leader?
  - What are some foreseen benefits of using this modeling method?
  - What are your thoughts on how the teachers are engaging in these “modes”?
- In your opinion, what is the most important? The actual activity or the process of the activity?
  - Explain.

Sunday: Unfortunately, we had to leave early during the January workshop, so I want to ask about the Sunday adventures.

- Briefly describe what you did that day.
- What was the most memorable aspect of that day?
  - Why was it the most memorable?
- Describe any other interesting aspects of the day?
- Did you use the cooperative teaching model on this day?
  - Briefly describe.
• At the end of the workshops you have teachers give an improv presentation.
  o Explain how the teachers responded to this activity?
  o I know you mentioned you have done these types of presentations in a workshop you attended. Why did you decide to include them in this workshop?

(Teachers)

• I noticed teachers were engaging in on topic transitions between activities and down time.
  o What do you think about this?
• Describe any issues/drawbacks that have been exposed during the homework assignments for the teachers.
  o Have you had to re-think/design any of the assignments?
• Describe the “victories”/benefits that have been exposed through homework assignments for the teachers.
• What is the strongest homework assignment you have seen so far? (Concerning your planning not specific to a school or teacher.)

(Administrators)

• I have observed a couple of instances where the teachers have opened up about issues they have with administrators.
  o Do you have a protocol for handling these conversations?
  o What is it?
  o What do you think about teachers opening up to you about the issues they have?
• During the first workshop there was a school that mentioned they were required to have the students recite objectives before class. This caused concern in the teachers thinking it would hinder the explore process.
  o Have you visited this with the administrators?
  o If so, briefly describe the conversation.
  o If not, do you plan to? Why/How or why not?
• What contact have you had with the administrators since the kickoff meeting?
  o Please describe any pushback you have experienced.
  o Please describe any surprises you have experienced.
• Which schools have you visited?
  o In your personal opinion….
    ▪ Concerning recourses, which school is the most competent for teaching outdoors?
Concerning staff, which school is the most competent for teaching outdoors?

(Objectives)

- How have you connected teachers with the latest research on brain-based science teaching and learning?
- Why is it important to engage teachers with specific tools, methods, and practical experience for student-centered learning they can take home and use in the classroom year round?
  - How have you done this/plan to do this during the workshops?
- How do you think you have increased teacher confidence by engaging them in hands-on lessons they can use in school?
  - Do you have any personal testimonies of teachers claiming they have increased confidence?
- How have you/will you use current data and monitoring techniques to demonstrate accessibility of tools and resources to teachers and administrators?
- Explain your protocol for creating an effective toolkit that guides teachers through the process of design and implementation.
Teachers

- Since the December kickoff meeting, have you taught outdoors?
  - How many times?
  - What was a challenge you faced?
- So far, how would you say the workshop experience improved your confidence in teaching outdoors?
- What has been the most useful/powerful experience at the workshop?
- Name one thing you would drop from the homework assignments and one thing you would keep.
APPENDIX E

JUNE INTERVIEW PROTOCOL
Administrators

Value

- Describe the value that outdoor education adds to instruction?
- These workshops were designed to encourage content integration and collaborations between teachers.
  - What benefits have you noticed from this co-design?
  - How do you think this adds value to the experience for the teachers and for your school?
- Tremont spent much of the March workshop focused specifically on how to use the new TN state standards and provided time for collaboration and lesson planning between schools.
  - As an administrator how valuable is collaboration between local schools?
  - How valuable are professional development activities that align with school, district and state policies and goals?
- This professional development focuses on citizen science.
  - What is your opinion on citizen science in schools (all schools)?
  - What are some ways you would like to see your school use citizen science in the future?
  - What do your superiors think about trying to implement citizen science in your school?
    - Have you received any push back or criticism? Explain.

Leadership

- How has the workshop addressed any barriers that may exist between administrators and teachers?
- What are some challenges teachers have faced this spring while teaching outdoors?
  - How were you able to support the teachers with/during their challenges?
- What are your perceptions of your (administrator) required involvement in this program?

Teachers

- In relation to before the workshops began, how often have you noticed your teachers teaching outdoors?
- Describe the reaction of other teachers (those not participating in the workshops) in your school regarding teaching outdoors.

General
• In your own definition, what is effective science instruction?
  o What are at least two necessities for good science instruction?
• Do you think teaching outdoors is content specific? Explain.
• What is your long-term vision for the use of this professional development opportunity in your school?
APPENDIX F

FOLLOW-UP INTERVIEW PROTOCOL
Program Leaders

Intended

- When designing this program, the GSMIT faculty chose schools of all grade levels to participate.
  - What were the intentions for doing this?
  - Why do you think it is important to focus on feeder schools and multiple touchpoints for students throughout their k-12 experience?
- A requirement for this professional development was the co-design aspect.
  - What were the intentions for this requirement?
  - What benefits have you noticed from this co-design between teachers?
  - What benefits have you noticed from this co-design between teachers and administrators?
  - Have there been any outstanding issues concerning this aspect?
  - How do you think this co-design aspect adds value to the experience for the teachers and for the schools?
- Define administrator support within the realm of this program.
- How did the workshops provide teachers with a better understanding of the value and power of experiential learning and Citizen science?
  - How did this experience provide administrators understanding of the value and power of experiential learning?
  - What are the plans to continue this with teachers and administrators?
- How do you think you have increased teacher confidence using content related to local watersheds and environmental issues?
  - Do you have any personal testimonies of teachers claiming they have increased confidence? Could you share?
  - Specifically related to using watershed content in the classroom?
- According to the goals, there are also intentions for teachers to develop a curriculum unit that addresses water and watershed issues.
  - When did or when will the teachers begin this process?
  - What are the general expectations of teachers and schools?
  - When should it be implemented in the schools?
  - What are the plans for collecting evidence on the implementation of the unit?
- There were many instances where the teachers had the opportunity to learn from the National Parks Services during the workshops. Why was this a major focus of the workshop experience?
  - Describe any form of evidence you have that teachers have continued working with the NPS in their classrooms.
- You participated in developing this unique workshop model, list sources of evidence that proves the model has been implemented. (How do you know?)
Implemented

- During the kickoff meeting teachers mentioned they were facing obstacles with time teaching outdoors, trouble linking content to standards and little confidence managing student behavior outdoors. During the first year of the program, how have you worked to try to alleviate these obstacles?
  - What aspects of the program do you think were most beneficial for teachers concerning these obstacles?
  - Could you share any testimonies from teachers concerning this?
  - Is there anything you would do differently during the workshops specifically regarding these obstacles for teachers?
- In June, teachers requested more time learning about Hand on the Land data base. You addressed this request. Have you had any contact with teachers who have specific questions or feedback from the use of this database?
- Describe any issues/drawbacks that have been exposed during the homework assignments for the teachers.
- Describe the “victories”/benefits that have been exposed through homework assignments for the teachers.
- Share an experience from the workshops that you found memorable and explain why it was memorable.
- The workshops varied in level of expectations. For example, I noticed January was busy, March was the most intense and June was more laid back.
  - Which meeting do you think worked best for the teachers?
  - In hind sight, are there any changes you would want to make specifically concerning the level of teacher expectations? Explain.
  - Would you modify the length of the workshop series? Explain.
- During conversation, you eluded to noticing the importance of giving teachers an opportunity to fail, reflect, then try again.
  - Do you remember when/why this understanding was founded?
  - This method of pedagogy is grounded in research. But concerning the program, where is the evidence for this understanding described?

