ABSTRACT

Title of Dissertation: A CASE STUDY OF URBAN STUDENT AND TEACHER EXPERIENCES SURROUNDING AN OUTDOOR ENVIRONMENTAL SCIENCE FIELD TRIP

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Field trips provide opportunities for students to experience many different contexts beyond the classroom, and are a popular choice of K-12 teachers in the US. Recent interest in learning that occurs at informal science education centers such as museums, zoos and aquariums has stimulated studies of the relationship between learning in and outside of schools. Although many studies focus on the teachers, the contexts, and/or the students *during* the field trip, only a few look at the entire process of learning by including the classroom setting before and after the field trip.

This study was designed to develop understandings of the student process of learning during and surrounding an environmental science field trip to an outdoor setting.

John Dewey's extensive writings on the relationship between experience and learning informed the analysis, creating a focus on active and passive elements of the experience, continuity within and across contexts, the interactive nature of the experience and the importance of subject matter. An exploration of environmental education (EE), environmental science (ES), and nature study as content revealed the complexities of the subject matter of the field trip that make its presentation problematic. An urban school was chosen to contribute to the research literature about urban student learning in outdoor environments.

During the field trip, the students' active engagement with each other and the environment supported meaningful remembrances of the field trip experiences during interviews after the field trip. The students accurately described plants and animals they had observed in different habitats during the field trip. They also made connections with their home life and prior experiences in the outdoors as they discussed the field trip and drew pictures that represented their experiences. One student integrated his outdoor experience with a language arts assignment as he reflected deeply on the field trip.

One implication of this study is that educational experiences in outdoor natural environments are complex in ways that contribute to lack of continuity between science lessons in an elementary classroom and environmental science field trip. Long term relationships between schools and informal settings that recognize the strengths of both contexts in terms of student learning processes surrounding field trip experiences are needed to strengthen the educative process for field trip participants.

A CASE STUDY OF URBAN STUDENT AND TEACHER EXPERIENCES SURROUNDING AN OUTDOOR ENVIRONMENTAL SCIENCE FIELD TRIP

by

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DEDICATION

To my husband,
Peter C. Preusch
For his patient
And
Positive outlook
On this
Project

And to my children,
Carl, Julie, and Sarah
And their families
Who were very
Supportive of this process

And to all of the educators
and students who
participated in this study

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I would also like to thank the field trip participants, and the site education staff who gave of their time, effort, and enthusiasm to support this research project. Without their cooperation and willingness to spend time discussing the field trip educational process, this research study would not have happened.

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CHAPTER I: INTRODUCTION

Statement of the Problem

Field trips to science-related educational sites have a long tradition as an alternative to school activities at all grade levels in the US. As resources become scarce, however, administrators and teachers must decide whether such excursions are worth the time, effort, and funding required. Advocates for field trips need documentation of what students learn and how that learning occurs. In addition current interest in the process of life-long learning has created the need for increased understanding of the learning effects of experiences beyond the classroom. Recent concern about the amount of time that children spend indoors versus time spent in the outdoors has also generated interest in the frequency and quality of educational experiences that children have in the outdoors (Louv, 2006; U.S.Government, 2008).

In the last two decades, researchers have developed a variety of understandings of the educational value of the field trip experience. Many research studies focus on museums as the context of learning during the field trip (Bamberger & Tal, 2006; Cox-Peterson, Marsh, Kisiel, & Melber, 2003; Finkelstein, 2005; Flexer & Borun, 1984; Gilbert & Priest, 1997; Griffin & Symington, 1997; Schneider, 2003; Tal & Morag, 2007; Tran, 2006). Fewer studies have focused on science centers (Falk & Storksdieck, 2005; Tal, 2001), parks (Brody, Tomkiewicz, & Graves, 2002; Knapp, 2000; Schneider, 2003), natural environments (Falk, 1983; Orion & Hofstein, 1991, 1994; Orion, Hofstein, Tamir, & Giddings, 1997; Simmons, 1993, 1994, 1996; Tal, 2001), school-yards (Cronin-Jones, 2000), and aquariums (Falk & Adelman, 2003).

Studies of field trips vary by context and also by the focus on different aspects and perspectives of the learning process in these contexts. Some focus on teachers' thoughts about field trips (Finkelstein, 2005; Schneider, 2003; Simmons, 1993, 1996; Tal, 2001) and motivation to take students on field trips (Kisiel, 2005; Michie, 1998). Some studies focus on the teaching strategies used at the informal context (Bamberger & Tal, 2006; Cox-Peterson et al., 2003; Tal & Morag, 2007; Tran, 2006). Others explore what students learn through analysis of self-reported learning (Cox-Peterson et al., 2003); student construction of knowledge with analysis of concept maps (Anderson, Lucas, & Ginns, 2003); student construction of knowledge via links to prior knowledge and experiences (Bamberger & Tal, 2006); student learning and behavior connections to the newness of the context (Falk, 1983; Falk & Balling, 1982); to mention a few studies. There are only a few studies that explore the student *process* of learning, that is, *how* students learn, including science experiences in the classroom before and after the field trip (Anderson, Lucas, & Ginns, 2003; Griffin & Symington, 1997).

Thus, several reviews of the research literature suggest that more studies of the learning process including both the informal field trip context and the formal school context are needed (Dillon, Rickinson, Teamey, Morris, Choi, Sanders, & Benefield, 2006; Falk & Dierking, 2000; Pugh & Bergin, 2005; Rennie, Feher, Dierking, & Falk, 2003; Rickinson, 2006). This study is designed to address this gap in the literature by developing an understanding of the students' learning process including classroom science lessons and the field trip experience at an informal science education center in an outdoor setting.

Using Dewey's concept of an educative experience to interpret the data, I develop descriptions and understandings of three different perspectives of this learning experience: that of the students, their teacher and the informal site educator. The choice of an urban school setting and students provided the opportunity to study a particular group of students and their process of learning, with recognition that although the urban school setting would not be representative of all school settings in the US, it would contribute to the field trip literature for urban students.

This study of students' meaning-making process surrounding a field trip is based on social constructivism, with the verbal and physical interactions between the participants, the teachers and students considered to be part of the students' meaning-making process. Their engagement with the environment and connections made by students to prior knowledge and experiences were developed as important indicators of the ways in which they made meaning of the experience.

In the following sections in this chapter, I develop the conceptual framework for the problem. I chose particular aspects that John Dewey discussed in his writings about the nature of educative experiences for the analysis of elements of the experience that might have contributed to the students' learning process.

The characteristics of an "educative" experience described by John Dewey are presented in the following section on framing the research problem. A discussion of the key attributes of outdoor contexts for learning is followed by a presentation of my motivation to undertake the study and the epistemology of the study. Finally, the purpose and research questions for the study are presented.

Framing the Research Problem

The experiences of the students and the teachers during the field trip and in the classroom are the unit of analysis for this study of the students' learning process. Because the field trip did not occur as an isolated incident in the lives of the participants, it was considered to be part of a continuum of experiences that have potential for connections to be made during the individual's meaning-making process. John Dewey's thoughts about the relationship between experience and education were used to develop a framework within which the students' learning process or meaning-making process could become the focus of this study. There are also ongoing interpretations, discussions and applications of Dewey's thoughts in the field of science education and research that provided further and more current insight into Dewey's philosophy of education (Fenstermacher & Sanger, 1998; Hawkins, 2000; Howes, 2008; Lemke, 2001; Miller & Boud, 1996; Wong, Pugh, & the Dewey Ideas Group at Michigan State University, 2001).

In the next sections, I discuss the Deweyan characteristics of an educative experience that I chose as applicable to this study of an outdoor field trip learning process. I then present key aspects of environmental education and/or environmental science education that are relevant to the teaching and learning of science based on the field trip. Finally, the outdoor context of learning is discussed as important to the ongoing educative process of all children and an experience that might be missing in the reality of our society and ecosystems.

Dewey and the "Educative" Experience

Dewey writes that a continuity of experiences provides the opportunity to rethink and develop depth of understanding of subject matter. He suggests that development of curiosity toward the subject matter is an important part of the forward motion of the learning process, especially if there is a progression of ideas involved (Dewey, 1938/1997). He also suggests that in an educative situation, there are both moments of activity and others that are more passive, both of which are equally important to the overall effect of the experience (Dewey, 1916/2007). Another element of experience important to Dewey is the interactive nature of an experience, with humans and objects in the environment providing a context for an educative experience that involves the use of the senses (Dewey, 1934/2005). Dewey also mentions the importance of the teacher's role in connecting experiences to subject matter and helping the student to continue his forward motion into the subject matter (Dewey, 1938/1997).

Dewey wrote extensively about the difference between what he considered to be "educative" and "mis-educative" experiences. The following quotations were selected from Dewey's writings to develop my interpretation of his ideas about experience as educative in this study. These include Dewey's thoughts about the active and passive elements of an experience, the importance of development of continuity in learning experiences, the interactive nature of an experience, including the use of the senses, and connections to subject matter.

Active and passive elements. In the following quote from *Democracy and Education*, Dewey (1916/2007) suggests that there are two elements of an experience, the active and passive:

> The nature of experience can be understood only by noting that it includes an active and a passive element peculiarly combined. On the active hand, experience is *trying*—a meaning which is made explicit in the connected term experiment. On the passive, it is *undergoing.* When we experience something we act upon it, we do something with it; then we suffer or undergo the consequences.………..The connection of these two phases of experience measures the fruitfulness or value of the experience. (p.117)

Although Dewey differentiates here between the active and passive components of an experience, he also suggests that it is the connection between the two that creates value in the experience. The connective process thus described evokes for me a reflective phase in an educative experience that is important to one's meaning-making process or education.

In the continuation of this description, Dewey places the entire experience into education via a connection making process: "Doing becomes a trying: an experiment with the world to find out what it is like; the undergoing becomes instruction---discovery of the connection of things" (Dewey, 1916/2007, p. 117). This description moves the "undergoing" of an experience into a more active process of making meaning through connections. Both elements, active and passive, are thus very important to making an experience an educative one.

I think that the combination of the active and passive elements of an experience provides a more complex way to look at learning than is commonly found in many so-called contexts for learning. In my experience the active, doing element is planned for, but the different ways in which the passive elements might be supported are not always considered by the teacher, or facilitator of the learning process. In addition the presence or absence of a guide during the passive phase is something that should be considered important to the successful process of facilitated learning.

<u>Continuity.</u> Dewey discusses the importance of continuity for an experience to be truly educative. In *Education and Experience* (1938/1997), Dewey proposes that an experience alone is not educative and that it must provide forward impetus into more learning.

> …, if an experience arouses curiosity, strengthens initiative, and sets up desires and purposes that are sufficiently intense to carry a person over dead places in the future, continuity works in a very different way. Every experience is a moving force. Its value can be judged only on the ground of what it moves toward and into. (p. 38)

This quote is taken from a discussion about the qualities of a present experience, and followed a paragraph description of the effects of spoiling a child to the present experience. In that case, Dewey proposes that a major effect of catering to a child's wishes is that the child expects certain things to happen, and loses the ability to persevere in adverse situations. This situation contrasts with an experience and development of curiosity when forward motion is created into the subject matter. Curiosity and the desire to learn more about a subject is thus a potential outcome of experiences that are continuous, or related.

The importance of continuity to the educative process is interwoven throughout Dewey's writings. He cautioned against experiences that were not well connected, making the statement that: "Again, experiences may be so disconnected from one another that, while each is agreeable or even exciting in itself, they are not linked cumulatively to one another. Energy is then dissipated and a person becomes scatterbrained" (Dewey, 1938/1997, p. 26). This statement about the individual effect of discontinuous events has larger implications for a group of students where a learning process is the intended outcome.

I think that continuity in experiences is important but may be difficult to achieve for many reasons. Continuity as described by Dewey is a laudable goal, with many different layers and ways that continuity can be achieved in educational processes. With recognition of many different ways that experiences can be connected, it might be easier to make decisions that will develop continuity with recognition that even small connections will strengthen the potential for the arousal of curiosity or the drive to learn more about something.

Interactive nature of experience. Dewey suggests in *Art as Experience* (1934/2005) that human interactions with the environment are completely reliant on the senses. He states that it is through the senses of sight, touch, taste, hearing and smell that our interactions with the environment result in an experience. However, Dewey posits that the experience is not complete without its translation into further engagement and communication with others.

> The senses are the organs through which the live creature participates directly in the ongoings of the world about him. In this participation the varied wonder and splendor of this world are made actual for him in the qualities he experiences……Experience is the result, the sign, and the reward of that interaction of organism and environment which, when it is

> carried to the full, is a transformation of interaction into participation and communication. (Dewey, 1934/2005, p. 22)

Direct interactions between an individual and the world occur through the senses, and then importantly, are shared and communicated with others to bring an experience to fruition. In interpreting Dewey's philosophy of education, Wong et al. (2001) suggest that it is the engagement with ideas, people, the environment and the natural world via the senses that is fundamental to the learning process and to life.

> Thus, the power and value of ideas are their ability to enrich participation not only with others, but with life as a whole. In every waking moment—with others, with nature, or by ourselves—there is opportunity to participate with our surroundings. Science teachers should help students see how powerful ideas help them to see, hear, touch, do, and feel in ways that they never thought possible. Meaningful learning engages not only language, but all faculties and senses. (Wong et al., 2001, p.335)

In the case of a field trip experience in the outdoors, the sensory inputs contribute to the experience, as well as the interactions with people in the outdoor environment. Another interpretation of learning from experience is that humans make sense of what is perceived through their senses and through the process of sharing their experience with others (Miller & Boud, 1996).

I think that there is an emphasis on learning in the absence of a range of sensory inputs in our school systems. One result of the absence is a dulling of the senses or sensitivity of children to inputs that are natural and normal in different environments. This situation affects expectations, which in turn also reduces potential responses to new and different types of sensory inputs. Field trips to different contexts thus may contribute in very important ways to continued development of understanding through sensory inputs, a skill or knowledge that otherwise might become atrophied in individuals and groups of individuals due to lack of use.

Subject matter connections. Dewey also considers movement from an experience into the subject matter as a crucial piece of the continuation of the experience. He proposes that it is the teacher's role to assist students in making connections between an experience and subject matter.

> But what has been said is organically connected with the requirement that experiences in order to be educative must lead out into an expanding world of subject-matter, a subject matter of facts or information of ideas. This condition is satisfied only as the educator views teaching and learning as a continuous process of reconstruction of experience. (Dewey 1938/1997, p. 87)

Here Dewey indicates his belief that the subject matter is central to an educative experience and that the process of learning involves the construction of knowledge with the educator's role as facilitator an important factor in the educative process.

Dewey's concern that teachers lead students into the subject matter is placed into historical context by Wong et al. (2001). They suggest that Dewey's intention in writing the book, *Experience and Education* (1938) was to address the lack of understanding about the importance of subject matter as the progressive education movement adopted his ideas about teaching practices. Thus, Wong et al. suggest that Dewey wrote the book specifically to clarify his thoughts on the balance needed between student-centered teaching and development of subject matter knowledge by both the teachers and students.

Another way to look at the teacher-student-subject matter relationship is described by Hawkins (1974). Hawkins considers thoughtfully the roles of the teacher (I) and child (Thou) in a learning relationship, and the importance of their common involvement in the subject matter (It) in his essay entitled: *I, Thou and It*. Hawkins (2000) discusses how and why the subject matter can be missing in teaching, and suggests that both teachers and students can use common sense, explore a science subject via discussion and experimentation and become engrossed in it, so engrossed that a depth of subject matter is developed that would not be possible with just the use of textbooks. These ideas about the relationship and interactions among the teacher (I), the child (Thou), and the subject matter (It), are central to this study of students' learning process related to a field trip.

Another view of this triangular relationship is found in Carol Rodgers' (2001) review of Hawkin's book, *The Roots of Literacy* (2000). In this review, Rodgers moves from her own experience of science to an explication of the triangular relationship proposed by Hawkins. In the following excerpt of the article, Rodgers succinctly analyzes the differences between teachers "covering" subject matter and "knowing" a subject.