Experienced

- To my understanding you have asked all participating teachers to attend a Teacher Escape Weekend. Why was this a requirement for the program?
  - How many schools attended the Teacher Escape weekend in fall 2018.
  - Would you like to share an experience related to the participating teachers who attended?
- Teachers were also asked to schedule a visit to Tremont during the 2018-2019 school year with students.
o How many schools have signed up?
o In November, a school came to visit. What are some things you or the Tremont Staff saw or learned?

- To what extent have you contacted the schools since June?
  o When did you first contact the schools after the June workshop?
    ▪ What was the reason for the contact?
  o Do teachers express challenges to you? If so what are some of the challenges mentioned?
  o Do teachers express positive outcomes? Is so, what are some things they have mentioned?

- How many total visits have you made with the schools?
  o Have you met this number of times with all of them?
  o Would you like to share anything from your experience visiting the schools?

- What are the reasons for attrition? If you are unsure, what are some reason you expect?

- Please share some insight on your perception of participant buy-in concerning the length of the program.

- Please describe any pushback you have experienced.

- Please describe any surprises you have experienced.

- Describe how this program opportunity has impacted your educational philosophy.

- What is your long-term vision for outdoor education?

- What challenges do you think you will face in the next 2 years?

- Could you share an accomplishment that is related to this experience that you are most proud of?

- Is there anything in general that you would consider changing? Why?

- Would you like to mention anything else that we have not already discussed?
Teachers

Experience

- What does outdoor experiential education mean to you?
  - What value does it add to your instruction?
- About how many times have you taught outdoors this fall?
- In December I asked all teachers what challenges they face regarding instruction in an outdoor space. Nearly all groups of teachers mentioned too little time for lessons, unsure how to connect standards and concerns about student management. To what extent did Tremont alleviate the challenges mentioned?
  - Science teacher: Do you continue to find it difficult to tie science and engineering practice standards to outdoor lessons?
  - Non-science Teacher - One administrator suggested the science and engineering practices align with all content.
    - What are your thoughts?
    - Have you used any of these practices this fall?
- What challenges have you faced this fall?
  - Did you feel more comfortable handling the challenges as compared to the beginning of the workshops? Explain.
- From my observations, I noticed willingness of all teachers to play/get dirty/participate fully more and more as the PD progressed.
  - Is this something you have noticed from your students? Explain.
- Could you share your most prominent memory of student reactions to learning in an outdoor space?
- In March you all observed a school at Tremont. Many concerns were expressed about their students being better behaved/smarter. After the professional development experience, do you still consider this a true statement?
- Reflecting on your own practice, share how the workshops have impacted your educational philosophy.
- What is your long-term vision for outdoor education at your school?
- Could you share an accomplishment that is related to this experience that you are most proud of?
- Tremont requested you reflect on what you know, don’t know, what you are excited about and what you are nervous about each meeting. Please respond with the first thing that comes to mind on each,
  - What do you know?
  - What do you not know?
  - What are you excited about?
  - What are you nervous about?
Implementation (What Tremont did)

- During the workshop activities you were asked to participate as a student many times. What are your thoughts on “acting as the student” during the workshop?
- Tremont requested you participate in a solo sit during your visits. What are your thoughts on this activity? Have you used it? Why/why not?
- Reflection was a large component at Tremont. To what extent have you embedded reflection in your instruction?
- December and January workshops heavily involved observation and questioning techniques. To what extent have you incorporated observation into your instruction?
  - Many activities presented at Tremont used “I notice, I wonder, it reminds me of”.
    - To what extent do you use this? Why/Why not?
    - Have you embedded it into your norms? Why/Why not?
- Many of you requested more information on the Hands on the Land database in June.
  - Have you used hands on the land this fall?
- Tremont provided a tool kit in June based on requests made by each school.
  - What did your toolbox have in it?
- The workshops varied in level of expectations. For example, I noticed January was busy, March was the most intense and June was more laid back.
  - Which meeting worked best for you?
- What has been the most useful/powerful experience related to the workshops?

Co-design

- A requirement for this professional development was the co-design aspect.
  - How often do you collaborate with the other teacher(s) participants from your school specifically about outdoor education?
  - What benefits have you noticed from this co-design?
- The workshop series combined elementary teachers and secondary teachers, many professional development experiences tend to separate based on grade level. One of Tremont’s intentions was to connect the feeder schools (elementary, middle, high).
  - What are your thoughts on this?
- Have you worked with other schools in your cohort since June? No
- Describe teacher buy-in at your school.

Support
• On a scale of 1 to 10, 1 being the least and 10 being the most, how well do you feel supported by your school and administrators to implement what you have taken away from this experience?
• Does your administrator encourage you to teach outside?
• How well do you feel supported by your administrators?
  o What does administrator support mean to you?
  o To what extent do you feel they value your opinion and vision? 7
• Explain how the workshop met your expectations.
  o Are there any expectations that were not met? Explain.
APPENDIX G

STIMULATED RECALL INTERVIEW PROTOCOL
SRI General Prompts

- As the video is playing, if you want to make any comments, please pause it and discuss.
- If the teacher needed more guidance the following general probes were asked.
  - What aspects of the video links to the workshop?
  - What are your reasons/thoughts of doing this activity?
  - Justify the use of pedagogy.
  - Did you use this before the workshop experience?
    - Describe any changes you have made?
    - Why did you make those changes?
  - Would you change anything if you did this again?
    - How would you change it?
APPENDIX H

APPLICATION FOR CITIZEN SCIENCE 2.0
Name of School *

School Phone Number *

Teacher 1 - Name *

Teacher 1 Email *

Teacher 1 - Phone Number

Teacher 1 - Title

Teacher 1 - Subject(s) you teach *

Teacher 1 - Grade(s) you teach *

Teacher 2 - Name *

Teacher 2 Email *

Teacher 2 - Phone Number

Teacher 2 - Title

Teacher 2 - Subject(s) you teach *

Teacher 2 - Grade(s) you teach *

Why do you want to participate in this workshop series? How do you envision participation in this series impacting your teaching? Your school and students? *

How do you see this project fitting in to your current and long-term teaching/curricula plans? *

Please share any examples of how you have already incorporated experiential education and/or outdoor education into your teaching.

This series will require additional time and energy on you and your partner’s part. Are you confident that you will be able to set aside 1-2 hours per week during parts of the year to devote to developing and implementing this project? *

How easy will it be for you to work closely with your teacher partner for the duration of this program?

Check all that apply *

What do you perceive to be your biggest needs to make this successful? Please choose your top two needs. *

If you selected 'Other' above, please explain here:
Is there an accessible body of water (stream, pond, lake, ditch, etc.) within walking distance of your school? *

If there is an accessible body of water near your school, please describe it below.

Does your school conduct field trips? Overnight school trips? *

How much emphasis is given to teacher professional development at your school? *

Administrator’s name *

Administrator’s title *

Administrator’s Email *

Administrator’s Phone Number

Do you understand and support this workshop series designed for your teachers? *

Please comment on your choice above.

Teachers will leave these workshops with newly designed curriculum units, assessments, and a toolkit to implement a community-based project relevant to your community and school. What support and resources will you and your school commit to providing that will ensure project completion and success? *

Kickoff and Planning Day - December 2, 2017

Residential Teacher Workshop #3 - June 18-20, 2018

Do you have anything else you would like to share?
APPENDIX I

OBSERVATION FIELD NOTES: ACTIVITIES MATCHED FOR ALIGNMENT
<table>
<thead>
<tr>
<th>Activity</th>
<th>Process/Description</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>I notice, I wonder, It</td>
<td>• Everyone including the staff, evaluators, and national park services participated in the lesson.</td>
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<tr>
<td>reminds me of</td>
<td>• This lesson was the first to model affective teaching strategies.</td>
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<td></td>
<td>• Teachers acted as students.</td>
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<tr>
<td>Quick Write</td>
<td>• Administrators and teachers were prompted to brainstorm what they see 4-6 years from now in teachers, students and community.</td>
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<td>4-6 years</td>
<td>• The quick write lesson lasted 3-5 minutes.</td>
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<td></td>
<td>• Ideas were to be written on a dry erase board.</td>
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<td></td>
<td>• Success continuing</td>
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<td></td>
<td>• Test scores increase</td>
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<td></td>
<td>• Multi-touch point park experience</td>
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<td></td>
<td>• More teachers utilizing the park and surrounding resources for teaching and inspiring</td>
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<td></td>
<td>• Students in internships/volunteering</td>
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<td></td>
<td>• Students post school trajectory altered positively due to park experience</td>
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<td></td>
<td>• Body of research that supports and further informs need for wider use of Experiential Education and Citizen science</td>
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<td></td>
<td>• Regular outdoor classroom usage</td>
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<td></td>
<td>• Student developed stewardship projects</td>
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<td></td>
<td>• Increased excitement for learning</td>
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<td></td>
<td>• Parent involvement</td>
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<td></td>
<td>• Students and teachers engaged in local decision making</td>
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<td></td>
<td>• Buy-in</td>
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<td></td>
<td>• Awareness</td>
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<td></td>
<td>• Sustainable Culture</td>
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<td></td>
<td>• Individual Voice</td>
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<td></td>
<td>• Global citizenship/cross curriculum/ climate-world view about learning</td>
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<tr>
<td>Activity</td>
<td>Process/Description</td>
<td>Notes</td>
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<td>-------------------------------------------------------------------------</td>
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</tbody>
</table>
| Information and expectations                                            | • Tremont leaders opened addressing information for expectations of the workshop, information on what schools experience at Tremont and what to do in case of emergencies.  
• Teachers who had spent the night at Tremont before were asked to stand in a line. Other teachers were asked to pair with them and discuss what they needed to know to “survive” Tremont.  
• After discussing teachers were asked to share what they learned from each group.  
• This led into further questions from teachers and answers provided by program leaders |                                                                                                                                                                                                                                                                                                                      |
| I notice, I wonder, it reminds me of | • Teachers were asked to clear the tables of nothing but the stick and hand lenses.  
• A program leader prefaced the activity. (Discussed vocabulary, how to use the lenses…)  
• Teachers were asked to blurt out I notice phrases in groups.  
• The program leader guided the process. (I want to hear “I notice…”)  
• The program leader modeled ways to help students develop scientific vocabulary. (I notice can become I observe.) This was accomplished by beginning a discussion with teachers about the difference between observations and inferences then liking those definitions back to “I notice” and the next part of the activity “I wonder”.  
• Teachers participated in the “I wonder” part then concluded as a group that vocabulary for “I wonder” could become “I hypothesize or I ask the question…”  
• Teachers participated in the “it reminds me of” part of the activity then discussed. One teacher mentioned prior knowledge.  
• Teachers were instructed to take this activity, use it and make it their own. |
| --- | --- |
| How do you introduce something new? | • Teachers were asked to stand in a circle, turn to someone and discuss how they introduce a new topic in the classroom.  
• As a group these things were discussed. |
| Piece of Nature Journaling Practice | • Teachers were instructed to take a “piece of nature” lichen to a solo spot and draw it in their journals.  
• The idea was to express data and information, not art.  
• Next teachers brought their nature and drawing (without name) to the center of the group circle and everyone tried to match the piece of nature with a drawing.  
• Teachers then discuss what they did and how they could use in in their content.  
• Next teachers paired up and gave each other critical feedback regarding their drawing in their journal.  
• Another group discussion wrapping up the ideas of the activity was held. |
Reflect on Practice

- The reflection was based on their own practice and is intended to be monitored and assessed throughout the process.

<table>
<thead>
<tr>
<th>What I know</th>
<th>What I don’t know</th>
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<table>
<thead>
<tr>
<th>What I’m excited about</th>
<th>What I’m nervous about</th>
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- This activity sparked many side conversations that the program leader gladly discussed. It seemed everyone was back in “teacher mode”.
  - Wait time
  - Expectation to “fail”

Activity field notes January 20, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process/Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before morning program</td>
<td>Free collaboration during and after breakfast.</td>
<td></td>
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<tr>
<td>Morning introduction</td>
<td>- Teachers were given time to discuss what they took away from the activities the night before.</td>
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<td></td>
<td>- Teachers were given time to discuss during the kickoff meeting.</td>
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<td></td>
<td>- Discussion and development of norms.</td>
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<td></td>
<td>- Teachers discussed what norms were, how they were set in their own classes.</td>
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<td></td>
<td>- Teachers then established norms for the workshop.</td>
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<tr>
<td>First morning session, outside</td>
<td>- Teachers were led to a tree that is located at the bottom of the stairway to the entrance of the building. Teachers were instructed to gather in a circle, observe the tree, and simply say 2 words that describe the tree. A quick discussion about the project was held.</td>
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<td></td>
<td>- After walking to another tree, the teachers were instructed to get in a spot and observe the tree. The time spent searching for a spot was between 10 and 15 seconds. Teachers observed from that perspective for about 30 seconds. This</td>
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</tbody>
</table>
was repeated two more times. Then a discussion about the activity was held. This activity was like zoom zoom zoom with only observations. Teachers were encouraged to get into silly positions to make it fun.

- Next teachers grabbed a partner and got into two parallel lines. They followed the program leader to another area across a driveway near the friendship circle (a fire pit). Here, excuses for not getting outside were discussed.
- Screaming toes – an activity where everyone gets in a circle, squats and looks at their toes then at the count of three looks up. If they are looking at someone they are out. It works a lot like musical chairs. This was used to lighten the mood and transition from outside to inside. (Brain break).
- On the way back inside teachers were instructed to find something beautiful, reflect on it and discuss what they found on the way back inside. This led to further collaboration between schools.