> In other words, the subject matter, in this case literature and social studies, had not been internalized—learned—by the teacher. It held dominion over her, rather than she over it. When a teacher's attention is on the book, on the lesson plan, on listening for the right answer instead of listening to students' thinking, when her mind is on worrying about where students

> should be instead of understanding where they are, then teaching is technique, a task, rather than an art. (p. 476)

Development of deeper understanding of the subject matter is crucial as teachers develop their skills working with students over time. In my view, the dynamics of the learning process are dramatically changed with different levels of subject matter understanding on the part of the teacher. With weaker levels, there still can be a strong relationship between a teacher, as facilitator of a learning process, and a student. In this case, the teacher and student might forge ahead together into the subject matter, both as learners.

As depth of subject matter increases, the potential for the teacher to act as a guide into understanding increases, and the dynamics of the learning relationship are different. Choices about teaching strategies to use might be more complex in this situation. With greater depth of subject matter knowledge there might also be enhanced understanding of the effects of the choices or the pathways to knowledge on the part of the teacher.

Subject Matter of the Field Trip

The subject matter of the field trip in this study is frequently chosen by elementary teachers, especially in grades K-4, and is commonly referred to as *either* environmental science or environmental education (North American Association of Environmental Education & Environmental Literacy Council [NAAEE & ELC], 2000). The complex nature of both topics contributes to the interest in this subject, but also makes it more difficult to address with students, making it problematic in terms of consistency of approaches and development of in-depth knowledge of the subject matter.

Because environmental education (EE) and environmental science (ES) evolved over time in an interrelated way, their borders are ill-defined in practice and in research literature. Environmental education in general is focused on development of a citizenry that is knowledgeable about the environment and its associated problems and motivated to take part in such problem-solving (Labinowich, 1972). Environmental education thus evolved to always include an action component, with behavior change the goal. Important to this study, many EE programs developed outside of formal education in what is considered an “informal” educational setting, and resources were diverted outside the school systems. Informal education generally refers to any education that occurs outside of formal education programs (Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003; Falk & Dierking, 2000; Larson, 2005; Smith, 2006).

In contrast, the study of the environment via scientific approaches developed as the subject of environmental science. Environmental science does not emphasize behavior change, but rather relies on a scientific process to define and then to solve and resolve environmental problems. Environmental science education is defined by the Maryland State Department of Education (MSDE) K-8 science standards as “students using scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyzing their impact from a local to a global perspective” (Maryland State Department of Education, 2005b).

The absence of clear definitions of the differences and similarities between EE and ES education makes development of attainable educational goals for either subject difficult (Gough, A., 2002). School districts vary widely throughout the US and even within states on the interest and support of EE and ES programs. As a result many projects devoted to education about the environment rely on individual teacher interest in the environment and/or science education. Recent reduction in the number of hours of classroom science due to the federal No Child Left Behind (NCLB) mandate often results in even lower frequency and duration of classes devoted to ES especially at the elementary grade levels (de Vise, 2007).

The problems associated with teaching about the environment are relevant to this case study of a field trip because the field trip involved students in studying animals, plants, and their habitats by using scientific methods in the outdoors. In addition to the confusion of terminology and goals, many EE topics like geography and the study of regional environments, and Science, Technology and Society (STS) issues are addressed in elementary *social* studies textbooks (Banks, Boehm, Colleary, Contreras, Goodwin, McFarland, & Parker, 2005). The lack of distinction between science and social studies only contributes to the complexity of developing an understanding of the subject matter.

In addition, both national and state science education standards use different terminology for ES topics, contributing to the confusion about how, when, where, and why to teach EE or ES. Because teachers' knowledge, attitude and interest in teaching EE and ES also varies, there is a wide range of what and how students learn about the environment (Rickinson, 2001).

The Outdoor Context and Learning

The idea that the context in which learning takes place is valuable for student growth and is the responsibility of the teacher is expressed by Dewey (1938/1997):

> A primary responsibility of educators is that they not only be aware of the general principle of the shaping of actual experience by environing conditions, but that they also recognize in the concrete what surroundings are conducive to having experiences that lead to growth. Above all, they

> should know how to utilize the surroundings, physical and social, that exist so as to extract from them all that they have to contribute to building up experiences that are worthwhile. (Dewey, 1938/1997, p. 40)

Here Dewey focuses on the teacher's role in developing meaningful experiences for students, using physical and social aspects of the environment to create experiences that are meaningful. The idea that the environment is important to the experience is congruent with the current emphasis placed by some educators on learning in local outdoor environments (Louv, 2006; McComas, 2008; Sobel, 2008). This emphasis is driven by the desire to strengthen the connections that children have with the environment.

The outdoor environment as the context in which learning takes place is fundamental to environmental education, environmental science education, outdoor education, and nature study, all of which have long histories of individuals who were schooled or learned in the outdoor environment (Dillon, Rickinson, Teamey, Morris, Choi, Sanders, & Benefield, 2006; Louv, 2006; Orr, 2004; Streeter & Bowdoin, 1997). In this study, the outdoor environment of the field trip provided the participants with the opportunity to experience the outdoors guided by an expert naturalist. This type of outdoor experience is common in environmental education, environmental science education, outdoor education, and nature study programs. In this study, the students from an urban environment were not as familiar with the rural/natural environment of the field trip. Often students from urban settings are not used to what a "natural" environment looks like, making their responses to the environment of a different quality than individuals who have regularly experienced a natural environment.

Recent concern that children in our society are not spending enough time in the outdoors has generated more conversation among EE and ES educators about different ways to address the problem. The discussion and responses to the problem are in alignment with the roots of the disciplines associated with the outdoor environment. Many of those who studied and highly valued the outdoor environment have written about the influence of their own outdoor experiences as children on their own interest in learning about the natural environment (Dillon et al., 2006; Louv, 2006; Orr, 2004; Streeter & Bowdoin, 1997). Both national and state legislators have written new legislation, the No Child Left *Inside* Act, that addresses the perceived deficit of time spent outside for our youth (U.S. Government, 2008; Maryland State Government, 2008).

Motivation for the Study

This study emerged from my interest in understanding the learning process related to study of the environment, especially in outdoor contexts, and my interest in working with youth from urban environments. The personal roots of my interest in the outdoor learning experience lie in my own lifelong experiences in the outdoors, beginning with unfettered explorations of forest, trees, and soils in my childhood, and culminating in explorations of field, streams, rivers, bays, forests, and agricultural lands more recently due to my work as an environmental science educator.

My perspective is based on both my work experience in the field of ES education and research and my formal education experiences. In my professional experience, I have developed and implemented a variety of ES education programs, covering a range of subjects from recycling and composting to water quality issues; forestry, native plants and agricultural application of nutrients to soil. My schooling in ES includes a certificate in environmental studies at the undergraduate level and a Master’s degree in environmental biology. My Master’s degree thesis involved soil science and addressed water quality issues related to applications of excess nutrients to agricultural soils in the Chesapeake Bay watershed.

As my experience in ES and education has grown over time from 1991 when I began managing a recycling program to the present, I have begun to question the educational value of informal programs. In particular, I am interested in the different ways that educational programs of relatively short duration affect the learning process for participants in these programs, the ways in which students connect ES experiences outside of school with their educational experiences in school, and the difference in the ways that ES is taught by experts and novices in the study of the environment that might affect the learning process and outcomes.

As an informal science educator, I frequently interfaced with a public interested in “saving the environment.” I noticed that many of those individuals who cared deeply about the environment and were dedicated to the concepts associated with EE, frequently had minimal knowledge of ES. This observation led me analyze the major differences between these two subject areas. Environmental education is often based on a mixture of science, social science, and technology, with problem solving, social justice, and action the end goals. Environmental science is a multi-disciplinary science subject area that involves understandings of biology, chemistry, geology, physics, earth science, etc. to solve environmental problems. I think that the complexity of these subjects contributes to confusion about terminology and goals when educational goals are not clearly defined and supported.

Epistemology of the Study

In this qualitative research study, I, as the researcher, situated my observations in the contexts in which the activities occurred and developed a representation of the nature of the students' meaning-making process. This representation was developed through the filter of my experiences and understandings as the researcher. This research was developed based on a constructivist paradigm, which is to say the understanding that meaning does not just exist, it is constructed. In addition, it is not a subjective meaning that is created, but rather a meaning that is constructed from "the world and objects in the world" (Crotty, 1998, p. 44). This construction of knowledge begins with perception of sensory stimulation, proceeding individually with associations to prior experiences. Through a socially mediated process and interactions with others the meaning-making process develops further (Stake, 1995; Guba & Lincoln, 2005).

Purpose of the Study and Research Questions

The purpose of this case study is to develop an understanding of the experience and process of learning by a fourth grade teacher and her students surrounding a field trip to an outdoor environmental science education site. In order to develop an understanding of the student and teacher experience and learning process surrounding the field trip, the following questions guided the research:

- What meanings do students make of the field trip experience and of connections with their school, home and other experiences in outdoor environments?
- What meaning does the teacher make of the field trip experience for herself and her students?

- How does the site educator perceive the students' experiences during the field trip?

The following elements of the study were central to the development of an understanding of the participants' process of making meaning based on the field trip: 1) the students' perspective, 2) the educators' (classroom teacher and site educator) perspective, 3) the science content (in the classroom and related to the field trip), 4) the contexts (the classroom and the field trip site) and 5) the researcher's perspective. The actions and interactions among the participants, and the science content within the two contexts were the basis of the analysis and interpretation of the data. In addition, the sensory quality of the field trip was considered as important to the meaning-making process of the participants.

The creative research process for this study involved complex decision making as I employed different tools and techniques as the study progressed. Development of a thick, rich representation of a complex situation was the intention, with the narrative descriptions from different perspectives providing raw material for crystallization, which involves development of different perspectives (Denzin & Lincoln, 2005; Richardson & St. Pierre, 2005).

Significance of Study

This study was designed to develop an understanding of the field trip participants' process of learning beyond just the time spent during the field trip. With a focus on the students' meaning-making process, perspectives of the educators and the researcher were used to develop a rich understanding of that process. The interactions between field trip participants and the environment provided the basis from which the educative quality of the experience was determined. This analysis is significant to understanding important elements of the relationship between formal and informal science education programs that contribute to the educative process of all participants. With increased interest in outdoor and environmental education, especially for youth from urban environments, understanding the effects of environmental science outdoor experiences is an urgent need that this study addresses.

Definition of Terms

Environmental education: Environmental education may be conceived as being directed toward developing a citizenry that is knowledgeable about its environment and its associated problems, aware of the opportunities for citizen participation in environmental problem-solving, and motivated to take part in such problem-solving (Labinowich, 1972).

Environmental science education: The Maryland State Department of Education K-8 science standards define environmental science education as "students using scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyzing their impact from a local to a global perspective" (MSDE, 2005a).

Formal education programs: Formal education programs are those in which a teacher, or designated authority require learning from a curriculum that is based on an already established body of knowledge (Livingstone, 2006).

Free-choice learning: Free choice learning is the learning that occurs when the individual is self-motivated to learn something of interest or that is necessary to learn (Falk & Dierking, 2002).

Informal science education programs: Informal science learning refers to learning that occurs outside of formal learning settings, e.g., outside of schools and universities (Dierking et al., 2003).

Non-formal science education programs: Non-formal education programs are defined by the North American Association for Environmental Education (NAAEE) as “structured” educational programs that occur outside of classroom science education and formal education programs (Larson, 2005).

Overview

This study was an exploration of the process of learning and meaning-making for nine fourth grade students as they experienced an outdoor field trip and studied science in the classroom before and after the field trip. From September through December, 2006, I made observations of students at work in the classroom and during the field trip, interviewed their teacher and the site educator before and after the field trip, and interviewed the students after the field trip. Using the writings of John Dewey about experience and education, I focused on the learning process for students engaged in exploring an outdoor environment during a field trip and their science classes before and after the trip. Discovery of different ways in which the students made sense or meanings from the experiences was facilitated by observations of the activities and analysis and interpretation of the dialogue occurring in both contexts.

In Chapter II, I focus on the principal elements of the framework for this study. These two elements are Science Teaching and Learning and the Subject Matter of the Field Trip. In Chapter III, I discuss the pilot study and the research design and methods chosen for the study.

In Chapter IV, I present narrative summary descriptions of the science lessons in the classroom and for the field trip. These descriptions are followed by a discussion of the data in a summary matrix (see Appendix C). The interactive elements of the science classes and field trips are displayed in a longitudinal format in that matrix. In Chapter V, I present three perspectives on the field trip experiences: the student perspective, the classroom teacher's perspective and the site educator's perspective. In Chapter VI, I discuss my own perspective as the researcher in terms of the Deweyan characteristics of an educative experience. Chapter VII is a presentation of my conclusions for this study.

CHAPTER II: REVIEW OF THE LITERATURE

The following review of the research literature involves two main conceptual areas that frame this study. The first section reviews studies of science teaching and learning in general and then focuses upon studies of science-related field trips.

In the second section, I present an overview of environmental science, environmental education and nature study with the intention of building a foundation for understanding the complexities of these subjects and the ways in which their interwoven histories might affect the teaching and learning in this study.

Science Teaching and Learning

Strategies for teaching science vary widely in formal institutions of learning and also in informal settings in the US. In this section I begin with a review of research on science teaching and learning in general to explore the full range of possibilities for teaching and learning science in the classroom. Next I explore the research literature on challenges faced by urban schools. I then review research studies of science teaching and learning during field trips.

Science Teaching and Learning in General

There were several aspects of science teaching and learning that were relevant to this study. I have chosen to discuss the characteristics of good science teaching as they are relevant to both the classroom teacher's and site educator's work with students. Particularly helpful was an article by Barnett and Hodson (2001), who incorporated general theories of teaching as the foundation from which successful science teachers operate into a model that represents the contexts in which teachers work and learn how to be good science teachers. Because inquiry and project-based learning teaching strategies are recommended in current national science teaching standards, I reviewed a research article on inquiry in the classroom (Crawford, 2000) and a study of Project-Based Learning (PBL) in an urban school setting (Tal, Krajcik, & Blumenfeld, 2006). Howes' (2008) study of exemplary teaching and learning of science in urban schools also informed this study. I discuss below ways that she interpreted developing science process skills in terms of Deweyan ideas about the difference between an educative and mis-educative experiences.

Characteristics of good science teaching. With ongoing efforts to reform education, there has been an evolution in educational research on important characteristics of teachers' knowledge and ways their practices are affected by these characteristics (DeBoer, 1991). Barnett and Hodson (2001) developed a model based on research into what good science teachers know, incorporating and citing the work of Connelly and Clandinin (1985, 1988), Schon (1983), Lee Schulman (1986, 1987), and other educational researchers into the model. The Pedagogical Context Model brings together current understandings of the crucial elements of what Barnett and Hodson describe as "good" science teaching employed by successful teachers. This model thus brings together different understandings of good teaching with a purpose of: "gaining some insight into the knowledge, understanding and skills that good teachers deploy in the classroom" (p. 429).

Barnett and Hodson (2001) suggest that in teaching science, there are four key factors of a teacher's knowledge and practice: the teacher's academic and research knowledge, pedagogical content knowledge, professional knowledge, and classroom knowledge. These knowledge bases are the framework of the model developed by

Barnett and Hodson (2001). These four components were useful in my analysis of both the classroom teacher and the site educator in this study, even though the contexts within which teaching took place were very different.

Academic and research knowledge is the knowledge acquired through courses, reading, and personal reflection on science content knowledge of facts and theories, understandings of the nature of science, and understanding of how and why students learn.

Teachers' pedagogical content knowledge (PCK) includes not just the teacher's understanding of the specific content, but also the teacher's ability to present the content effectively to students (Shulman, as cited in Barnett & Hodson, 2001). Pedagogical content knowledge involves a teacher's knowledge of learning goals, sequencing of lessons and different teaching strategies for particular topics that teachers acquire through experience and discussion with colleagues.

Professional knowledge evolves over time and is influenced by conversations with other teachers in the school, collaborative efforts to develop school programs and the practical knowledge acquired that is based on typical duties of teachers.