<table>
<thead>
<tr>
<th>Second morning session (inside)</th>
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<tbody>
<tr>
<td>- This session was more of a typical workshop lecture with discussion. The focus was research for routines of science learning.</td>
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<tr>
<td>- The benefits and drawbacks of anthromorphism and naming/identifying were discussed.</td>
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<table>
<thead>
<tr>
<th>First afternoon session (inside)</th>
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<tbody>
<tr>
<td>- Turn and talk – teachers had to turn to a partner and talk about the first good childhood memory about science.</td>
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<tr>
<td>- History of Citizen science in lecture form.</td>
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<tr>
<td>- How can citizen science be used lecture/discussion?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Second afternoon session (outside)</th>
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<tbody>
<tr>
<td>- Exploratory Investigation – 10 -15 minutes was allowed for exploring.</td>
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<tr>
<td>- Teachers were pulling up sticks and turning over rocks and scratching through leaf litter. One even pulled out a pocket knife to explore.</td>
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<tr>
<td>- Discuss instruction-</td>
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<tr>
<td>o Instruction were “go explore” within boundaries.</td>
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<tr>
<td>o Teachers mentioned they would not want actual time restrains because they were afraid the exploring would stop. (but it did…see notes)</td>
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<tr>
<td>- Teachers were instructed to get to know their object and journal about it.</td>
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<tr>
<td>- Cool critter Convention – half of the teachers lined up and the other half went around asking questions about and looking at the critters. Then they swapped.</td>
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</tbody>
</table>
• Journals were used after the critter convention to write down questions for later.

| Assessment map and stations | Teachers were instructed to get 5 rocks, 5 seeds, and 5 leaves.  
|                           | There was a pie chart with questions about the workshop on it. It had instructions on it. As they teachers returned they added to the map.  
|                           | Next teachers were asked to find a better way to organize the data.  
|                           | Teachers were instructed to go to different station that had poster boards and write ideas/answer questions and discuss.  
|                           | Then it was dinner time.  

| Evening program | Teachers were given 2-3 minutes to discuss how to use questions.  
|                | Then they shared what they discussed.  
|                | o Nonverbal communication  
|                | o Tone  
|                | o Avoid questions that are too easy or too difficult  
|                | The program leader pulled out objects and asked what do you notice? The teachers again took the student role and answered the questions that were being modeled.  
|                | The program leader pointed at details on the object and asked for inferences.  
|                | More questions were asked by the program leader then teachers were to come up with questions that could be asked.  
|                | Types of questions – Broad and narrow. The program leader gave examples of these questions and asked for more from teachers.  

| Skit | Teachers were asked to volunteer to participate in a skit. There were 3 skits so each teacher had to participate at some point.  
|      | o Sage on the stage  
|      | o Guide on the side  
|      | o The entertainer  

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After the skits the “activity lab” Teachers were to use what was taught during the day to plan broad and narrow questions related to the topic to teach. This will be presented in an improv fashion the following day.

Activity field notes March 16, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Evening Program Overview</td>
<td>• The program leaders asked teachers to find someone and discuss one thing that has happened since the last meeting.</td>
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<tr>
<td></td>
<td>• Gave explanation of what to expect for the workshop weekend.</td>
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<td></td>
<td>• Showed a video of a teacher who took her students outside.</td>
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<td></td>
<td>• Readdressed norms.</td>
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<td></td>
<td>o Asked if teachers had used them.</td>
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<td></td>
<td>o One teacher shared their experience</td>
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<td></td>
<td>o Teachers added “student focus” to the norms</td>
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<td></td>
<td>o Address venting with administrators “misunderstandings” “different viewpoints”</td>
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<tr>
<td>Thought Swap</td>
<td>• Teachers made 2 lines facing each other, the program leader asked questions.</td>
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<td></td>
<td>o Describe 1 attempt at new learning routines you have had since the last workshop?</td>
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<td>o Share something you feel you have grown in since the last workshop?</td>
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<td>o Do you feel more curious about your PD since the last workshop?</td>
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<td></td>
<td>• The teachers had 30 seconds to talk about the questions with the person they were facing. One person from one side goes down the middle of the line and the other side scoots to form new partners.</td>
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<tr>
<td>Learning more about the national park</td>
<td>• Discussed National parks history, resources and opportunities available for teachers. 500,000 acre classroom</td>
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<td></td>
<td>• Vote with your feet.</td>
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<td></td>
<td>o The national parks representative asked the teachers a question and asked them to stand to vote. (extreme _____________ extreme)</td>
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<td></td>
<td>• Handed out post it notes and asked the teachers to write a species they believe in in the park. The Majority represented vertebrates</td>
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</table>
Closing

- Program leaders revisited the expectations for the weekend and gave a reflection prompt to revisit.

<table>
<thead>
<tr>
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Activity field notes March 17, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Morning Program</td>
<td>- The teachers were supposed to begin with a solo sit before breakfast.</td>
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<td></td>
<td>- After breakfast teachers split into 2 groups to observe the visiting school participate in activities. The activities were the Geology Hike and Stream Physics. Teachers observed for about 1 hour.</td>
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<tr>
<td></td>
<td>o Allowed teachers to see what an experience with students is like.</td>
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<td></td>
<td>o How the naturalists interact and use techniques that have been demonstrated at the workshops.</td>
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<td></td>
<td>o Teachers asked questions when they had the opportunity</td>
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<td></td>
<td>o One teacher spoke with a chaperone from the visiting school. They confirmed the students participate in this type of instruction regularly.</td>
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<td></td>
<td>- Project leaders led a debrief teachers mentioned the following:</td>
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<td>o “our students will not behave”</td>
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<td></td>
<td>o Research activity before coming to make sure co-teaching is accurate</td>
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<td></td>
<td>o Journal before</td>
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<td></td>
<td>o Impressed with the use of the mind pie. (demonstrated in January)</td>
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<td>o “don’t just give the answer ask ‘what do you think?’.”</td>
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<td></td>
<td>o Pull out the “math” when students designed a way to figure out the flowrate.</td>
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<td></td>
<td>o Provided cards for students to prompt learning. And expressed their importance so they would keep up with them.</td>
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<tr>
<td>Second morning activity –</td>
<td>- Discussion about how to improve understanding</td>
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<tr>
<td></td>
<td>o Make content more relatable</td>
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<td></td>
<td>o Spark curiosity</td>
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</table>
| construct understanding (Beatles) | o Age level makes a difference  
| | o Prior knowledge  
| | • Teachers were given a hand out titled Research-based information about students learning. They discussed it in groups. They used examples that other teachers in the workshop have mentioned.  
| | • Some teachers were not sure how to use some of the ways to construct understanding presented.  
| | • From discussions  
| | o **Students come to the classroom with preconceptions about how the world works.**  
| | ▪ “Could use mind pie with false understandings”  
| Activities that construct understanding | • The program leader showed pictures of leaves and asked what they were. After the answer was provided, they gave the correct answer and showed another picture. All pictures were different but they were either poison oak or poison ivy. Eventually the teachers began identifying each picture as poison oak without thinking because that was the majority of the picture.  
| | • Next the program leader asked how the teachers could facilitate the difference in poison oak and poison ivy.  
| | o Talk about misconceptions and preconceptions  
| | o Make observations  
| | o Make connections  
| | • Teachers read scenarios then made a concept map of a bird and the moon phases.  
| | • After the concept map of the moon phases, teacher were asked to sit in a circle and demonstrate the moon phases using a lantern and Styrofoam balls on a stick.  
| | o Teachers made observations and inferences  
<p>| Afternoon Program | • The program wrote the word adventure on a white board. Then asked for other words that describe it and wrote them around the word. Then changed adventure to science and asked if those words still apply. |</p>
<table>
<thead>
<tr>
<th>The new TN standards</th>
<th>• Evaluator team presentation on NGSS/TN Science Academic Standards shift. First provided a history of standards in general then talked about alignment of the new TN standards with NGSS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards activities</td>
<td>• Led by the program evaluator – Teachers worked with their co-design teams. They were given a science and engineering practice from the new TN standards and asked to design a lesson using any content. They lessons were informally presented and debriefed.</td>
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</tbody>
</table>
|                      | • Led by the National Park Representative – Teachers were asked to go outside and take 10 pictures of either habitat or adaptation.  
  o Teachers spread out and were intently engaged with taking pictures.  
  o This was done individually  
  o Teachers gathered back in a circle and chose their favorite picture  
  o After presenting photos to each other they discussed standards that could be taught using the photo.  
  o The program leader handed out a piece of paper with cross-cutting concepts and science and engineering practices on them and asked which best fits the picture and standard they chose.  
  o Then the standards for the 4 disciplines, Earth Science, Life Science… were laid in groups and cut out. The teachers chose one and used the materials from the activity to develop a lesson.  
  o Debrief- teachers shared how to use standards and the cross curricular concept and science and engineering practices. |
| A discussion about discussion “1 cent, 2 cent” | • Teachers were placed in groups of 4 and they faced each other. One teacher talked for one minute then they went around until each teacher had talked. Then repeated for 30 second each to add anything they wanted to the conversation. If one teacher was talking the others could not talk.  
• Debrief – Teachers mentions  
  o This gives students time to think and process before sharing  
  o This is good for introverts  
  o This teaches students to share space in a conversation  
  o This can be used as a debate protocol |
| Evening Program UBD | • Evaluator discussed UBD in active lecture format  
|                     |   ▪ The goal was to help the teachers develop lesson plans with the end in mind.  
|                     |   ▪ Then the program leader provided more detail of what is expected by the teachers concerning the workshop and the lessons they have to develop. Teachers were given an hour to develop the lesson.  
|                     |   ▪ After an hour there was a short debrief on the lesson and the progress that was made. |

**Activity field notes March 18, 2018**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Before breakfast</td>
<td>• Teachers could participate in a Bird Watch with the program leader or a Solo sit.</td>
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</table>
| Citizen science Sampler           | • The project leader introduced this activity by referring to the January meeting. Today will be a sample of citizen science projects that can be completed without a continuous source of water.  
|                                   |   ▪ The teachers divided into 3 groups of 4                                                                                                                                                              |                                                                                                                                                   |
| Testable vs non-testable          | • As part of the debrief from the sample the project leader asked questions. The teachers were to determine if the question was testable or non-testable.  
|                                   |   ▪ This led to peer review and its importance of use in the classroom.                                                                                                                                  |                                                                                                                                                   |
| Planning an exploratory investigation | • Teachers were asked to gather into groups and decide on one testable question that could be used.  
|                                   |   ▪ Teachers divided into 4 groups one group consisted of 2 schools the others groups were one school (co-design group).  
|                                   |   ▪ After developing the question and getting approval from the program leaders, teachers developed a research plan that could be completed in 15-20 minutes.  
|                                   |   ▪ On what surfaced do the three types of lichen grow?  
|                                   |   ▪ What direction does moss and lichen grow the most on?  
|                                   |   ▪ Then they actually competed the exploratory investigation and received peer feedback.  
|                                   |   ▪ During this a school used “we noticed”…. (this has been embedded in activities since the kickoff meeting)                                                                                  |                                                                                                                                                   |
- Teachers spent roughly 5 min to synthesize data collected and prepare to present findings.
  - One group of teachers developed a way to incorporate math into the lichen citizen science project by converting the amount of lichen on a tree from fractions to decimal to percentage.

**A review of citizen science**
- The program director introduced hands on the land website and provided a contact for teachers.
- Before lunch began teachers spent about 20 minutes talking about what they wanted to do.

### Activity field notes June 18, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Afternoon Program</td>
<td>• Participants met in the friendship circle for re-introductions. This was mostly to inform the administrator(s).</td>
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</tbody>
</table>
| Walk and Talk           | • Teachers formed two lines parallel to each other and discussed the question.  
  • There was a discussion about what teachers said when they all reached Girl Scout Island  
  • The goals for Tremont to continue support were discussed and a response from the teachers was requested.  
    - Help spark curiosity in students  
    - Give students experience to take care of the environment early  
    - Get outside to help with mental and physical health |       |
| Zoom Zoom Zoom          | • Teachers were asked to choose something and sketch it at 20ft, 5 ft and 1 ft.  
  - This activity highlights perspective  
  - An animal call was used so participants knew when to transition  
  • Teachers came back to discuss  
  • They were then instructed to take someone to their beginning spot and have them guess what they drew.  
    - After they returned there was a further debrief discussion |       |
Exploring the stream
- During the instructions of how to properly catch the wildlife a teacher grabbed the naturalist because they saw a small snake and were concerned.
- The discussion stopped to turn focus to the snake the naturalist caught.
  - How to properly handle the snake, smells (defense), touch it, identify it, release it.
- While in the water teachers and the administrator were prompted to ask questions, spark curiosity and observe others.
- After a break (continue exploring and swimming hole), it was dinner time.

Evening program
- In the Cove room a visitor gave a testimonial.
  - “Getting urban kids outside…”
  - She has an outdoor space but students did not want to go outside.
  - She encouraged a student from “I don’t do outside” to “are we going outside today”
- She encouraged teachers to defeat student resistance
- Talked about overcoming challenges and how
- She asked if anyone had “qualms” about taking students out
  - One teacher raised their hand
- Emphasized parks in the classroom program
- Emphasized hands-on activities
  - Bean biomes
  - Teachers participated in this
- Showed a video of her students at Tremont
  - These students had been at school two weeks and they did not know each other
  - They were chosen to participate by their previous year teachers so the teacher did not know them well either.

Activity field notes June 19, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning Program</td>
<td>- After breakfast teachers went to watch the bird banding.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Rode to Cades Cove to meet the National Parks Services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- They sampled water near horse stables for E coli</td>
<td></td>
</tr>
</tbody>
</table>
| Afternoon program: Leave no trace | Activity discussing decomposition
  - Meant to help introduce/transition into soil topics. |
|---------------------------------|-------------------------------------------------|
| Transitional discussion         | The leader wrote the word “ecosystem” on a board and asked for words that describe it
  - After showing a picture they asked for more words
  - This was used to transition into an activity |
| Matter and Energy Transfer      | Participants divided into 4 groups
  - Provided a board with the words animals, air, soil and plants on it.
  - Asked to make connections between them.
  - Turned focus to soil.
  - Teachers were provided soil to explore and separate the soil. |
| Decomposition Mission           | Walked outside to explore decomposition in groups.
  - Found different items and placed them in order of most composed to most decomposed
  - Ex: leaves from green and full to brown and broken.
  - During the debrief discussion an administrator linked reading to science
  - Said it is good for students to recognize they all explain things differently
  - Next teachers competed in an erosion pan contest
  - Use paint pans with dirt in them, find things lying around, place the items on the dirt to prevent erosion, use a water can to make the “rain”, see who has the clearest water. |
- Teachers had a short break and then went to dinner.

| After dinner Soil testing | Participants gathered in the cove room to learn how to use soil testing equipment |
| | - Described where their soil came from. |
| | - Tested soil then added things (salt, sugar...) |
| | - Brainstormed how to use in their classroom |
| | - Groups works on different “projects” |

- After activities teachers and one administrator socialized and discussed brainstorming organically. Some discussions were held over a card game and others were held as they continued personal soil sampling.