Classroom knowledge is defined by Barnett and Hodson (2001) as teachers' knowledge of their students and classrooms. They assert that this knowledge is constantly under construction due to the everyday situations in the classroom. Connelly and Clandinin, as cited in Barnett and Hodson (2001), developed the idea of a teacher's *personal practical knowledge* or the idea that teacher's knowledge changes over time, coming from personal experiences both inside and outside the classroom. This personal, practical knowledge provides teachers with a sense of control, and a sense of validation and security as a teacher (Barnett & Hodson, 2001). Teachers' personal practical knowledge evolves as they develop their teaching skills and identity (Greene, 2001). Greene asserts that if teachers are passionate and involved in their own active and reflective processes, they are better able to engage students in active learning. Teachers also sometimes improvise and solve problems using their own personal *tool bags* of ideas.

There are several additional issues associated with classroom dynamics that affect teachers' development of classroom skills. The fact that the science curriculum is not always controlled by the teacher is recognized as a common problem faced by teachers that constrains their subject matter choices (Barnett & Hodson, 2001).

The differences between *novice* teachers and *expert* teachers in terms of both content and teaching skills were discussed by Barnett and Hodson (2001) as very complex due to the nature of science teaching. They suggest that novice and expert teachers approach problems differently, and that knowledge gained in specific contexts can be successfully transferred to other contexts, but is done so more fluidly by expert teachers. Experts are able to effectively use over-arching principles when needed due to their more extensive knowledge base that is organized in clusters. Differences between teachers with more or less years of experience are found in several studies of field trips, with differences emerging in teacher understanding of related science content and extent of integration of the science content into classroom curricula (Kisiel, 2005; Schneider, 2003; Tal & Morag, 2007).

Inquiry in the classroom. Crawford (2000) conducted an in-depth study of the beliefs and practices of a high school biology teacher who had successfully developed inquiry-based science teaching practices in his classroom. In her analysis, Crawford (2000) proposes there are additional roles beyond facilitator and/or guide that teachers assume while using inquiry-based pedagogy. The teacher in that study assumed roles of motivator, diagnostician, guide, innovator, experimenter, researcher, modeler, mentor, collaborator and learner as he successfully implemented inquiry approaches in science (Crawford, 2000). These findings suggest that there are many different possible teacher actions that contribute to success using inquiry strategies. This study thus was useful in informing the complexities of teacher actions during a field trip to an environmental science site.

Crawford's methodology involved a reduction of data via creation of narrative descriptions of the videotaped class observations. Crawford developed multiple narrative representations of the observations including an overview of the lesson and a commentary on the lesson segments. These summaries and narratives of each lesson were then coded, with sections underlined that were particularly important to the research questions. Crawford then checked the patterns and themes that emerged for accuracy with all sources of data, from researcher notes to informal conversations with the teacher. Finally the teacher himself was asked to take a look at the emerging themes and assertions that were made about his teaching to either refute or corroborate their accuracy. The themes were displayed in matrices to assist with development of conclusions and verification of these conclusions.

Crawford stated that the analytic methods evolved because of the extensive data she had collected from classroom observations. She also chose *critical incidents* that were representative events that had occurred during the course of the year-long data gathering process as another analytic tool to develop the interpretation and discussion points. The analytic methods chosen by Crawford were helpful to my decision-making process regarding the extensive data that I collected in the classroom and during the field trip.

Project-Based Learning (PBL) as an *ideal*. Project-based learning incorporates inquiry teaching strategies and the basic tenets of constructivism into investigations of science (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991). When PBL teaching strategies are used to teach science, students are actively engaged in phenomena and in questioning, predicting, explaining, and interacting with concrete materials. Students use prior knowledge, apply skills to new situations, and take time to reflect on the whole process through investigations. The teacher evaluates varied representations of knowledge, and asks for revisions which became part of the learning process. Learning communities develop as students participate in discussions and debates, resolve conflicting thoughts, and participate with knowledgeable persons willing to share their ideas and skills. In addition, the authentic nature of projects enables development of meaningful driving questions of relevance to the students, with connections to the real world (Krajcik, Czerniak, & Berger, 2003).

Project-Based Learning is a science teaching and learning strategy that is frequently used to develop understanding of the environment and solutions to environmental problems (Goodwin & Adkins, 1997; Jenkins, 2003; Windschitl, Dvomich, Ryken, Tudor, & Koehler, 2007). Manzanel, Barreiro, and Jimenez (1999) found that students often develop an ethic of defense of the environment based on their understanding of ecological concepts as a result of an experience in the field.

In one urban school system, a study of PBL focused on the role of the teachers as they worked with their students on science projects (Tal et al., 2006). In this case, four teachers were chosen from an urban school involved in professional development with the researchers. Because the goal of the study was to discuss good science teaching practices based on reform efforts in the school, two teachers who were successfully using inquiry practices with their students were chosen.

One of the teachers in the study had six years experience and the other had nineteen years of experience in the classroom teaching science. Both teachers implemented curricula that were based on investigations around a driving question with relative success in the classroom with the students. The analysis of the teachers' practices revolved around curriculum coverage, time spent on task, teacher content knowledge, teacher pedagogical content knowledge, use of technology, student collaboration, and teacher attitude toward students. Success was demonstrated in these cases by student engagement in inquiry, student processes of learning, small group work, collaboration, and teacher facilitation of the use of technology in the classroom.

Tal et al. (2006) conclude that having relevant learning materials and technology in the classroom with extra support are very important to the development of student understanding of science in urban schools. In the case of these two teachers, both enabled their students to learn science content using inquiry by fully engaging in the instructional approaches. Tal et al. (2006) discuss the difficulties in urban schools and mention that effective management of the urban students was a prerequisite of using inquiry or PBL strategies with the students.

Developing experience with science *process* skills. Howes' (2008) study of the ways in which teachers use animals in their classroom to help students develop observation skills is another example of a study of PBL in the classroom. Howes' study informed the development of my study particularly because of the focus on Dewey's ideas about educative experiences.

Howes (2008) selected some of Dewey's criteria for an *educative* experience to interpret key components of science teaching. The motivation for the study was Howes' interest in further developing her own understanding of elementary teachers in order to improve her understanding of elementary science teaching. She was particularly interested in helping preservice teachers attend to both children's thinking and to their need for real world experiences in science in the classroom. Her study focuses on experienced teachers' roles in assisting students to make connections between an experience and their prior knowledge and future experiences.

Howes (2008) develops an interpretation that synthesizes a series of Dewey's ideas about factors that contribute to the educative quality of the students' experience in the classroom. Her interpretation focuses on the teacher's role in facilitating the students' process of making connections between an experience and future experiences, and also with prior experiences. The teachers in her study were working on student development of the scientific process skill of making observations. Howes (2008) observed that this science process skill of making observations was central to student development of further interests in topics related to an initial experience.

The students in Howes' (2008) study attended school in an urban setting. The setting was not the focus of the study. It was described by Howes as typical of urban settings, providing different challenges for preservice elementary teachers. The teachers involved in the study were all bilingual in English and Spanish. They were chosen because they liked teaching science and maintained a progressive approach in their classrooms. All of them had small animals in the classroom, which were used to develop inquiry based lesson plans (Howes, 2008). All of these teachers asked their students to make observations of the animals, and to record their data over time. These observations then became the basis for development of student questions and further explorations into living things.

Howes (2008) concludes that the process of making observations resulted in an experience of the tentative nature of science for both the teacher and her students and the beginnings of a deeper exploration of science content, with the teacher playing an active role in facilitating the children’s process over time. Exploration of the subject matter was facilitated because the teachers asked their students to link observations to recording data and facilitated student-led discussions that focused on their observation of the animals.

Howes (2008) also suggests that student exploration of subject matter via development of the science process skill of making observations would benefit from simultaneous science content explorations. As a result, she believes that a challenge for teachers of preservice elementary teachers will be to develop their understanding of the importance of science concepts to science inquiry and the development of process skills.

Challenges of Teaching and Learning in Urban Schools in the US

Urban schools in the US continue to face a variety of challenges as they meet the needs of their increasingly diverse student populations. There is some agreement in the literature about what those challenges are. Among them are high absentee rates, high mobility among students, lack of resources, large class sizes, and old school buildings (Calabrese-Barton, 2002; Hewson, Kahle, Scantlebury, & Davies, 2001; Tal et al., 2006). As a result of these conditions, and high percentages of teachers with little experience, instructional practices often are dominated by whole class instruction and direct teaching (Haberman, 1991).

In addition, cultural differences between the school, the teacher, and the students are not always recognized or considered as important to the dynamics of teaching and learning in the classroom (Gay, 2002; Ladson-Billings, 1995; Lee, 2005). In fact, within our society, the standards of the mainstream, European-American remain the norm, creating at best an indifference to difference and at worst, resistance to diversity.

Stereotypes of different cultural backgrounds often result in classifications of individuals by behaviors, social class, and language that are negative. Oftentimes African American students are labeled as unruly and deficient in particular ways due to home lives other than the white norm. Children of color and low economic status vary in their background experiences, their values, cultural expectations, and viewpoints in addition to different physical characteristics. Current research indicates that reform movements have done little to overcome these differences, with much work to be done to develop teacher education programs that incorporate culturally responsive teaching techniques (Calabrese-Barton, 2002; Fraser-Abder, Atwater, & Lee, 2006; Ladson-Billings, 1995; Tal, et al., 2006).

One aspect of cultural difference applicable to this study is the way in which students make connections between their home culture and the culture of the school, which is also referred to as “border crossings.” Because values and practices between the two cultures of the home and school environments can be very different and discontinuous, Lee, Buxton, Lewis and LeRoy (2006) recommend that teachers make the discontinuities explicit. This will assist students as they attempt to transition from their home cultures to learning about science through inquiry in school, for example.

Science Teaching and Learning during Field Trips

In this section, I review the field trip research literature, particularly studies of teachers' perspectives on field trips and of the students' behavior and learning based on field trip experiences. Because only a few research articles use the term "environmental science" to describe the science content, the literature review was broadened to include research on field trips in general and field trips to informal science education centers.

Studies that examined teachers' thoughts about field trips, including their vision for teaching and learning that might take place, or their motivation and intentions for students during the field trip were of particular interest to me during the pilot study.

Other studies of field trips were designed to develop understandings of student learning that were relevant to this study. In a series of studies by Falk and various co-researchers, the effect of the 'novelty' of a field trip context on student behavior was explored (Falk, 1983; Falk & Balling, 1982). One study of student retention of content knowledge (Knapp, 2000) involved recognition of time as a factor in student recall of content information. In another study, Anderson, Lucas, and Ginns (2003) used concept map analysis to determine student learning based on a field trip experience.

Teacher motivation. Studies from the field trip literature that I selected for review revealed that teachers value field trips as an opportunity to extend student learning and increase student interest in science and care for the environment, to increase subject matter knowledge, and to increase student retention of knowledge (Finkelstein, 2005; Kisiel, 2005; Rickinson, 2001; Schneider, 2003). Field trips to science education centers are also considered by teachers to assist students in making real world connections and expose them to different career possibilities in science (Kisiel, 2005; Michie, 1998; Tal, 2001).

Michie (1998) explored factors that influence teachers' decisions to undertake field trips. Twenty-eight teachers who participated in different field trips with their students were interviewed in this study of potential influences on the teachers' decision-making process. Teachers shared their belief that field trips improved student behavior after the trip, articulated problems associated with administrative support for the trip, discussed the teaching/learning outcomes, and considered whether or not members of the school community supported the decision to take students on a field trip. One finding of this study was that teachers were interested in using the field trip as part of their teaching pedagogy by providing *hands-on*, real life experiences or to examine applications of science which augment their classroom studies.

The idea that hands-on exploration is important to learning is based in constructivist theories of learning, with field trips to science centers commonly involving hands-on opportunities for student learning (Klein & Merritt, 1994; Duensing, 1987). Teachers often mention hands-on exploration as a positive teaching strategy that enhances the field trip experience. However, it is not always possible to engage students in making connections to inquiry and the process of developing meaningful questions (Schneider, 2003; Simmons, 1996). Because the hands-on nature of the field trip is frequently linked to student “enjoyment” of a field trip experience, the educational potential of the experience is not always considered (Michie, 1998; Duensing, 1987).

Kisiel’s (2005) study of teacher motivations to take students on field trips encompasses not only the motivations, but development of the teacher’s perception of the informal field trip setting. Ten upper elementary teachers from schools in urban settings were chosen for this study from a larger pool of teachers who participated in a survey analysis. To create a more in-depth analysis after the survey process, the teachers were interviewed before and after the field trip to a natural history museum. The teacher and students were observed during the field trip, with observations recorded manually.

Most of the teachers involved in the study cited making connections to the curriculum as important, but noted that this type of connection often was required for school system approval. Many of the teachers recognized that they were providing an opportunity that students might not otherwise get and often mentioned the importance of the *hands-on* nature of the experience.

The teachers indicated that the choices they made regarding the field trip location and timing during the school year were often limited by the school system. The location of field trips was also limited by acquisition of funding and high transportation costs (Kisiel, 2005). Teachers who indicated that they had little say in where they would go on the field trip were more likely to have general motivations for students, and said that they wanted to expose their students to general experiences. Success of the field trip was measured by these teachers in terms of “having fun”, learning about something new, making connections to class studies, and increased motivation to learn about the subject.

Teachers also cared about student behavior and whether or not students' engaged by asking good questions during the field trip (Kisiel, 2005).

To further explore what teachers meant when they said they would "make curriculum connections" with the field trip, teachers were interviewed individually (Kisiel, 2005). Some teachers meant that the field trip would provide review or introduction to a curricular unit. Others described the field trip as a way to reinforce vocabulary and language skills and connect to the curriculum. Some teachers associated "hands-on experiences" with literally handling an object. But in the case of museums where things may not be really touchable, teachers meant that students would have a "firsthand" experience. Some teachers in this study wanted to provide general learning experiences and foster student interest in a subject area.

Kisiel (2005) suggests that museums and informal learning centers should consider ways that they can support the teacher's agenda for the field trip, especially in the case of urban schools. Support for multilingual students, admission passes, and discounts would increase access. He also notes that the planning process should involve both the teacher and the institution, with particular attention paid to the teachers' agenda or motivation for the field trip.

Kisiel's analysis of teacher motivation and thoughts about field trips provided an in-depth view that provides evidence of the important role that teachers play in the enactment of a field trip into their curriculum. Recognition that the institution can also play an important role in the success of the field trip is important to the potential for partnering between institutions.

Novice and experienced teachers. In some studies of teacher perceptions of field trips there were differences between the actions and perspectives of novice and expert teachers, usually defined by number of years teaching. In two studies, Schneider (2003) and Tal (2001) characterize the important differences in the perceptions of novice and expert teachers toward a field trip and the related science content.

Schneider (2003) describes a situation in which her survey respondents were mostly experienced teachers, with ten or more years teaching in the classroom. In this study of teacher and student experiences in informal settings, Schneider found that novice teachers, with 0-2 years experience teaching cited very different reasons for choosing an informal experience for their students than did the more experienced teachers. Novice teachers mentioned the goal of "hands-on" learning and wanted to link the informal experience with specific curricular topics. This contrasted with the goals of the experienced teachers who made curricular connections more broadly, sometimes with PBL as the teaching strategy.

Schneider's (2003) study encompasses multiple schools and several informal settings. Examples of interesting strategies employed by different schools and teachers are embedded in this study. In one example, a school where teachers spiral the curriculum across grade levels, students go on the same field trip each year, but address the content intended differently based on grade level. Different pre-trip orientation methods were used successfully by multiple teachers, resulting in greater awareness of at least the teachers' goals for the field trip experiences.

In another study of teachers' goals for field trips, number of years teaching made a difference in teachers' perceptions of content, learning, and problem solving during field trips (Tal, 2001). Tal asked teachers to think of a field trip as a complex method of teaching while they were participating in a field trip themselves. The teachers also contemplated the possible contributions of the field trip to student learning. After experiencing the field trip, they wrote a structured observation and a report based on three categories: science content, activities experienced, and the problem-solving quality of the field trip activities. In addition, four teachers from each group were interviewed to validate the written reports and interpretation of the data.