Activity field notes June 20, 2018

<table>
<thead>
<tr>
<th>Activity</th>
<th>Process</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Morning Program | - Began by introducing the administrator that joined us this day.  
  - Each teacher, faculty member and the administrator that was present the whole time shared their most favorite thing of the experience. | |
| Further discussion | - Teachers were asked to get into teams and take about 10 minutes to discuss…  
  - Accomplishments so far  
  - Still left to do  
  - Questions or ideas  
  - Needs  
  - After teams discussed this they connected with another team to share.  
  - I joined a group of two schools who did not have an administrator in the group.  
  - The discussion was primarily about school culture and parent support/lack of support for going outside.  
  - Both school culture were opposite from police scanning plates for warrants (unwanted by the school) to parents lining up 1 hour before the bell rings.  
  - Each of the three groups joined in a large circle to discuss as a whole group  
  - The group I was in shared  
  - One school noted they do have administrator buy-in, some teacher buy-in and now working on parent buy-in. | |
- They trusted me as a colleague for the first 2-day trip to Tremont and teachers have bought in.”
- “Parents see ‘bear’ and they have a negative stigma we need to work on giving parents a realistic view.”
  - The other school said they have pushback from other teachers to bring students to Tremont
  - The group coming in the spring has to “apply”
  - There is great division between grades concerning teachers so they are still working on getting teachers on board
  - Faculty have helped this school take baby steps for 6 years.
- Feeder schools paired up for the discussion
  - They made a goal to build buy-in and have The GSMIT faculty come do PD.
    - Specifically build administrator buy-in. One school commented on the other school administrator giving information on their point of view.
    - Specifically community buy-in
      - Goal of 1:10 ratio of parents to students in elementary school, more interactions with community members, get others (NPS, college students) to come help with outdoor lessons.
- Last team discussion
  - The noted the importance of being willing to fail, then reflect and create collaboration
  - Have the GSMIT faculty come out for a visit
  - Get feedback from The GSMIT faculty on teaching outdoors
  - Asked for connection for help…others shared the following.
    - Master Gardeners
    - Americorps
    - University of TN
    - Pre-service teachers
<table>
<thead>
<tr>
<th>Afternoon program: Friendship circle</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Teachers were to choose something they learned from the experience to modify and share. These are described below.</td>
</tr>
<tr>
<td>o Write a word on a board and ask for a word to describe it. First the word Tremont was used then it was replaced with school. (there were not many changes)</td>
</tr>
<tr>
<td>o Mind pie – each “slice of the pie” is represented below…This workshop…</td>
</tr>
<tr>
<td>▪ Inspired me to get out of my comfort zone to take more risks</td>
</tr>
<tr>
<td>▪ Has made me feel more comfortable working with my administrator</td>
</tr>
<tr>
<td>▪ Has made me more comfortable taking kids outside</td>
</tr>
<tr>
<td>▪ Made me feel more prepared to start next year with more outdoor experiences</td>
</tr>
<tr>
<td>▪ Made me feel capable of asking for help and resources</td>
</tr>
<tr>
<td>▪ Prepared me for implementing my action plan (unit).</td>
</tr>
<tr>
<td>o Use two words to describe your hope for using this experience</td>
</tr>
<tr>
<td>▪ Hopeful, implementation</td>
</tr>
<tr>
<td>▪ Eager, enthusiastic</td>
</tr>
<tr>
<td>▪ Excited, challenged</td>
</tr>
<tr>
<td>▪ Optimistic, jazzed</td>
</tr>
<tr>
<td>▪ Fresh, interested</td>
</tr>
<tr>
<td>▪ Inspiring, students</td>
</tr>
<tr>
<td>▪ Open, motivated</td>
</tr>
<tr>
<td>▪ Paradigm shift</td>
</tr>
<tr>
<td>▪ Spark excitement</td>
</tr>
<tr>
<td>▪ Effective learning</td>
</tr>
<tr>
<td>▪ Outdoor science</td>
</tr>
<tr>
<td>▪ Determined, nervous</td>
</tr>
<tr>
<td>▪ Leading change</td>
</tr>
<tr>
<td>• Story telling</td>
</tr>
<tr>
<td>o Teachers shared a story of taking their students outdoors.</td>
</tr>
</tbody>
</table>
| Hike to the waterfall | - Teachers and administrators participated as students along the way.  
- They also asked questions along the way concerning the hike with students.  
- At the falls some swam, all reflected and ate a sack lunch.  
- After a break at the falls the group began the return back the same way they entered.  
- At an open area all stopped and the leaders concluded the workshop.  
- A solo hike followed. Each person waited until the other reached a certain distance before walking. |
APPENDIX J

THE GREAT SMOKY MOUNTAINS INSTITUTE AT TREMONT AREA MAP
The Great Smoky Mountains Institute at Tremont area map, retrieved from

http://gsmit.org/facilities-and-maps/
APPENDIX K

ASSIGNMENT EXAMPLE: WORKSHOP #1
Workshop #1 - What should YOU expect?

What will YOU be doing in this Workshop?

1. **Doing:** Being the student again
2. **Practicing:** Explore and practice routines of learning
3. **Reflecting:** Reflecting, discussing and synthesizing our thinking
4. **Assessing:** Gaining feedback to continue to inform instruction
5. **Preparing:** Feeling prepared and clear on program direction

Logistics: Workshop #1

**Dates:** January 19th-21st, 2018

**Arrival Time:** Arrive Friday, Jan. 19th between 3:00-5:00pm to check in

**Ending Time:** Depart Sunday, Jan. 21st around 1:30pm

**Where:** Tremont Campus (residential)

**What to bring:** Outdoor clothing (layers), water bottle, day pack, rain gear, toiletries, linens, pillow, stream shoes (pair of shoes to get wet), anything else to feel comfortable in our dorm setting

**Who is to attend:** Teacher Team (min. of 2)

**When should I expect more details about Workshop #1:** Early January via email

Workshop #1 Overview: Establishing a Practice of Learning Routines

This initial workshop will include some water/watershed content, Understanding by Design framework, Teacher Toolkits, modeling effective pedagogical techniques for teaching and learning, an introduction to citizen science, and the opportunity to practice techniques and collaborate with experts and peers. This will establish the topic relevance and increase their excitement level in teaching the subject matter, as well as the process of engaging their students in experiential education. Teachers will leave this workshop equipped to begin compiling lessons, assessing their communities, and building local support for their project.
Homework Expectations:

(Some things have changed or been elaborated on - please read fully!)

Team Planning –

1. Map out a weekly/bi-weekly schedule for your team members to meet.
2. Bring these dates with you to Workshop 1.
3. Meet at least twice before Workshop 1 to make sure you're on the same page, to brainstorm and share ideas.

Cohort Communication –

1. Check out our Wikispaces classroom and make a profile.
2. Check out the photos Tiffany posted of Kickoff Day!
3. These assignments are also posted on wikispaces for your reference.

New Code: 33D33TT

Site: https://wikispaces.com/join/33D33TT

Check out 'wikispaces classroom' on YouTube to find lots of instructional videos.