Experienced and novice teachers had different perspectives on the field trip experience. The experienced teachers commented on the advantages of the field trip in terms of creation of a learning environment that promoted "interaction, investigation, problem solving, and interdisciplinary learning" (Tal, 2001, p. 45). The novice teachers were more highly motivated to include field trips in their teaching, but did not discuss the complexities of the field trip as thoroughly as did the experienced teachers in the study. However, the experienced teachers also indicated that they did not feel comfortable in the outdoor field trip environment. One teacher, who was interviewed in-depth, suggested that the discomfort was the result of the fact that both the content and pedagogy resided outside of the knowledge base of the teachers (Tal, 2001).

Novelty of setting effects. In a series of studies on the "novelty effect" of student learning in contexts unfamiliar to them, Falk and co-authors explored the effects of the newness of a field trip context on student learning (Falk, 1983; Falk & Balling, 1980; Falk & Balling, 1982; Falk, Martin, & Balling, 1978). In one study, Falk and Balling (1982) analyzed the overall effect of a field trip on student attitudes, behavior, and learning. The students had participated in either an exploration of trees in the vicinity of their own school or at a nature center during an all-day field trip. Student behavior during the trips was assessed with an instrument developed to enable observers to code students' behavior quality during the field trip. Cognitive effects of the field trip were measured through the administration of pre- and post-trip recognition/memory tests, which had been designed to measure cognitive aspects of learning (Falk & Balling, 1982).

Settings that were new and different to the learner had a negative effect on student attention to task in this study (Falk & Balling, 1982). A model of the relationship between novelty of experience and student attention to tasks was then developed. This model showed that as the novelty increased, student attention to task decreased. An additional finding of this study was that older, fifth grade, students displayed a higher level of cognitive task learning and a lower level of non-task behavior in the more novel setting of the nature center than the third graders involved in the study. However, moderate novelty levels for any grade levels were found to produce the highest levels of on-task behaviors. These findings suggest that the novelty of setting and activity during field trips has potential for a positive effect on student attitude and behavior, and that there are different novelty effects at different grade levels.

Orion and Hofstein (1994) also found a novelty effect in their study of the factors that influence student learning during outdoor field trips. Orion and Hofstein (1994) analyzed student learning related to field trips to natural environments and found that two factors, novelty and quality of the field trip, most affected student learning. The field trip experience in this study involved a preparatory unit before the field trip, a one day field trip, and a unit afterwards that summarized the desired learning outcomes. This quantitative research study was designed with pre- and post- trip student questionnaires and observations of the field trip.

Orion and Hofstein (1994) differentiated specific aspects of the novelty of an outdoor field trip that might affect student learning. They discuss three factors as contributing to student behavior during field trips to areas with which they are unfamiliar. Cognitive, geographic, and psychological novelty factors were determined to be important to the overall focus of students. Orion and Hofstein (1994) propose that if these three factors are addressed before a field trip, a more meaningful experience for students becomes more likely.

The quality of the field trip in this study was defined by the structure of the activities, the learning materials, and the teaching strategies used. Interactions with the environment were important to making the experience more concrete for students.

Student content-knowledge retention. In a study of student retention of knowledge of particular subject matter related to a field trip, Knapp (2000) found that students did not retain specific subject information at any time after the field trip. However, interest in learning more about the subject at one month and eighteen months after an environmental science field trip experience remained high (Knapp, 2000). A written survey was administrated to the participants in the study from three different rural, mid-western elementary classes. Plant adaptations were the subject matter focus of the field trip.

In the analysis of the survey responses, Knapp (2000) indicated that although the students remembered the general activities as learning about plants, they did not discuss specifics of the information conveyed to them during the field trip at both time intervals after the field trip. These conclusions are interesting, but generate questions about factors such as the effectiveness of the educational strategies during the field trip that were not addressed in the study. There may also have been a survey design effect that contributed to student deficits in content knowledge related to their experience.

Student construction of knowledge. One study by Anderson, 1999, as cited in Falk and Dierking (2000), involves the use of concept maps to aide student construction of knowledge related to a field trip to a science center where electricity and magnetism was the focus. In this study, students were coached on how to develop a concept map before the field trip. They then developed concept maps on electricity and magnetism before and after the field trip. An in-depth interview focusing on the students' concept maps revealed that student construction of knowledge was positively affected by the field trip experience (Anderson, 1999 as cited in Falk & Dierking, 2000). Anderson found that students constructed their knowledge from a wide range of related learning experiences involving parents and extracurricular activities. However, there were individual differences based on the nature of these experiences and the student's own individual learning process (Anderson, 1999 as cited in Falk & Dierking, 2000).

Summary

In this exploration of studies of science teaching and learning in general, I focused on research studies that develop understandings of the nature of good science teaching and effects on student learning. Because inquiry and PBL are considered to be ideal science teaching strategies, my exploration of the literature involved studies that considered important characteristics of both approaches. In several studies there were significant differences between novice and expert teachers as they develop science teaching skills. I also reviewed studies relevant to the challenges of teaching in urban schools and in particular the ways in which those challenges affected science teaching and learning.

In many of the field trip research studies the teachers' perspectives on the field trip were recognized as important to the quality of the educational experience for students. In many of the studies there was a difference in teacher reasoning and choices regarding the field trip experience based on the number of years teaching. Significant differences were found between novice and experienced teacher approaches to the field trip as an educational experience.

Several studies explored the effects of novelty on student learning and behavior during field trips. Although student retention of subject matter knowledge based on a field trip experience was the focus of several studies, only a few included observations of related classes in school.

Development of understanding of content matter is important, to both the teacher and the student, and affects the learning relationship (Dewey, 1938/1997; Hawkins, 1974, 2000). As discussions about the effects of efforts to reform our schools have continued, one side effect is that when the classroom is more student-centered, teachers must sometimes teach a topic that is beyond their own understanding (Floden, 1997). The triangular relationship of the teacher, student, and subject matter would be very different if students take the lead on exploration of a subject. Floden (1997) suggests that teachers should not think of this situation as one in which there is a gap in their own understanding, but rather should embrace learning together with the students. Thus, in-depth explorations of the subject matter would likely occur with students and teachers developing their understandings together.

Because many science field trips provide opportunities to explore subject matter outside of the established curriculum, teachers' understanding of the science content may be less important than their willingness to learn alongside their students, facilitating the process in different ways.

The Subject Matter: Environmental Education, Environmental Science or Nature Study?

In the next section I discuss the importance of the subject matter to learning and different ways in which the complexities of environmental education (EE) and environmental science (ES) confound understandings for both the teacher and the student. This section expands on Dewey's contention that subject matter should be considered an important element of development of student-centered learning practices that provide educative experiences.

The following exploration of the historical roots of both EE and ES illustrates the complexities and intertwined nature of these subjects. The resurgence in interest in the study of nature has its roots in curriculum materials entitled *Nature Study* that developed around the turn of the 20th century in our school systems. This is an additional factor contributing to the complexities of teaching and learning about the environment. The following discussion of the history and evolution of all three of these subjects is designed to explore the complex nature of the subject matter of the field trip. The relationships among environmental education, environmental science, school curricula, and state and national standards are discussed as in terms of their potential influence on the teaching strategies and content knowledge of the teacher and site educator during the field trip.

Nature Study

In addition to the confusion of terminology and concepts associated with EE and ES, there are also concepts from other subjects such as *conservation*, *natural resources*, *nature study*, and the science of *ecology* that have historical associations with the study of the environment. Each of these terms is an indicator of a particular perspective on the environment, each also has a history of endeavor associated with it. Nature and the study of nature are foundational for all of them.

An exploration of the definition of the word *nature* reveals multiple layers of meanings. The word *nature* comes from the Latin root *natura*, which means birth, constitution, character, course of things, and also *nasci*, which means to be born (Louv, 2006). A broad interpretation of the word nature includes the material world and all of its objects and phenomena. Another interpretation of the word refers to nature as the *outdoors*. However, the word *nature* is commonly used to refer to natural wilderness and the sense of wonder that these areas of sparse human population often evoke.

Naturalists are individuals who have in-depth knowledge of natural systems, usually of all aspects of these systems, including plants, animals, water systems, effects of climate and geology. Naturalists are often the educators at nature centers and environmental education centers.

Currently, concerns about the relationship between natural systems and the health of our planet, and the relationship between the health of children and the loss of natural spaces due to landscape changes that are occurring ever more rapidly are of more interest to the general public than in the recent past. Concerns about the loss of time and opportunity to explore nature and the outdoors for children growing up today have been considered by many authors from different perspectives, over time.

One author, Richard Louv (2006), writes about his childhood experiences exploring, unfettered by extreme parental concern, the edges of wild properties close to his home. He vividly describes the quality of that experience and how it affected his growth and understanding of the world. It is from these experiences that he wonders about the experiences of youth, currently growing up constrained by lack of space, freedom, and access to wild places. Louv establishes multiple connections among natural outdoor experiences and health of youth through stories of others, who like him, have established a strong connection with the outdoor environment.

Louv (2006) asserts that the use of the senses, the value of play, and the development of care about the environment are some of the areas that are intrinsically connected to experiences in the outdoors during the formative childhood years. The importance of experiencing the outdoors with a knowledgeable adult is also recognized to be a factor in deepening the meaning of the experience (Louv, 2006). It is concerns like these that drive initiatives for particular sites to provide extra funding for urban youth to participate in outdoor field trips.

In a study of the historical roots of *place-based* education, Streeter and Bowdoin (1997) emphasize the role that observation skills played for two naturalists, Gilbert White and Henry Thoreau. The stories of these two men as naturalists suggest that the process of recording observations and then communicating those observations to others is very important in the development of an individual's relationship with the environment (Streeter & Bowdoin, 1997).

In their analysis of Dewey's writings, Dennis and Knapp (1997) found many connections among educative process, democracy, conservation, and science education. They traced the roots of environmental education in terms of Dewey's extensive writing on nature study, outdoor education, and conservation education and Dewey's support of integration of subjects around organizing principles. In *Democracy and Education*, Dewey, explores nature study as something that should not be undertaken in isolation:

> The real remedy is to make nature study a study of nature, not of fragments made meaningless through complete removal from the situations in which they are produced and in which they operate. When nature is treated as a whole, like the earth in its relations, its phenomena fall into their natural relations of sympathy and association with human life. (1916/2007, p.173)

Dewey recognizes the value of study of the environment or nature in the outdoors, in context, rather than studying pieces of it brought inside, as is sometimes the case in science classes. Consideration of the earth and nature and the environment as a whole in our instructional practices will help to increase awareness and understanding of the interrelationships among plants, animals, humans, and the physical environment.

Environmental Education

In the US, the field of EE began with a focus on problem-solving and in response to the Environmental Education Act of 1970 (Pemberton, 1989**).** The original goals of EE were based in the social context of the time, in which industry, government, and universities had been slow to respond to citizen concern over issues related to environmental degradation such as air, soil, and water pollution (Pemberton, 1989). During the 1960s and 1970s the detrimental effects of increased population, manufacturing, and industry on the environment were quite visible to the public.

According to Disinger and Monroe (1992), environmental education provided connections among science, technology, economics, policy, people, and the environment. The effects of strip mines, oil spills in coastal waters, and problems associated with the use of insecticides were just some examples of ways in which the natural environment had obviously been disrupted by humans. One definition of the term *environmental education* became widely accepted:

> Environmental education may be conceived as being directed toward developing a citizenry that is knowledgeable about its environment and its associated problems, aware of the opportunities for citizen participation in environmental problem-solving, and motivated to take part in such problem-solving. (Labinowich, 1972, p. 2)

This definition recognized the importance of development of a citizenry educated and enabled to make complex decisions related to the health of the environment.

Environmental education evolved in the US around 1980 with the objectives of increasing environmental awareness, education of the public towards responsibility and concern for environmental problems, and stimulation and development of individuals' willingness and ability to make personal contributions to activities that might improve the environment in which they lived (Keiny & Zoller, 1991). The following set of instructional goals developed by Hungerford, Peyton, and Wilke (1980) were designed to foster the development of responsible environmental behavior, and in particular *ownership* and individual *empowerment* (Hungerford & Volk, 1990; Hungerford, Litherland, Peyton, Ramsey, & Volk, 1996; Klein & Merritt, 1994). These goals focus on the learner and reveal the importance of the development of a variety of understandings and awareness at different levels of understanding.

The levels represent a hierarchy of understandings that build on each other to enable an individual to take action and take proactive stances to have a positive effect on the environment. These levels also were recognized internationally in the 1977 Belgrade Charter (Serbia) and the 1977 Tbilisi (Republic of Georgia) Intergovernmental Conference Report on the Environment (Hungerford & Volk, 1990).

Level I: *Ecological Foundations level*—the learners acquire sufficient ecological knowledge enabling them to eventually make sound decisions with respect to environmental issues.

Level II: *Conceptual Awareness level*—issues and values: building of conceptual awareness that individual and collective actions affect quality of life and the environment. Resulting issues need to be resolved through investigation, evaluation, values clarification, decision-making, and finally, citizenship action.

Level III: *Investigation and evaluation level*— the learner develops knowledge and skills needed to investigate environmental issues and evaluate alternative solutions. Values are clarified through this process.

Level IV: *Action skills level*—training and application: guided development of skills needed to take positive environmental action that maintains a dynamic equilibrium between quality of life and quality of the environment.

In level I there is recognition that ecological knowledge provides the scientific understanding which is the basis from which environmental decisions are made. It forms the basis from which concepts, investigations, and evaluative actions occur in this suggested hierarchy of understandings. In the final goal of taking action, the conflict inherent in many environmental issues, or the conflict between man and the environment, is recognized.

During the 1990s there was a proliferation of programs and funding for urban environmental education initiatives. Stimulation for these programs originated from the more widespread awareness of the extent of damage to the urban environment, the ever-present gap in achievements between urban youth and others, and increased concern by individuals and organizations that changes must be made to improve the urban environment - for humans and for the planet.

The development and dissemination of the *National Science Education Standards* (National Research Council [NRC], 1996), increased understanding of the importance of inquiry-based education. Many environmental education programs are designed with investigations and experiments. Another very popular teaching strategy for EE has been PBL. Project-Based Learning in EE enables a comprehensive approach easily applicable to real world problems. There are many examples of PBL that have been developed in coordination with scientists and organizations to facilitate education of the public about the environment and environmental issues. Examples of these efforts include the Global Learning and Observations to Benefit the Environment (GLOBE) Project and the educational components of Long Term Ecological Research (LTER) sites (Berkowitz, Nilon, & Hollweg, 2003).

Environmental education programs with a focus on outdoor education and/or integration with other subjects have been developed in both formal and informal settings over time. Integration of EE with the social sciences, math and technology was expanded to include language arts during the 1990s until the present (de Vise, 2007; Mathews, 2007). This integration has been driven to some degree by the intensification of math and language arts in the schools, resulting in the exclusion of the study of and time spent on science (de Vise, 2007; Mathews, 2007).

Although these changes in didactics from the 1980s to the present reflect pedagogical advances based on research in science education, standards for training in EE are only now being developed at a national level (North American Association of Environmental Education, n.d.). These new certification standards are the national response and recognition that often educators at outdoor education centers are experts in particular fields of science, but have not taken the time or had the opportunity to develop deep understandings of how people learn (Rickinson et al., 2004). The certification standards also are designed as a pathway for classroom teachers to develop recognition of their in-depth environmental knowledge.

Environmental Science

From the late 1990s to the present there has been increased recognition of the importance of educating citizenry about the environment including environmental science (ES). The following quote from a U.S. government report on the status of environmental education calls for a consideration of ES in the educational process to help solve environmental problems.

> We are moving beyond a time when we can rely on a cadre of environmental experts to fix our environmental problems….A stronger public understanding of environmental science and related issues is a growing necessity, and comprehensive environmental education is the only answer that makes complete sense. (Coyle, as cited in National Environmental Education Advisory Council, [NEEAC], 2005, p. iv)

Definitions of ES vary slightly by source, but there is usually agreement that it is an interdisciplinary science. The following definition of ES characterizes it as a broadly based science that addresses issues related to the health of the environment.