Video –

1. Video yourself instructing students (no more than 10 minutes).
2. Remember, you are free to choose what you'd like to film. Feel free to film a segment of your best lesson.
3. Make one video per teacher.
4. Watch the video and take notes on your instructional choices and the reactions of the students to your choices, note your style and any need for improvement.
5. NOTE: On Monday, you will receive an invitation to a private Dropbox folder for your school. Please upload your videos to this folder no later than Monday, January 15th in either of these two formats - .MOV or .MP4. Please also label your video file with your last name and school and number. (Example of file name: “Mcguigan.Tremont.1.MOV”).

Journal Reflections in your schoolyard –

1. Twice a month - Conduct a 'solo sit' somewhere in your schoolyard and spend some time reflecting in your journal about your experience.
2. This time is for you! We want you to become comfortable with the routine of reflecting, sitting quietly, and observing your surroundings. The more time you spend in your
schoolyard, the more connected you will be to that place and the more prepared you will be to lead your students on adventures there.

3. Helpful prompts to get started:
   a. **BEFORE REFLECTION:** At top of page in journal indicate date, time, location and weather.
   b. **FIRST 5 MINUTES:** Sit somewhere in your schoolyard. Sit, be present and notice surroundings
   c. **NEXT 10 MINUTES:** Record in your journal what you notice in and around your schoolyard through your senses - Hear? See? Feel? Smell?
   d. If you feel moved, continue reflecting in your journal (drawings, writing, etc)

**Schoolyard Site Inventory and Brainstorm –**

1. Map your schoolyard - fill out the attached schoolyard site survey, or you make your map using Cornell's Habitat Network!
2. Take a few pictures of your schoolyard - attach them with your schoolyard site survey or bring them with you to next workshop
3. Record discussion responses from your team to inventory category questions (found in attachment)

**Journal** - Personalize your journal and bring it back with you to Workshop 1. Remember to be CREATIVE! You'll be using this journal throughout the teacher workshop series.

**Ideas and Questions** - Come to Workshop 1 with a prioritized list of questions, ideas or concerns that you and your team have generated. Feel free to contact us before Workshop 1 with your questions and we can be sure to make space for this during the workshop.
APPENDIX L

SITE INVENTORY MAP: SUBMISSION EXAMPLE
Please record your team's responses to: (USE ADDITIONAL PAGE IF NECESSARY)
1. **Natural Phenomena**: Highlights of areas with biodiversity and/or natural phenomena of interest
   - Carpenters Prairie
   - Critter Cove
   - Field
   - Stream Ecology
2. **Limitations**: Discussion of potential limitations (i.e., time, transportation or classroom resources)
   - Class time: 20 minutes for science
   - No “free” jackets
   - Losing (keeping track of kids)
   - Trash/brush
   - No bikes
   - Volunteers
3. **Materials**: Instructional materials or resources that would be needed to effectively access spaces
   - Signs at natural spaces
   - Stream eco/measurements needed
   - Map of outdoor space
   - Wildlife feeders or plans on use
4. **Support**: Identify current support networks in place in/around these spaces
   - Picnic tables
   - Reversign information
   - Area signage
   - Pictures or signs
5. **Observations**: Other observations or questions of interests
   - Notice:... deadpoles? / dots in stream
   - Why the trees fell down?
6. **Ideas**: Record any new ideas this process cultivated for your teacher team
   - Solo walks through prairie
   - Drawing/NA activities near signs
7. **Additional Details**: Keep your responses concise, but include as much detail as possible (no more than 1 additional page)
APPENDIX M

IRB APPROVAL AND CONSENT FORM
You are receiving this inactivation notification for one of the two following reasons:

Exempt Determinations:

This protocol is has been granted an exemption determination. Based on this exemption, and in accordance with Federal Regulations which can also be found in the MSU HRPP Operations Manual, your research does not require further oversight by the HRPP.

Therefore, this study has been inactivated in our system. This means that recruitment, enrollment, data collection, and/or data analysis can continue, yet amendments to this study are no longer required. If at any point, however, the risk to participants’ increases, you must contact the HRPP immediately.

Non-Exempt Approvals (Expedited or Full Board):

A request to inactivate (with the submission of a final report) your non-Exempt protocol was submitted and approved. If this is the case, there should be no further data collection or data analysis conducted under this protocol.

For additional questions pertaining to this study, please contact the HRPP at irb@research.msstate.edu.
**Title of Research Study:** An Outdoor Professional Development Model in the Era of the NGSS: Pedagogy for Teachers to explore, reflect and implement
A Professional Development Model for School-Based Experiential Outdoor Education: Exploring, Reflecting and Implementing

**Researchers:** Dr. Ryan Walker and Shana Lee, Mississippi State University

**Procedures:** We are requesting your participation in research. The researchers will be conducting stimulated recall interviews in addition to using data collected during the professional development program evaluation. Interviews will be recorded on an audio device. A private meeting time will be scheduled for each interview. The interviews will average about thirty minutes and are not intended to last more than one hour. When interviews are transcribed, an alias will be assigned to each participant then the audio copy will be destroyed. The alias will be used during evaluation in order to protect your privacy. Follow-up interviews may be conducted over a phone call or through email after the workshops end.

**Questions:** If you have any questions about this research project, please feel free to contact Shana Lee at slee@bagley.msstate.edu or Dr. Ryan Walker at rwalker@colled.msstate.edu

**Voluntary Participation:** Please understand that your participation is voluntary. Your refusal to participate will involve no penalty. You may discontinue your participation in this research at any time without penalty.

---

**Please take all the time you need to read through this document and decide whether you would like to participate in this research study.**

If you agree to participate in this research study, please sign below. You will be given a copy of this form for your records.

<table>
<thead>
<tr>
<th>Participant Signature</th>
<th>Date</th>
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<tr>
<th>Investigator Signature</th>
<th>Date</th>
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APPENDIX N

EXAMPLE OF JOURNAL COVER
Field Journal Entry Checklist:

This list is a good starting point for a consistent and well-organized field journal. Feel free to use this list, but don't let it bog you down!

Create your own style! Date, time, and location are most important for recording nature observations that you'd like to refer to later.

- Date
- Time
- Locality
- Weather
- Site description (habitat, manmade structures, etc.)
- General commentary
- Species List
- Sketches of observations
December 8, 2017

Cold and snowfall today. The sun is not shining and there is a slight breeze. The school is closed due to the weather. I walked around the school property, looking at the snow and ice. It was beautiful, but also very slippery. I noticed a few students walking around, bundled up against the cold.

December 10, 2017

It is cold and snowfall today. The wind is blowing hard, and the trees are swaying in the wind. I walked around the school property, looking at the snow and ice. It was beautiful, but also very slippery. I noticed a few students walking around, bundled up against the cold.

January 10, 2018

What a difference a week can make! It is currently in the mid-winter. The trees are covered in snow, and the ground is white. I walked around the school property, looking at the snow and ice. It was beautiful, but also very slippery. I noticed a few students walking around, bundled up against the cold.
What I KNOW:

1/15/13 - About learning and constructing understanding: I knew that I don't know how to incorporate all of this into my Social Studies class.

2/15/13 - About how students construct understanding: I knew students do not construct. They build on prior experience and prior knowledge. They must have opport to build on their experience and knowledge.