> Environmental Science is the study of the physical or virtual environment of objects including physical, chemical and biological parts or components of the environment. It is an interdisciplinary science overlapping the categories in Natural Sciences, Engineering Sciences, and Social Sciences. Environmental science encompasses issues such as climate change, conservation, biodiversity, groundwater and soil contamination, use of natural resources, waste management, sustainable development, air pollution, and noise pollution. (Environmental science, 2007)

However, the definition of environmental science has been questioned in the environmental education research literature, by individuals in the world community who are concerned about a perceived decline in public interest in EE, and by those interested in developing effective environmental education programs at many levels and in different educational contexts (Dillon, 2002, 2003; Gough, A., 2002; Hart, 2003). Part of the problem is in the overlap in terminology and in reality with EE, and the belief that the overlap has not been effectively addressed by either science educators or environmental educators (Gough, A. 2002).

Gough characterizes the relationship between the two disciplines as “distant, competitive, predator-prey and host-parasite” (Gough, A., 2002, p. 1203). Problems caused by the nature of the relationship that should be addressed include a combination of the decline in student interest in science education simultaneously with the marginalization of EE. Gough proposes that the rationale of science education has changed enough that including more of a *promotion* of environmental wisdom will make it easier for environmental educators to accept a scientific approach (Gough, A., 2002).

Arguments against including a more scientific basis in EE are: 1) fear that the global trend towards standardized curriculum, will further remove teachers from planning and development of their own curriculum; 2) dominance of scientist influence on the curricula, with less inclusion of education and student interests; 3) teacher consideration that EE is yet another subject to add to their already dense curricula; and 4) little interest on the part of science in the interdisciplinary work of ES (Gough, A., 2002).

These points are particularly applicable to the current situation faced by teachers in the US, who are responding to demands for higher student assessment results, reduced classroom time for science, curriculum and guidelines with little room for change or adjustment, and the language of multiple levels of science standards.

School curricula and EE/ES. The history of EE illustrates its development as a mixture of science, social science, politics and technology which make it a multidisciplinary subject area (Dillon & Teamey, 2002; Disinger & Monroe, 1992; Rickinson, 2001). In one study of K-12 classrooms in the US, the subject of the environment was most frequently discussed in science, but also occurred in math, English, reading and social studies (NAAEE & ELC, 2000).

In contrast, ES is a multidisciplinary *science* that requires knowledge of the principles of biology, ecology, chemistry, physics, geology, etc. to solve environmental problems. Because ES is not a standardized subject offered in K-12 schools in the US, it sometimes is taught under physical sciences or ecology, and frequently is an interchangeable subject with earth science (Davis, 2000; Gough, A., 2002; NAAEE & ELC, 2000; Pemberton, 1989).

One attempt to address the need for interdisciplinary science has been developed through the Science, Technology, and Society (STS) education movement. This movement is based on the vision of science as a human endeavor that is located within the contexts of politics and economics in society (Pedretti, 2003). Since the 1970s, concerned science educators have promoted this initiative as important to development of critical thinking and problem solving skills for students (Zoller, Donn, Wild & Beckett, 1991). The Environment was added to STS in an effort to encourage active citizen participation in environmental problem solving (Zoller et al., 1991). Science, Technology, and Society and Science, Technology, the Environment, and Society (STES) programs have been incorporated into science curricula development in Canada and Australia, but are still marginalized in the US (Zoller et al., 1991; Pedretti, 2003). Fear that science would dominate EE efforts caused relationship changes and created distance between those working in EE and ES education that remain today (Dillon & Teamey, 2002; Gough, A., 2002; Gough, N., 2002).

National and state science standards and EE/ES. With the divergence of EE and ES education over time, the U.S. national science education curricula and standards developed separately from EE standards (Davis, 2000). In the national science standards documents, references to the environment occur predominantly under the content heading of *Science in Personal and Social Perspectives* (NRC, 1996, pp. 102-111). In contrast with the national standards, ES education is located at the same level as *Earth/Space Science*, *Life Science*, *Chemistry*, and *Physics* within the *Maryland Voluntary State Curriculum* (VSC) science education standards (Maryland State Department of Education [MSDE], 2005a).

Although state science standards were developed in Maryland in 2005, they remain on a voluntary basis (MSDE, 2005a). A separate section for environmental education on the state education department website lists many opportunities available to teachers through state run EE, and cites national and local teacher resources for development of EE programs (MSDE, 2007). Although there is, thus, programmatic recognition of both EE and ES at the state level, the similarities between the two may cause confusion for those teachers who do not have great depth of knowledge of science.

The lack of definition of environmental science or environmental education in national and state science education standards contributes to potential for science teachers and educators to be confused and/or to incorporate the study of the environment into their work with students randomly. With no guidelines, the presentation of subject matter is more likely to be based on the teacher's own prior interest and knowledge in the subject, which varies widely.

Summary

The study of the environment involves many different topics and scientific disciplines including nature study, environmental education, and environmental science education. With a multiplicity of topical approaches and many different educational programs available outside of the classroom, there is an automatic complexity to decisions about inclusion of programs into curricula. In addition to the overarching subjects, there are also science topics of chemistry, biology, ecology, geology, and geography that can easily be utilized as the over-arching subject for a study of the environment.

Historical understandings often are useful in developing at least an opening into subject matter. Choosing one particular environmental topic or problem also can be useful as a way to acquire depth of knowledge to support future understandings of the over-arching topics of EE, ES, and the study of nature. At least development of an awareness that there are many different ways to study the environment might be useful to teachers who choose environmental science field trips in the outdoors.

CHAPTER III: RESEARCH DESIGN

Overview of the Design Process

The initial impetus for the study came from observations that I made during my experience as an informal environmental science educator. My experiences developing and delivering educational programs for pre-schoolers to adults raised questions about the educational value of informal programs. In particular, I questioned the educational effect of programs of relatively short duration and ways students might connect these experiences with their formal educational experiences in school. Because there are many environmental science sites that are visited by school groups in Maryland, I decided to focus my study on an environmental science field trip. This research study began as an exploratory pilot study for my dissertation during Spring, 2005.

I begin this section with a summary of the pilot study, which included field trip observations during Fall, 2005, and Spring, 2006 field trip seasons. The pilot study summary is followed by the design and methodology of the final study, which focused upon one field trip during Fall, 2006.

The Pilot Study

I began this study with a search for field trip locations. The education directors at two sites indicated interest in participating in my study. To familiarize myself with both sites, I observed as many field trips as possible (approximately ten per site). Because of these observations, I became familiar with the field trip designs, the site educators and the experience of the field trip for students and their teachers at both sites.

The pilot study occurred at both sites, with field trip participants from both public and private school systems**.** The Spring, 2005 field trip season ran from mid-March through June. An application for approval to do research with human subjects was submitted to the University of Maryland Institutional Review Board and was approved in May, 2005, and has been re-approved every year since then.

The contexts within which the field trips took place were important to the overall field trip design at both sites, as were the teaching strategies used during the field trips. During the pilot study, I interviewed about six teachers who had participated in field trips at each site. I developed interview questions about the teachers' knowledge, attitude and interest in science and their motivation to bring students on field trips.

Qualitative research techniques were chosen with the intention that the final study would be informed by the pilot study. With the researcher the primary instrument for data collection, the possibility of adaptations and responsiveness to the context and what was happening was facilitated (Cresswell, 2003; Merriam, 1998). As I began to work in the field, I did not have a pre-determined design in mind, but rather functioned as an observer to increase my knowledge of the field trip experience and contexts. My intentions were to get to know the phenomena of the field trip at two different sites, and from that knowledge to move toward development of an appropriate research design. The pilot study involved an evolution from broad to more specific questions (Bogden & Biklen, 2003). The initial guiding questions for the pilot study were:

- How do students learn science related to field trip participation?
- In what ways do students from urban schools interact with each other, the teachers, and the environment surrounding an outdoor environmental science-related field trip that supports their learning of science?

- What is the influence of classroom pedagogy on student participation and learning of science related to the field trip?

Over the course of the pilot study, the following sub-questions emerged and guided the discussions with teachers and students during interviews:

- What motivates teachers to take their students on a field trip?
- In what ways do teachers integrate a field trip into their science curriculum?
- How does the field trip experience influence student understanding of environmental science concepts?

<u>Pilot Study Locations, Participants, and Data</u>

There are many locations throughout the metropolitan D.C. area, Maryland and Virginia that offer environmental science educational programs as field trips for school children. I defined environmental science education for the purpose of choice of location as a program that predominantly focused participants on scientifically-based processes and information about the environment. The two locations for the pilot study thus were chosen based on the following criteria:

- an educational field trip program based on environmental science,
- a focus on water habitats during educational programs,
- connections between education programs and scientific research at the site.

Site A was an environmental science research and education center located on a brackish river that is a tributary of the Chesapeake Bay. Site B was an environmental science research and education center that is owned by the county park system and is located beside a freshwater tidal tributary of the Chesapeake Bay. Both sites were located on protected land and used piers of different sizes as educational areas where groups accessed the water. Both sites had established scientific research that was initiated by both on-and off-site scientists. At Site B, volunteers supported on-going research studies in the field.

The pilot study involved observations of teachers and their students from different local private and public school systems who participated in field trips to either of the sites during 2005, or Spring, 2006. Grade levels ranged from third grade to eleventh grade. Twelve teachers and six site staff educators then were invited to participate in the pilot study and were interviewed after their field trips. Four to five students from five different classes were interviewed for the pilot study during Spring, 2006, with permission granted for the study from the county and the school administrations.

My sources of data were video and audio tapes from observations of science classes and the field trip, interviews with the teacher, site educator and students, and student worksheets and drawings from the interviews.

The results of the pilot study teacher interviews suggested that both experienced and novice teachers struggled to connect the environmental science learning in context to the school science curriculum. Teachers indicated that connections to the curriculum were problematic for different reasons, varying from their own lack of depth of knowledge of the science associated with the field trip to a reduction in time allocated to science in the classroom. I found that when teachers within a school collaborated on field trip preparation, the experience of novice teachers was enriched by the comments and advice of the more experienced teachers.

The interview questions were informed by the science teaching factors described by Barnett and Hodson (2001). Based on the data analysis, there were different levels of academic and research knowledge in the teachers' knowledge of science content, their understanding of the nature of science and their theories about how and why children learn. Pedagogical content knowledge and longevity in the classroom made a difference in the teaching strategies employed by classroom teachers and site educators with varying expertise in the environmental science content during field trips.

Observations of the field trips also revealed that differences in the site characteristics of the field trip affected the quality of the outdoor experience of the students, as did the instructional design. There was a wide range of different learning opportunities during the field trips due to seasonal variations in plants, animals, and the status of the wetland areas. However, these unique characteristics of a particular field trip were not easily recognized by teachers and their students. In other words, when students came back for the spring field trip, they often expected to see the same vegetation and animals, even though the plants and animals were in a completely different phase of their life cycles. Many teachers indicated that studying the environment was their desired focus for the field trip, with no specific connections to science mentioned. Other subjects that were less frequently requested included water quality, trees and wetlands, with connections to science sometimes requested.

Final Study Research Design

All research studies have methodological and theoretical perspectives that are the foundations of the design (Crotty, 1998). The particular methodology is described by Crotty (1998) as the plan of action or choice of methods to reach desired outcomes. For this final research study, I chose to use naturalistic inquiry as the theoretical perspective to inform the methodology. Naturalistic inquiry as described by Denzin and Lincoln

(2005) involves the “study of things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them” (p. 3).

These techniques were well suited to development of a thick, rich, description of the field trip context and process and an understanding of the participants’ process of meaning-making or making sense of their experiences during and surrounding the field trip (Lincoln & Guba, 1985; Merriam, 1998). With a focus on the meaning-making process, the view of human knowledge or epistemological underpinnings of this study are constructivist. In this view of human knowledge, meaning is constructed through engagement with the world (Crotty, 1998).

Case study methodology was chosen to develop an understanding of a particular case, bound by time, place and participants (Stake, 1995). Case study design involves boundaries, described by Merriam (1998) as “a thing, a single entity, a unit around which there are boundaries (p. 27). This case study was designed to explore, in-depth, the field trip program experience for the fourth grade, urban elementary students and their teacher as they participated in a particular environmental science field trip.

During the pilot study, I had focused on the teachers’ reasons for participating in a field trip, and the quality of the field trip itself. During this final case study, I chose to develop an understanding of the students’ meaning-making process based on a particular field trip experience.

Rationale for this Particular Case

The effects of science field trips on student learning have been studied in general more frequently than for outdoor environmental science field trips in particular. Thus, the study was designed to contribute to the understanding of this particular type of destination (outdoor, with multiple habitat types) and topic (environmental science) for field trips.

The participants and field trip setting were chosen to provide insight into a *typical* example of an ES field trip taken by students and their teacher, with the purpose of looking at the ways in which the students learned about science surrounding the field trip (Merriam, 1998; Patton, 2002; Stake, 1995; Yin, 2003). Elementary students were chosen because a high percentage of the field trips at both sites involved elementary students.

Students from an urban school were chosen to contribute to the research literature on students from urban settings and because extra funding for urban students is commonly available for EE field trips. The school, and therefore this particular class, had received funding for the field trip as part of a site initiative to ensure that more students from urban schools would get to participate in field trips.

Refinement of the Research Questions

During the course of the pilot study, I had developed an understanding of particular teachers' reasoning behind their choice to have students participate in an outdoor field trip. During the time that I spent observing multiple field trips, I decided that developing a case study would be the best way to research the students' learning process in the context of the field trip, because it would enable development of in-depth understandings of the nature of the experience for the field trip participants. I decided to include observations of science in the classroom before and after the field trip, in order to be able to observe any connections that were made by the students and their teacher to the field trip science content and/or process. The final research questions were then developed to address the meaning-making process of one particular group of students and their teacher, with the perspectives of each important to the study. The site educator's perspective was included due to the role that she played in the preparation and implementation of the field trip.

The following research questions were used to guide the research process:

- What meanings do students make of the field trip experience and of connections with their school, home and other experiences in outdoor environments?
- What meaning does the teacher make of the field trip experience for herself and her students?
- How does the site educator perceive the students' experiences during the field trip?

Settings

Both the school and the environmental science education site were located in the mid-Atlantic region and the Chesapeake Bay watershed on the east coast of the United States. Elementary students from a small urban area participated in a field trip to a wetland sanctuary along the banks of a tidal freshwater river located about fifteen miles away in the same county. During the field trip, students hiked through meadow, forest and wetland habitats in small groups of nine students led by site staff educators. Science lessons were observed in the classroom setting before and after the field trip.

Participants

Participants in this study were the public school teacher and her fourth grade students and the education staff at the environmental science education center. Pseudonyms for the teachers and students will be used throughout this study.

<u>Teacher and her students</u>. The fourth grade class of eighteen students was selected from the list of classes participating in the fall, 2006 field trips at the site. The students were of lower socio-economic status, with 95% of the students receiving free and reduced lunch at the school. The school was in a small urban area and was in a public school system in Maryland. The student population was primarily African American, with a few Caucasian and Hispanic students. Out of eighteen students in the class, eight students agreed to participate in the study.

The teacher was a Caucasian female (pseudonym for this study, Ms. Nicole Miller) in her second year of teaching elementary students after graduating with an undergraduate degree in teaching from an east coast university. During my observation of Ms. Miller during a field trip to the site in the Fall of 2005 trip, she was energetic, positive and supportive of her students' activities, all characteristics which influenced me to ask her to participate in my study. As we talked briefly after the field trip, she indicated strong interest in taking advantage of the funding provided for her students to attend the field trip.

This particular school had been chosen by the site volunteer association for several years in a row to receive funding to support the field trip for the students. Thus, the field trip during Fall, 2006 was the second time that Ms. Miller had participated with her students on this particular field trip.

<u>Site educator</u>. The lead site educator (pseudonym for this study, Ms. Susan Freeman) was a Caucasian female who had worked as an educator at the site for eleven years. Her training as a naturalist and scientist had begun with her Master's degree in biology which she had expanded through field work and research in environmental science. Prior to working at this site, she had worked as a naturalist/environmental science educator educating elementary students about birds.

Her scientific research focus was on herpetology (the study of reptiles and amphibians) and the ecology of plants. The educator had developed her expertise in field identification of a wide range of herbaceous and woody plants, invertebrates, amphibians, reptiles, fish, and birds to a high level. During the field trips, she used this knowledge base to assist students as they made observations of many different plants and animals. Her depth of knowledge of the unique characteristics of the plants and animals in different habitats at the site was revealed as she told stories of prior observations of the same animals, told histories of the use of plants, shared information about the life cycles of animals, and discussed current research findings.

It was evident that Ms. Freeman had developed an understanding of particular teaching strategies that would be most effective in the outdoors. She indicated that the National Science Teachers Association resources were particularly applicable to development of interesting and effective lessons for students during field trips.

Role of the Researcher

Although I maintained the role of an observer during this research, there was some interaction with the participants during the field trip and classroom observations, as the students became accustomed to having me in their class and due to their inquisitive nature about what I was doing and how my equipment worked. During the study, I experienced occasions during which I was drawn into conversations to answer student questions about the field trip, into general discussions with participants around me, or was briefly involved in helping to support student learning during an activity. These periods were usually of very short duration and were noted in the transcription of data.

Data Sources

Data sources included a) field notes, b) audio and video tapes in the classroom and during the field trip, c) taped teacher and student interviews, d) documents describing the field trip, and e) worksheets used during the field trip.

Field notes. The observations of the field trip and classroom activities were recorded in a semi-structured field note format, with some questions prepared in advance. The field notes included descriptive comments on the left hand side of the page and reflections of the researcher on the right side of the page. Structure was added to the observations of the classroom and the field trip via the following questions:

- What is the science content discussed in the classroom and during the field trip?
- What are the activities experienced in the classroom and during the field trip?
- What is the nature of student interactions with others and with objects found in the classroom and during field trip activities?

Audio and video tapes of classroom instruction and field trip. During the field trip and classroom observations, I remained at the back of the line or room while using my video-camera to record the day's activities. I also made digital audio recordings during the observations to preclude loss of data due to equipment failure. My intention was to be an unobtrusive visitor, but occasionally the students would talk to me while participating in the activities.

Interviews

Teacher and site educator interviews before and after the field trip were designed to identify key factors in their backgrounds, interests and science teaching that might have affected their vision and actions throughout the educational process with the students. Observations of the field trip and classroom science provided the opportunity to observe participant behavior during the activities at each context, and enabled development of more intimate understandings of the settings and actions of participants. Student interviews after the field trip were designed to develop the student perspective, the *emic* or insider's perspective of the experience (Merriam, 1998).

Pre- and post-field trip teacher interviews. The teacher interviews were open-ended in the sense that I endeavored to maintain a freely flowing conversation based on the teacher's thoughts and opinions. I asked the following general questions during the interviews:

Pre-trip:

- Describe your preparations for the field trip.
- How does the field trip fit into the science curriculum, or not?
- How is the field trip different/similar to school/class work in science?
- How will you assess student learning related to the field trip?

Post-trip:

- What did you think of the field trip experience?
- What are the teaching strategies that you work from?

    - I have noticed that you frequently use open-ended questions with the students. Why do you choose this strategy and in what ways do you think it benefits student understanding of science?
- Which subject area do you enjoy the most and are the most knowledgeable in?
    - Do you teach that subject differently than science?

The teacher interviews occurred several weeks before the field trip and after the field trip in the classroom setting, usually after I had observed a science class. They lasted for one to two hours.

Pre- and post field-trip student journals and interviews. Ms. Miller and I had decided that before the field trip, we would ask the students to write a paragraph about "what they would do if they were a scientist" before the field trip. After the field trip, we asked them to write a paragraph about what they liked about the field trip. In addition, I interviewed the students in small groups after the field trip, in the "science" room just down the hall from the classroom.

Because there were only eight students whose parents had agreed to let their children participate in the study, I decided to invite four students to participate in each interview session. For each session I began by thanking the students for their willingness to participate in the research. I then spent a few minutes discussing what we would be doing. I gave them special pencils to write with and to keep as a little thank you present. We talked about what research is.

We then returned to the worksheet questions, with the students answering one question at a time. When all of the students had completed a question, we discussed their answers. There were three questions on the worksheet. The series of questions were designed to enable students to think about the field trip using words, then sentences and finally a paragraph description of their favorite thing about the field trip (see Appendix A). Then I asked the students to make a drawing of their experiences during the field trip collaboratively in groups of two. Before they started drawing we discussed the dynamics of trying to work with somebody else to make a picture to ensure that they would engage in discussions with each other as they made decisions about what to draw.

The particular questions for student interviews were developed with the intention of ensuring that students had the opportunity in different ways to recall and represent their field trip experiences. The design of the worksheet and types of questions was informed by the interview designed by Falk and Storksdieck (2005) for their study of visitors to a science center exhibition. In addition to the worksheets I decided to ask students to collaboratively draw pictures of their field trip experience. This decision was informed by the work of Emily van Zee, and a research study in which participants interacted actively in small groups while drawing representations of their field experiences (Personal communication, August, 2006).

Pre-field trip discussions and post-field trip site educator interviews. Because of my prolonged contact with the site educator and other staff, I did not develop specific interview questions before this particular field trip. I had taped our informal discussions over time for analysis as part of this study. We frequently discussed many aspects of the field trips, including preparations for field trips, problems that frequently came up, and changes made to the program over time.

Immediately after the field trip, I stayed at the site and interviewed all of the educators regarding their thoughts on the day's events.

I also interviewed Ms. Freeman a few months after the field trip do get her perceptions about many different aspects of the field trip that had emerged as I was transcribing the data. The questions that I asked were designed to develop a deeper understanding of her choices during field trips, on content and pedagogy in particular. I also was interested to hear one more time her goals for students during field trips. I asked more about her background as a field naturalist, as her identification skills during the field trip were quite important to students.

Documents. Documents that provided additional sources of information about the field trip and site included copies of the field trip application form filled out by the participating elementary school teacher, brochures describing the site's field trip options, and site descriptions available to the public in the exhibit room. I also took a closer look at the science and social studies textbooks and the county *pacing* guide which guided the scope and sequence of science topics to be covered during the year.

Worksheets. The worksheets that were prepared by the site educator for use during the field trip were handed out to the chaperones on clip boards to be filled out interactively with the students during the field trip. They included pictures of each of the habitats visited, with sections to note animals and plants found by students during the field trip. These worksheets provided a record of what the students had observed throughout the day, but were not collected by the teacher.

Contexts. The data were collected over a four month period with individual perspectives obtained through the interview process. Through the development of thick, rich descriptions and a summary matrix, analysis of connections across time and contexts was facilitated. There were five different contexts in which data were gathered with video and audio tapes and field notes.

1) Site educator interviews (before and after the field trip)

2) Teacher interviews (before and after the field trip)

3) Classroom sessions on science (three before and three after the field trip)

4) The field trip (with segments based on habitats studied)

5) Student interviews (after the field trip)

<u>Analysis and Interpretation of Data</u>

Analysis and interpretation of the data were guided by the research questions (Merriam, 1998; Stake, 1995). The extensive data collected over a four month period enabled development of in-depth descriptions and interpretation of the classroom and the field trip in my examination of the students' meaning-making process.

During the course of interpreting the data from this study, I shifted emphasis from triangulating data from multiple sources toward a process of crystallization (Richardson, 2005). Crystallization provides a new way to look at data, in a quest not for validity, but for value placed on the different perspectives in a study of a particular experience. With crystallization of data, several different perspectives are used to develop interpretations of the data in the study (Miller & Crabtree, 2005; Richardson & St. Pierre, 2005). Thus, the multiple sources of data are important for the purpose of developing multiple *perspectives* on the field trip experience and the meaning-making process of the participants. Richardson proposes that the crystal provides an alternative, multi-faceted way to look at the world:

> I propose that the central imaginary for “validity” for postmodernist texts is not the triangle—a rigid, fixed, two-dimensional object. Rather, the central imaginary is the crystal, which combines symmetry and substance with an infinite variety of shapers, substances, transmutations, multi-dimensionalities, and angles of approach. Crystals grow, change, and are altered, but they are not amorphous. Crystals are prisms that reflect externalities and refract within themselves, creating different colors, patterns, and arrays casting off in different directions. What we see depends on our angle of repose---not triangulation but rather crystallization. (Richardson & St. Pierre, 2005, p. 963)

With this imagery in mind, I chose to develop the perspectives of the students, the classroom teacher, and the site educator, and then to further explore all three perspectives on particular aspects of the field trip process.

Data were gathered via audio and video tapes to facilitate understanding the different ways in which the interactions among the teacher, the students and the science content in both contexts occurred and might affect the student learning process. These interactions were explored in terms of dialogue as described by Burbules and Bruce (2001) as the interactions of the participants with each other and with their environment involving their communication and activities. Burbules and Bruce (2001) suggest that the definition of dialogue in education should be extended to include the contexts, relationships, subject matter and differences among people involved in the process:

> One of our central claims will be that there are forms of dialogue, and that their usefulness in educational settings will depend on the relation among

> forms of communicative interaction and (a) the contexts of such interaction, (b) other activities and relations among participants, (c) the subject matter under discussion, and (d) the varied differences among those participants themselves. (p. 1102)

I have chosen to use this broader definition of dialogue in teaching and learning as a way to approach the interactions among the participants in this study, with each other and within the particular contexts of learning. This approach is supported by recent interest in the language of science and what teachers and students say and write as they make sense of science (Ball, 2000; Gee, 2004; Hammer & van Zee, 2006; Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001). During this study, I anticipated that students would use everyday language in their social interactions and during the interviews as they made sense of science and their field trip experience (Ball, 2000; Gee, 2004; Lemke, 2001; Warren et al., 2001).

In preparation for the interpretation process, I developed a list of categories that were of particular relevance to the research questions. These categories were then used to code the data (See Table 3.1). Table 3.1, outlines the relationship between the source of data and the particular aspect that was chosen to inform the interpretive process.

Table 3.1. Data Sources and Approach to Interpretation

Data Sources	Coding and Approach to Interpretation
Students	
Pre/post-trip classroom observations	Coding of classroom science activities Development of categories in the coding.
Video during field trip	Development of the structure of the field trip; analysis of student participation, interest level; analysis of what students say, what types of questions they ask
Post-trip journals	Coding of the word choice; development of any categories that emerge; analysis of structure of the student drawings
Post-trip interviews	Development of categories from coding of the discussions; analysis of interactivity and content of what the students say; comparison with what they say and what they write; comparison between the pictures that they draw individually and in the small group
Teacher	
Pre/post-trip classroom observations	Analysis of teaching style, and choice of content, teaching strategies used; level of management in the classroom
Video during field trip	Analysis of teacher/student interaction and interest in the field trip
Pre/post-trip interviews	Coding to look for relationships between what the teacher says and how she incorporates subject matter into her class curriculum
Site Educator	
Field trip observations	Analysis of teaching style, choice of content and teaching strategies used; level of management
Interview	Coding of what is said to look for patterns and important points
Site Scientists	
Interface with educational field trips	Analysis of frequency of interaction with field trips and quality of interaction
Relevant Literature	
Site brochures	Overall analysis of language that pertains to the field trip and the school curriculum/relevant content areas
School curriculum	Analysis for environmental science and education location in the curriculum and suggested activities
State science standards	Analysis of the location of environmental science and education in the standards and potential effects

	on the local (classroom) curriculum
National Science Education Standards	Analysis of the location of environmental science and education in the standards and potential effects on the local (classroom) curriculum

<u>Coding</u>. After I transcribed the data, I began to read and re-read it in order to begin the interpretation process. The interpretation process involved making sense of the data, by looking for important features and discerning patterns in the data that were informed by the bounded nature of the study (Denzin & Lincoln, 2005; Stake, 1995). I looked for patterns in the data and proceeded to underline sections of the transcript. I made notes on the emerging patterns in the margins of the documents (Miles & Huberman, 1994; Stake, 1995). I made a list of different actions to look for in the data using Table 3.1 as a guide.

These actions became the primary codes for the participants and contexts of learning and are illustrated in Table 3.2.

Table 3.2. Data Codes Used in Transcripts

Codes for interactions in classroom and during the field trip	**Codes for teacher actions in classroom**	**Codes for student actions in classrooms**	**Codes for sensory inputs at the school and the field trip site**	**Codes for site ed. actions in classroom**
Worksheets	References to prior lessons	Accessing prior knowledge	Visual	Sharing practical information
Textbooks	Use of technical terminology/big words	Interacting with other students	Tactile	Describing animals and plants
Open ended questioning	Response to students	Working quietly	Auditory	Modeling making observations
Close ended questioning	Tone of voice shift	Asking questions	Smell	Behavior management practices
Direct instruction	Advance planning	Reading		
Inquiry	Use of visuals and visual cues	Thinking		
Conversation	Use of text			
Debate	Use of kinesthetic activity			
	Giving directions			
	Open-ended or close-ended questioning strategy			
	Response to student needs			

The coded sections of the transcripts were used to develop the narrative descriptions of the science classes and the field trip and participant perspectives.

Descriptions. Descriptions of the physical nature of the contexts for learning were developed based on auditory, tactile, visual, and physical data from notes taken during the observations and from the transcriptions of audiovisual data for each setting. Transcripts of videotaped classroom sessions and the field trip were reduced by creating narrative versions of what happened in the classroom, field trip and interviews. Rich descriptions of the physical location and action of participants were created in narrative form for each classroom session, each segment of the field trip and for the teacher and student interviews. These descriptions were informed by the data reduction processes described by Crawford (2000). An example of a general *description* of the field trip follows.

> The field trip site was a county park and recreation department property designated as a wetlands sanctuary that includes an education/research center that was open to the public one day per week. The sanctuary was situated in a forested area that is adjacent to the river and wetlands area. During early fall and late spring, field trips are offered to school groups for a fee. The educational programs were attended by students from local states and counties, with both public and private educational institutions participating. Teachers were given the choice to lead their own field trip or to rely on the site educators to design and implement the field trip. Typically, students hiked through different habitat areas, made observations, and participated in different field activities along the way. In the pre-trip survey, teachers were asked for their preference of topics to cover and what the students were currently studying in science. The site

educator then designed the field trip based on the information given by the teacher.

The descriptions begin with attributes of the physical contexts, and then moved into a representation of the interactions among teachers and students and their environments for both the classroom sessions and the field trip (Auerbach & Silverstein, 2003). Sections of the transcript of participant interactions were included in order to both portray the actions and interactions of participants with each other and with the environment and to develop the *emic* voice in the study (Stake, 1995).

The classroom and field trip descriptions were then organized in chronological order (see Appendix B). These narrative descriptions were placed in chronological order to aide in the analysis of patterns in the data across contexts and participants. I also developed summary narratives for each science lesson observation and for the field trip, which are presented in Chapter IV. These summaries were useful in both the crystallization process of the participant perspectives and for the development of the summary matrix.

Summary matrix. A longitudinal matrix was designed to develop a summary interpretation of the interactive nature of the field trip and science classes and is presented in Chapter IV. This method was suggested by Miles and Huberman (1994) as a way to deal with extensive data collected over time. In particular, I wished to be able to look at the characteristics of the locations, the flow of events, and connections between events. I chose the following three categories of data for the matrix display:

1) the sensory quality of the contexts,

2) the nature of the interactions in terms of inquiry, conversation, instruction, and debate, and

3) open or closed quality of questions asked by the teacher and students and references to prior knowledge made by all participants.

The data in these categories were condensed and then displayed in chronological order of observations in the summary matrix.

Overview

A pilot study of field trips to two different environmental science research and education sites provided the opportunity to explore the dynamics surrounding environmental science-related field trips for school groups in general. As a result of interviewing teachers and site educators and exploring pedagogy at both sites during the pilot study, I chose to develop a qualitative research case study at one of the sites, with one particular teacher.

The following research questions were developed over time based on observations and input from other researchers. They were designed to explore the students' educational process related to the field trip from three different perspectives:

- What meanings do students make of the field trip experience and of connections with their school, home and other experiences in outdoor environments?
- What meaning does the teacher make of the field trip experience for herself and her students?
- How does the site educator perceive the students' experiences during the field trip?

At this site, the field trip design was based on a combination of the teachers' requests for particular subject matter, topics easily taught at the site, and the expertise of the site education staff. Thus, each field trip was designed for particular participants. The county's elementary science curriculum indicators were incorporated into the design by the site educators.