3/15/13 - I knew that a number of the strategies we have learned can easily be translated and adapted for Social Studies.

What I DON'T KNOW:

1/15/13 - About learning and constructing understanding: I know that experience makes things relevant and interests kids/adults to learn. All else makes it easier to construct knowledge when we have experience that we can refer to.

2/15/13 - About how students construct understanding: I am not sure how to always present app for students to build on prior knowledge especially at their age level.

3/15/13 - I don't know how I am going to fully implement journaling and other techniques to stimulate student thinking. It will have to be more detailed in my planning.
What I am EXCITED ABOUT

[*] About learning & constructing understanding: I am excited about helping my students to develop a deeper understanding of the world in an engaging way.

[*] About how students construct understanding: I am pumped about finding new ways to excite and motivate students to explore new ideas and to construct relevant and lasting meaning.

[*] I am excited to see how I can make my classroom even more student-centered & student-driven. History is often just about facts, but I seek to illustrate history students’ need to "think" beyond the facts, to understand the link between everything, to step back & see the big picture. These students are also imaginative & empathetic, they put themselves in the shoes of the past. It’s amazing if students can get “lost” in history, perhaps I can foster more of that.

What I am NERVOUS ABOUT

[*] About learning & constructing understanding: I am nervous about finding the time to fit this into a 55 minute class & still hit my standards.

[*] About how students construct understanding: I am nervous about pacing & as always failing my students.

[*] I am nervous that I will neglect some of this in the heat of the moment of the school year & not make the time to connect it.
I think because I believe that we must have intelligent, critically thinking citizens in order to thrive & thrive democracy if want to make a positive impact in the world.

January 29, 2015

It is amazing how much you start to notice when you just sit in nature & are still. There are so many things around us and it is all there. The sound of water, running down streams, touching our rocks, splashing by ice, little squiggly ants from jet wash up around a rapid & the water has killed a snapper hiding in it, the sound, like a solitary stone, water occasionally lifting it, seeking to ice in freezing water. The mass of damselflies clinging to the rocks and butterflies which never feel the winter. Early morning fog, it is so much beauty all around me, it amazes me.

*I notice...
*I wonder...
*I reminds me of...

What are norms?

- Rituals: Teacher sets, students assist, Admin informs
- Expectations: School-wide
- Class Culture: Teacher
- Classroom Culture: 
- Classroom Management: Teacher (relevant to TE)
- Guidelines: School/Teacher
- Behavior: Everyone
- Procedural: where to go, how to do, materials? (Teacher/Admin)
- Consequences: School

OUR NORMS

- Why do I teach?
- Receptive to open/honest communication.
- Safe place, Brave place.
- Is what you’re about to add helpful? Thoughtful
- Step up, Step back.
Think/Pair/Share

1. Elements I gleaned from this section are:
   - I can encourage my students to observe an event & use their observations to discuss other types of events in real-world applications of the lessons from the events.

2. For my reflections about:
   - how can I apply this in my class set-up, appearing to take a political side.

3. Something I'm struggling with is:
   - how will I develop the independent observation & application of learning in a real-world way.

4. How will I incorporate this into my own instruction:
   - I think I will use journals to encourage my students to observe & make predictions based on observations. I think I will also ask them to apply their observations to the world today.

- How is my lesson coordinating?
- What kind of lessons do I teach?
- What role do the male student's ideas play?
- What is the life cycle for this insect?
- What do the female students do?
- In the ochre, what does it eat?
- How do we answer questions?
- Can we design experiments?
- Help create understandable testable questions.
February 21, 1910 — I took my students outside to sit on
prince tables under a pavilion while we recorded
animal noises. One would expect that the students
would be noisy, restless and distracted by the
outside, but the opposite happened. The students
were calm and quiet. They all worked on their
research quietly. Delicately, I very briefly read
our research guidelines because we were only
going to the outside portion right outside
my classroom.

February 22, 1910 — Today, it is so warm! My Cottage
is nothing but a buzz. The sun is shining and it feels
like May or early June. The back yard is now a
mess. There are no ants, just a few flies and a
few poison ivy plants. All the tulip flowers have
died. I am not too sure about my spring flowers.
They need to bloom any new growth. The
grandfather clock has already started ticking
and the pond behind the school has already
opened. All of this makes it hard to get my
work done. I want to stay out here, but I am due
by this hour to meet with my students. The
students must feel the same way, but this feeling
is spreading. I am thinking about hiring a
delivering service. That knowing students must
feel the same way, but this feeling is spreading. I
am thinking about hiring a
delivering service. That knowing students must
feel the same way, but this feeling is spreading.
February 26, 1948

We are completing two assignments in
the present lab session. The second one
is a major one involving the future of the
field of nuclear energy. We have been working
on the problem of fission reactions in a few nuclear
materials in order to determine the best way
to use them. I have been able to reduce the
number of elements to a few, and I have been
able to narrow the field of possibilities to a
few. I have been able to select a set of elements
which seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising.

March 1, 1948

We have finally wrapped up our work on
the assignment. I have completed the
assignment in two parts: the theoretical
part and the experimental part. In the
theoretical part, I have been working
on the problem of fission reactions in a few nuclear
materials in order to determine the best way
to use them. I have been able to reduce the
number of elements to a few, and I have been
able to narrow the field of possibilities to a
few. I have been able to select a set of elements
which seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising. I have
been able to select a set of elements which
seem to be the most promising.

The students did relatively well. I did have
some students who did not complete the
assignment. However, I was able to
encourage them to work on it and they
were able to complete it in the end.

The students did relatively well. I did have
some students who did not complete the
assignment. However, I was able to
encourage them to work on it and they
were able to complete it in the end.
March 18, 2018

Q: What are some notable features on the campus that are not connected to the library?

Q: How might the library be an indicator of the quality of life on campus?

Q: How healthy is the campus for the students in relation to health studies?

Q: How is the health of the air quality in the area?

<table>
<thead>
<tr>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/17/18</td>
<td>6.4</td>
<td>6.4</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>

March 22, 2018 - After the rain and hail, it was a nice day. However, the temperature dropped significantly, and the wind was strong.

March 27, 2018 - It is still cold, and the forecast predicts more cold weather for the coming days.

April 13, 2018 - Today, I am sitting outside, enjoying the warm weather and the sun. It is a great day to be outside.

April 27, 2018 - I am sitting by the lake, thinking about my future. I am feeling a bit anxious about the upcoming exams, but I am trying to stay positive.
May 3, 1945. I did a workshop in my 12th History class. I asked each student to draw the end of their lives. We had already discussed and examined the choice to drop the bombs. Whether or not there were necessary. I wanted students to reflect on the history of the devices while also contemplating their understanding of democracy. Surrounding America's decision to use the bomb, I told students that they were going to choose two words to describe the bomb. Years at the end of July, they gave them to consider, to think of two words that best described the American reaction to the dropping of the bomb. All were interesting to see how they did. Some words used were freedom, justice, hatred, and hatred. Some words used were happiness, democracy, and democracy. This could be said by anyone to make sure all original words are used.

May 5, 1945. I had a thought swing in my History class today. The topics were comparable in nature, intended to tie everything together. From the year, I asked them questions such as, 'Which day will you be the greatest impact? Would it have been the greatest impact of the week'