I chose to work with an elementary school field trip because there was a higher frequency of visits to this field trip site by elementary schools. The urban school chosen for this study had received extra funding from the site volunteer association for the entire fourth grade to attend two field trips at the site, one in the Fall, 2006 and one during Spring, 2007. This school was in the county from which I had already received approval for my study. I contacted that school, received approval from the principal, and invited one of the fourth grade teachers to participate in my research study. She agreed to participate in the study.

The units of analysis for this study were the science lessons in the classroom and the field trip experience. I began collecting data in the classroom before the Fall field trip, and interviewed the teacher in mid-September before the field trip. During our meeting for the interview, we also scheduled the subsequent observations of science lessons before and after the field trip. We also decided on the student journal questions before and after the field trip. The teacher agreed to distribute the consent letters to her students that week. Because of our experience with consent forms during the pilot study, we both knew that it was not probable that all of the students in the class would consent to participating in the study. Eight students out of eighteen agreed to participate in the study. During the field trip, students in the study walked near the end of the line so that the voices audible in the recordings are from students for whom permission to participate had been granted.

As the analysis and interpretation process evolved, I decided to develop my representation of the unfolding process for students in this study in two different ways. First, I developed a summary matrix of the interactive nature of the longitudinal experiences, following guidelines of Miles and Huberman (1994). Second, I developed the perspectives of the participants with the intention of analysis via crystallization of data, which was inspired by Richardson (Richardson & St. Pierre, 2005).

Chapter IV begins with the narrative summarizations of the science lessons and field trip. These descriptions are followed by the summary matrix. I included the narrative summaries to provide some level of detail from which the summary matrix was developed. The summary matrix is an interpretation of the interactive nature of the field trip in terms of Deweyan characteristics of an educative experience.

CHAPTER IV: SUMMARY DESCRIPTIONS AND MATRIX

Science Teaching and Learning in Two Contexts

I begin this chapter with a description of the classroom context, which is followed by summary descriptions of each of the science lessons that I observed before and after the field trip. The observation just before the field trip was a pre-trip discussion led by site educators who had visited the school to orient the students to the activities of the field trip. The classroom descriptions are intended as summaries of the teaching and learning that occurred during each science lesson, and are presented here in chronological order separate from the field trip.

In the next section, I describe the context of the educational field trip. That description is followed by brief summary descriptions of the science teaching and learning that occurred during each segment of the field trip. Each segment of the field trip involved a different type of habitat, so descriptions of each habitat are included.

The final section of this chapter is a discussion of the matrix (see Appendix C) in which key characteristics of both science lessons in the classroom and the field trip are presented in terms of the Deweyan characteristics of an educative experience selected for interpretation of data in this study. The matrix is designed to be a longitudinal representation of the series of experiences to enable development of a different perspective.

Thick, rich narrative interpretations of both the science lessons and the field trip can be found in Appendix B. These are arranged in chronological order to better represent the over-arching experience of the participants. These detailed narratives present and interpret the data that support the claims summarized here. They also include sections of the transcript important to development of the voice of the participants as described in the next chapter, Chapter Five.

Classroom Context

All of the classroom science lesson observations occurred in the fourth grade classroom at the urban elementary school. The classroom was large enough for desks for eighteen students and additional worktables and chairs. An overhead projector and screen with maps behind it were located in front of the blackboard at the front of the room. The wall spaces on the side and back of the room contained pre-fabricated spelling and writing prompts for students. A word wall in the back of the room remained devoted to math words for the entire year, with the list changing over time to include more and more complex math terminology. Occasionally the students' work was displayed on the wall next to the windows during the three month period of this study.

Because the field trip occurred in early October, the initial observations in the classroom happened not long after the start of the school year, in September, 2006. The observation schedule was arranged during the initial teacher interview and was based on the pre-determined days designated for science lessons. Science and social studies alternated every six weeks and were scheduled right after lunch on Wednesdays for thirty minutes. The school and county requirements for time devoted to language arts, reading and math content areas because of the federal No Child Left Behind (NCLB) mandate left very little time for science and social studies.

During the science lessons that I observed before and after the field trip, Ms. Miller used a variety of teaching strategies, struggled with off-task student behaviors during class, and was very responsive to student interactions on the lesson and otherwise.

The students were typically very active and moved around the room, talked with each other, and sometimes argued openly during class time. As a result, the teacher spent a significant amount of time reviewing rules and expectations for behavior. She also used a more stern "teacher" tone of voice that contrasted sharply with a more engaging tone when she began to teach.

Classroom observation one. During the first class period that I observed, students were exploring a map of the region with guidance from Ms. Miller. The subject was social science, with a focus on the state of Maryland, its surrounding states and regional geographical attributes. Students were asked to locate the states that surround Maryland on the map. This exploration was followed by a text-based discussion of different land formations such as mountains, plains, and plateaus.

Classroom observation two. During the second classroom observation, Ms. Miller asked the students to share their own questions and thoughts about the solar system. As she went around the room and called on each student, Ms. Miller responded to everything that the students had to say. When possible, she answered questions, and/or referred students to the science textbook. This session was very interactive, and students were excited to share their thoughts with each other. At the end of the lesson, Ms. Miller asked three students to portray the movements of the earth around the sun and the moon around the earth.

Classroom observation three. The third classroom observation occurred the week before the field trip, during a presentation by Ms. Freeman and other site educators. This pre-trip visit lasted for a half hour and was an introduction to the field trip. Ms. Freeman described the field trip, the items that students should bring and not bring, what they would be doing during the field trip, and plants and animals that they might see. Ms. Freeman interacted with the students in an instructional style, with frequent interjections of thought-provoking questions. Ms. Freeman had brought in several salamanders and walked around the room while inviting the students to look at the salamanders closely. The session ended abruptly as the students had an assembly to attend.

Classroom observation four. The fourth classroom observation involved a lesson on microscopes. Ms. Miller discussed the parts of a microscope as students labeled the parts on a diagram on a worksheet. The students were learning the names and functions of the parts of a microscope in preparation to using them the following week. The class work was interrupted by Ms. Miller's need to work individually with a non-responsive student. While she worked with the student to figure out what was going on for him, she very fluidly redirected the other students to complete the worksheet independently. In a few minutes, she contacted the principal's office for assistance. Students quietly worked to fill out the worksheet while the situation was addressed in the classroom. Ms. Miller kept to her predetermined time of thirty minutes for science and moved on to math as scheduled.

Classroom observation five. During the fifth science class, Ms. Miller had developed an activity in which students were to place words in one of two columns on the board. She had designed the exercise with a mystery component. The columns were not labeled, but one column had *human* in it and the other had *pencil* in it. Ms. Miller asked her students to state their reasoning for putting their own word into one of the columns, and then hypothesize what they thought the real groups of words should be. The students interacted thoughtfully with each other and the teacher as they expressed their own ideas about the word lists on the board.

Ms. Miller provided ongoing encouragement as the students attempted to make sense of the word lists. One student finally stated her reason for what should be in the columns, accurately identifying that one list was for nonliving and the other for living things.

Ms. Miller then extended the learning process with some additional activities that provided opportunities for students to explore the concept of living and nonliving things for the entire week. During the interview on December 6th, she indicated that the entire week's work had been very successful. She described how student understanding of the difference between living and nonliving things had developed due to this series of activities.

Classroom observation six. The sixth science lesson began with a review of the parts and functions of cells that was extended into student development of an analogy. Ms. Miller asked the students to draw analogies between the parts and functions of a cell and the different parts and functions of their school and staff. Students were very engaged in the discussions as they built the analogy. Afterwards Ms. Miller indicated that she had decided to use this strategy to make sure that students would be engaged during the lesson and hoped that it would help them develop an understanding of cell parts and functions.

Field Trip Overview

In this overview section of the observations of the field trip, I present a narrative summary description of the field trip itself, starting with a description of the context. I then present brief descriptions of each habitat area and the activities during the field trip.

Field Trip Context

The field trip site was a county park and recreation department property designated as a wetlands sanctuary that included an education/research center open to the public one day per week. The sanctuary was situated in a forested area that was adjacent to the river and wetlands area. During early fall and late spring, field trips were offered to school groups for a fee. The educational programs were attended by students from local states and counties, with both public and private educational institutions participating. Teachers were given the choice to lead their own field trip or to rely on Ms. Freeman to design and implement the field trip. Typically, students hiked through different habitat areas, made observations, and did field activities along the way. In the pre-trip survey, teachers were asked their preference for topics to cover and what the students were currently studying in science. Ms. Freeman then designed the field trip based on the information given by Ms. Miller.

Ecological and environmental science research projects were frequently organized by outside university researchers and by on-site staff. Data for these research projects were frequently gathered by volunteers under the direction of the site director and education director. There was a relatively small laboratory room adjacent to the education exhibit and meeting rooms. This room housed the equipment available for the research. It also was the area where animals were kept short-term while data were taken. Scientists and volunteers sometimes discussed their work with education program participants, with fairly frequent informal discussions occurring during *chance* encounters in the field. The lead educator at the site was a naturalist with extensive experience leading groups in informal environmental science and education settings for over twenty years in different capacities.

For the outdoor environments, variations in plant sizes and shapes, how far one could see, proximity to water, etc. of each habitat area affected the visual quality of the experience. Encounters with animals also varied based on plants, soil, and water combinations in each of the habitats. More detailed descriptions of the different habitats as a context for learning are located in the following field trip segment descriptions.

Descriptions of the Field Trip Segments and Habitats

The following descriptions are summaries of the field trip activities. More detailed descriptions can be found in Appendix B, which also includes sections of the transcript to portray interactions among participants.

This particular field trip was designed as a hike through different habitats. It began with an opening circle discussion inside the education center and closed with a visit inside the educational exhibit area. The students explored several different habitats outside, including the grassy lawn in the vicinity of the education center, the meadow area, the forest, and the tidal freshwater wetland adjacent to the river. Throughout the hike, Ms. Freeman asked the students to look for plants and animals, to make observations and ask questions about everything they found, and to work cooperatively using different simple tools such as magnifying glasses, egg carton organizers, and spoons for digging up soil.

Site staff had prepared to work with the students for approximately three and a half hours, from an arrival time of 9:30 am until their departure at 1:00 pm. Lunches brought by the students were to be eaten around noon. However, the length of this particular field trip was shortened due to the need to return the bus to the school. Upon their arrival, Ms. Miller indicated that because the bus needed to return to the school the students would not be able eat lunch on-site.

Fourteen students (four students from the class did not attend the field trip) from Ms. Miller's class were divided into two groups of eight male students and six females, a decision that was made by Ms. Miller at the last minute. She indicated to me that she was more concerned about the boys' behavior during the field trip, and so decided to have all of the boys in the group that she was chaperoning. At the time, I knew that it might affect my study, but felt that it was okay to continue with the teacher's decision to split the students into groups by gender. The lead educator, Ms. Miller, and a chaperone (her brother) and I participated in the field trip with the all-male student group. An assistant site educator (pseudonym, Ms.Diane) led the female group. Additional adult supervision was provided by a reading teacher from the school and a volunteer site educator. Because the field trip was designed for all groups to participate in similar activities, I was confident that the experiences of the female students would be similar to those experienced by the male students in our group.

Opening segment. The opening segment of the field trip occurred inside the education center, in the meeting room area. The building was around fifty years old, with an extensive porch overhang and several exterior doors. The meeting hall was carpeted and had a large stone fireplace prominent in the room. Bathrooms were located at one end of the hall. The room had a high cathedral ceiling. Stuffed animals, birds and mammals were displayed up and down the walls of the meeting room. Both the exhibit room and the laboratory room were adjacent to the meeting room. The open ceiling enabled sounds from all the areas to be heard as people worked and visited the site.

The students were asked to be seated on the floor in a circle. After welcoming everyone to the site, Ms. Freeman led an interactive discussion starting with an overview of the field trip. She described where the group would be going and asked the students if they remembered some of the site "rules" for behavior that she had discussed with them during the pre-trip orientation visit at their school. The students were very responsive and remembered that they should not use words, like *eeuwh* and *yuck* in reacting to plants and animals, and that they should leave everything at the site and be careful not to touch poison ivy. After the discussion, the students were divided into the two groups, and they proceeded to the first habitat to be explored.

Lawn adjacent to the education center. This area was frequently used as an alternate meeting and greeting area for field trip participants. It included a large grassy area, a mulched area with picnic tables, and a display board about archaeological artifacts and history of the site. The area was surrounded by paths to other areas of the property, trees and the entrance to the parking area. Submerged aquatic vegetation tanks, a storage shed for boating supplies, and recently built fenced in areas to protect injured animals were located behind the building.

After the students gathered into their small group and formed a circle on the lawn outside the education center, Ms. Freeman distributed the first set of "tools" to be used by students as they explored the environment around them. The students were given magnifying glasses on strings. The chaperones were asked to record descriptions of what was found on worksheets on clipboards. Cricket, bird, and airplane sounds dominated this section of the field trip as students began to examine the grass and soil for small creatures. At first they remained close to each other, but as their comfort level increased, they moved further apart. As they found bugs, crickets, water drops, and beetles, they showed them to Ms. Freeman. She enthusiastically responded with questions, comments, and information about the findings.

Meadow area. The meadow area was adjacent to the parking lot and was surrounded on three sides by the forest area. It was periodically mowed, and a grassy strip along the edges was maintained. The meadow vegetation included tall grasses and native plants, native cacti, patches of sumac trees, and other small shrubs. Most visitors to the area walked on the grassy areas, but the field trip hikers were invited to explore the meadow vegetation by walking into it.

During this segment of the field trip, the students were given a small magnifying box as an additional tool for exploring small animals. Ms. Freeman gave explicit instructions for catching the animals without injuring them. The students found spiders, crickets, beetles, toads, hickory nuts, dragonflies, grasshoppers, sumac trees, goldenrod, mushrooms, and a cactus.

At one corner of the meadow area, Ms. Freeman gave the students another tool to assist in their exploration of soil. For this activity, they used a spoon to dig up soil samples. They were asked to describe the soil to Ms. Miller and the chaperone who took notes on these words. They used their senses to describe how the soil felt (cool, smooth, and bumpy) and what it looked like (light, dark, brown, and black).

This section of the field trip ended with a lengthy discussion about hickory trees, which was followed by a discussion about why trees lose their leaves. All of the equipment was collected and the group moved off to enter the forested area.

Forest. The property included an area of land at a higher elevation, called the *upland area*, where secondary growth forests were located. The forest consisted of species that had re-grown after the land had been cleared for farming about one hundred years ago. These forested areas provided excellent habitat for different invertebrates, fish, amphibians, reptiles, and birds (Burke & Swarth, 1997; Freibele, Swarth & Stafford, 2001).

As the students entered the forest, Ms. Freeman distributed egg cartons and directed students to make a collection of interesting things that they found on the forest floor, not including animals and leaves still connected to trees. As a result of this direction, the students found some interesting things such as an insect gall on a twig, seeds, leaves from different trees, acorns, a gum ball from a sweet gum tree, and more. Along the walk into the forest they spotted a mushroom, were shown where marbled salamanders live, and heard a woodpecker call, which Ms. Freeman mentioned was different than the sound of a woodpecker pecking on a tree.

The students walked across the meadow area and found additional creatures of interest such as ladybugs, lizards (which were identified as "six-lined race runners") by Ms. Freeman, crickets, and spiders on their way to the wetland.

Wetland. The wetland area was an extensive watery habitat that floods periodically during the day due to tides from the Bay. The panoramic view from a deck built on the upland area was dominated by water and wetland plants of different varieties throughout the floodplain. From this vantage point, birds of varying sizes and colors could be seen darting in and out of the habitats or soaring above the water, in the case of the larger birds. Both plants and animals varied seasonally, with an expanse of green plants during the late spring and summer and an expanse of brown, dying plants during late fall and winter. These colors dominated the walk on the boardwalk at water level. During the fall boardwalk, cattails were at their full height in one section of the walk and many vibrantly colored green tree frogs (about one inch long) were frequently found.

The students first saw the wetland from the deck, which was about 100 feet above the water. As the students walked onto the deck they made many observations of spiders, a large tree trunk with a big cavity near the deck entrance, and then were surprised to see the expanse of water and wetland plants extending to the horizon in several directions. Some of the students were a little unsure as they stepped onto the deck and needed reassurance that they would be okay. They spent some time observing the water and birds flying above it. As they entered the wetland area and the boardwalk, they sighted brown-colored frogs that Ms. Freeman identified as green frogs. This sighting was only the beginning of many discussions about plants and animals along the boardwalk. The students walked in single file behind Ms. Freeman. The vegetation along the boardwalk changed from trees to submerged aquatic vegetation with large leaves, to cattails as we approached the end of the boardwalk.

Ms. Freeman reminded the groups to add animal and plant sightings to their graphic organizer depiction of the wetland area. Two students at the end of the line had found a rat snake, and then two queen snakes all curled up on trees. A beaver house and otter tracks were also spotted along the way. Tiny green tree frogs were very abundant toward the end of the boardwalk, and Ms. Freeman told students to wet their hands or fingers before touching them. The students were able to take some time to look closely at the tree frogs and the vegetation which lined the end of the boardwalk.

Outdoor cages, tanks and the exhibit area. The field trip was not over at the end of the boardwalk. The group climbed back to the upland area through the forest and then visited an outdoor cage for injured animals. After finding a turtle in the cage, they moved on to explore the Submerged Aquatic Vegetation (SAV) tanks. They used scoop nets and found more frogs, toads, dragonflies, tadpoles, lady bugs, water striders, and algae in the tanks of water.

The field trip ended with a tour of the exhibit area. This area had a wealth of informational posters, computer programs, hands-on displays about plants, soil and animals, and aquarium tanks. The area was designed to supplement the field trips or for use by other visitors to the site. A large colorful mural on one of the walls depicted a wetland area with plants and animals found in marshes, swamps, and wetlands. Aquarium tanks holding fish and amphibians were surrounded by descriptive posters and signs. The displays varied from interactive signs to computers with series of pictorial programs, to a table of shells and fur pieces. An entire section focused on soil quality and its relationship to water quality. Wetland plants were described with laminated description cards, a plant adaptation booklet, a book about native plants of the count, etc. The displays were designed at different levels of reading/comprehension/interest with a variety of different kinesthetic and visually stimulating approaches.

As our group waited for the arrival of the other half of the class, the students had enough time to look closely at multiple informational displays in the exhibit room. Ms.

Freeman pointed out the black rat snake on the poster just as the girls in the other group came into the room. The student who had found the snakes in our group immediately asked the girls if they had found any snakes. They had not found snakes, but excitedly reported finding a small salamander under a log in the forest.

I developed the narrative summary descriptions of each science lesson and the field trip to reduce the data. This reduction in volume of data enabled me to begin to develop an understanding of important aspects of the science teaching and learning in both classroom and field trip contexts.

In the next section I present data that has been reduced in a matrix format. I developed the longitudinal matrix with the idea of identifying broad patterns across contexts and activities over time. The entire matrix is presented in Appendix C.

Summary Matrix of the Interactive Nature of the Experiences

In order to distill important aspects of the field trip, I decided to develop a matrix of data focused on the interactive nature of the experience of the series of learning experiences in this study. I intended for the matrix to enable identification of broad patterns across contexts and activities over time, with a focus on the interactive nature of an educative experience using the characteristics chosen from Dewey's writings.

As suggested by Miles and Huberman (1994) a summative matrix of data (see Appendix C) is one way to display sequential data which enables a simultaneous view of the condensed data. For this matrix, the science lessons and field trip dates are listed across the top in chronological order, and the criteria displayed in the rows of the matrix are all related to the interactive nature of the educative process in both contexts. The four categories of analysis were:

1) Physical descriptions of the setting and participant actions
2) Sensory quality of the contexts in terms of discernable sensory inputs
3) Nature of the teaching and learning interactions and their conversational characteristics
4) Elements of construction of knowledge

The four categories in the matrix were chosen to enable development of a summary view of the interactive nature of each class and field trip observation. A description of each category follows, and includes the rationale for each choice. The matrix was not designed to be all inclusive of all of the Deweyan characteristics of educative experiences, but rather was created to focus on the interactive elements of the field trip and classroom experiences.

The physical descriptions were developed due to the importance of the attributes of the context to the overall experience in both the classroom and the outdoors. Differences in context affect the interactions that are possible in important ways due to quantity and quality of materials available.

The sensory quality of each of the contexts for learning are displayed in terms of visual, auditory, and tactile characteristics. This is an attempt to capture the interactions in a multi-sensory way, as suggested by Denzin (1995), to include more than just the visual and auditory aspects of the experiences. These sensory inputs also were chosen to speak to Dewey's idea of "undergoing" an experience in which the world acts on the person. (Wong et al., 2001).

The nature of the teaching and learning interactions that occurred in both the classroom and the field trip are described in terms of dialogical engagement characterized by Burbules and Bruce (2001). In their analysis of pedagogical communications, Burbules and Bruce (2001) propose that there is a range of patterns of verbal interaction between teachers and students, rather than just one form of communication. They suggest that teaching can involve different forms of dialogue, involving inquiry, conversation, instruction, or debate. Burbules and Bruce (2001) characterize “Inquiry” as the co-investigation of a problem, “Conversation” as a more open-ended discussion, “Instruction” as the process by which a teacher works with students leading to particular understandings, and “Debate” as an interaction involving for and against positions.

The construction of knowledge for students and teachers section combined analysis of the quality of questions in terms of being open or closed and participant references to prior knowledge of a topic as indicators of construction of knowledge. The choice to analyze questions based on open or closed quality was made to assist in determination of the quality of the teaching during the instruction, with open-ended questions more likely to stimulate discussion and close-ended questions used to determine if students know the correct answer (Chin, 2007; Cox-Peterson, Marsh, Kisiel & Melber, 2003). The frequency and quality of student and teacher references to prior knowledge and prior experiences were part of this analysis due to their importance in the process of learning based on constructivist theories of learning (Pugh & Bergin, 2005).

Interpretation of the Matrix

In the following section, I compare and contrast the educative elements of both the classroom and field trip contexts of learning. Because the two contexts of learning were so different, the comparison revealed an overview of the different ways in which the field trip affected participants’ experiences.

<u>Physical descriptions of the classroom and field trip contexts of learning</u>. The classroom setup changed over time, with student desks moved into different configurations. All of the classroom observations involved discussions with the teacher and limited student movement during the lesson time period. Each class session had a different visual focus, varying from an overhead projector screen to a post-it chart or worksheets and the textbook.

This contrasted with student movements throughout the field trip when students hiked or walked through a progression of habitats and different environments. The field trip design incorporated a pre-trip orientation session in the classroom the week before the field trip. It included elements of orientation to the physical environment and to the study of the natural environment at the outdoor education center. The site educator assisted students in making observations throughout the hike. Her discussion points were designed to include elements of general observations and then identification of the plants and animals.

A significant difference between the two contexts was the indoor static quality of the classroom and outdoor dynamic, colorful, and open-air nature of the experience during the field trip. The contrast between the two contexts created different opportunities for learning experiences, visual, and auditory inputs and *hands-on* opportunities for learning.

<u>Sensory quality of the experience.</u> The sensory quality of the classroom was dominated by voices: student questions and answers, teacher tone changes based on teaching or managing students, and student background chatter all punctuated by periodic loud speaker announcements and the buzzing of the electric pencil sharpener.

During the field trip, there was a wider range of sources of sound and visual and tactile stimuli including the sounds of birds and insects and visual colors and textures of forests, meadows, and wetlands. Tactile stimuli varied from different tools to leaves, grass, soil and water, and various animals. Students were in direct contact with small insects and amphibians, and made observations of other animals such as birds, reptiles, and turtles. Sounds of the students' excitement during activities and the site educator's voice were periodically interrupted by bird calls, insects buzzing and whirring, and the sound of an airplane overhead.

Nature of the teaching and learning interactions. The classroom teacher, Ms. Miller, was very responsive to different circumstances in the classroom and showed creativity in her use of dialogical strategies with her students to ensure their engagement in the lesson. She usually worked with the whole class using direct instructional strategies, with teacher initiated questions. Her lessons were sometimes a co-investigation of a problem, based on a question of her choice.

The field trip interactions were also mostly direct instruction, but were also conversational in style. In the process of investigating the environment, the students asked many questions. They freely engaged in the learning activities during the field trip, which was noted by the site educators.

Elements of construction of knowledge for students and teachers. During both the classroom science sessions and the field trip, questions asked by the educators were most often close-ended. Both educators periodically asked open-ended questions to stimulate student interest in the subject and their thought process.

Ms. Miller was careful to support student thinking with positive feedback that would encourage them to continue to participate in the discussion. The two best examples of Ms. Miller's openness to student questions and comments occurred during the solar system lesson on September 27th and during the class session on living and non-living things that occurred on October 31st. During the solar system session, the students' comments guided the entire class session. During the class session on living and non-living things, the teacher worked with the students using an inquiry strategy, creating a situation in which there was some freedom as they worked towards developing an understanding of living and non-living things.

There were several class sessions with infrequent or no references to prior knowledge by the students. However, throughout the field trip, students made references to prior knowledge as they made comments or answered questions. One such reference occurred when a student immediately called a large spider a "tarantula". During the interview, one of the students drawing the snake picture in detail wanted to add a pink color, and referenced a coral snake.

Reflection on Development of the Summary Matrix

The development of the matrix enabled me to see the relationship between the nature of the interactions in both contexts over time more clearly. The reduction of the data involved making generalizations about each of the four categories of data that were then compared between the two contexts of learning. These comparisons contributed to my understanding of the interactive elements of each experience within the over-arching learning experience. However, the voice of the participant or *emic* perspective on the experience is not fully represented. This matrix is based on the *etic* perspective, and my observations and representation of the science lessons and the field trip. In Chapter V, I develop the student, teacher, and site educator perspectives on the student learning process related to the field trip.

CHAPTER V: PERSPECTIVES ON THE MEANING OF THE EXPERIENCE

Overview

The three main research questions that guided this study created a focus on the students' meaning-making process during their experiences related to the outdoor field trip experience. Each question developed one of three perspectives: that of the students, the classroom teacher or the site educator. By perspective, I mean the participant's point of view as can be inferred through the evidence of what the participant did, said, wrote, and/or drew.

There are three sections in this chapter, one for each of the three perspectives. In each of these sections, I develop theperspective by first describing the actions taken by each of the participants in the classroom and during the field trip. I provide excerpts from the transcripts to support this development of the perspective. Sections of the participant interviews are included to incorporate the participant voice in each perspective. Each section is then discussed in terms of Dewey's attributes of educative experiences.

The Students' Perspective

This interpretive section focuses on the research question: What meanings do students make of the field trip and of connections among the field trip experiences and their school, home and other experiences in outdoor environments?

Discussion of the students' meaning-making process begins with descriptions of the site educator's visit to their classroom and student actions during the field trip. I first describe the activities during the field trip and then develop my interpretation of the student meaning-making process by incorporating data from the student interviews. These descriptions of student actions before and during the field trip provide the foundation for development of an understanding of the student meaning-making process through the active elements and the passive elements of the field trip experience. During the field trip and the interviews, I also developed questions that probed the different ways in which students made connections to their prior experiences and knowledge. The interview questions were designed to explore student remembrances from the field trip and their understanding of the field trip experience in their own words.

The data were interpreted in terms of four Deweyan characteristics of educative experiences: the active and passive elements of the experiences, continuity within the field trip and across contexts, the interactive nature of the experiences, and any subject matter connections that were made by the students or educators involved in this study.

Site Educators' Visit to the Classroom

A week before the field trip, site education staff members came to the classroom and facilitated a thirty minute introductory discussion about the field trip with the students. The lead site educator (Ms. Freeman) began with a description of what students would do on the field trip, rules for the day, what to wear and to bring, lunchtime procedures and what could be found at the site's website.

Students were introduced to the leaders of the field trip, and to some of the natural characteristics of the site. In addition, students were able to take a close look at two marbled salamanders that had been caught the night before.

Ms. Freeman shared with the students that she had been involved in a *special* activity the night before. She described staying out until midnight watching and collecting marbled salamanders that were moving around on the forest floor during a rainstorm.

ED: Something special happened last night. Some people are always disappointed when it rains. I actually was at the site last night until almost midnight.

Student (ST): Whoa!

ED: Last night, what was happening was that we had some nocturnal animals. Do you know what nocturnal means?

ST: Nocturnal means it is an animal that is awake at night and asleep during the day.

ED: Exactly! And it only comes out if it rains at night and they were coming out because it is time for them to lay eggs… and so inside this box…..I have two of them and one is a boy and one is a girl and stay where you are and I will come around.

ED: This animal has wet slimy skin. The toes do not have claws. And when it is time for it to lay the eggs, they will be laid in water and they will be like jelly. This animal is a salamander, so who guessed salamander?

ST: Do you know which one is a boy and which one is a girl?

ED: That is a fabulous question: Which one is a boy and which one is a girl? Where do you think this one was found, based on what is in the container? In the wetland or in the forest?

ST: The forest?

ED: Well, it was a trick question. It was found in a forest that has wetlands. Now I am going to pass it around and you decide which one is a boy and which one is a girl.

ST: It is that one. It is pregnant (students talking loudly). That one is pregnant.

As the site educator talked about the salamanders, she described their habitat and characteristics. She introduced science vocabulary words that were later used throughout the field trip, such as “nocturnal” and “camouflage”. For example, when one student asked about animals that are hard to see she responded using the word camouflage.

ED: Does anyone have another question?

ST: If you couldn’t see it and you stepped on it…..

ED: Most of our animals are well camouflaged. You have to watch where you walk.

This was the first of many times that camouflage was mentioned in relationship to finding animals.

Overall the pre-trip orientation provided students with an experience that was designed to reduce the “novelty” effect (Falk & Balling, 1982) inherent in their visit to the educational site the following week. Student responses and questions during this visit showed their willingness to engage in dialogue with the site educator and their natural curiosity about the site and the animals. Several students indicated an interest in her suggestion to check out the website in advance to explore information about the site further.

Student Activity During the Field Trip

The students' enthusiastic involvement and high levels of engagement during the field trip were important active elements of the field trip. The students exhibited their interest and enthusiasm throughout the field trip via exclamations when they found things and frequent questions about their surroundings. Passive elements of the field trip were exhibited when they were very quiet. Sometimes this occurred when they were unsure of what to say in response to questions and other times they were quiet when they were just observing their surroundings. Student activities during the field trip are presented below.

Asking questions. During the opening segment of the field trip, the students were engaged during the opening circle discussion and interacted freely with the site educators. They answered questions that were based on the pre-trip orientation and remembered a lot of the information shared with them at that time.

During the opening discussion, they asked many questions, for example: What if a mosquito bites you? What is self defense? How do you find snakes? Do they bite? What kind of birds? Is there a banana snake? Some students noticed the stuffed animals around the room as they looked around, and wondered how they had died. At the end of the circle discussion, students were divided into two groups.

Using magnifiers and finding bugs. During the next segment of the field trip, the students were attentive and listened carefully to the instructions about using magnifying glasses to look at things in the grass. After the magnifiers were distributed to the students, they just bent over as instructed. At first, they stayed close together looking in the grass for insects. As they seemed to become more comfortable, they spread out through a larger area. The adults all supported student engagement by assisting with use of the magnifiers. The educators and chaperones supported student efforts with positive comments about the animals and plants that were found by students. This contributed to the creation of a positive learning environment throughout the field trip. In the following excerpt, student excitement at finding things is evident.

> ST: Ooh! I found a bug….
>
> ED: Awesome…What kind of a bug is that?
>
> (Student voices) I see a little one…(students are all bent over and looking at the grass)
>
> ST: I found a cricket!
>
> ED: Look at it and pass it around. This is a caterpillar.
>
> ST: I found a beetle!!…real loud….

Students found many different insects and identified them based on their prior knowledge of crickets, beetles, etc. They were encouraged by Ms. Freeman to find more.

Imitating bird sounds. Throughout the field trip, bird, insect and airplane sounds contributed to aural aspects of the overall experience. Sounds heard throughout the day were not always discussed, but in the meadow habitat, Ms. Freeman mentioned that the bird making the sound must be well camouflaged. One student then imitated the loud bird call.

> ED: I see it all the way over there (loud bird call several times). It is well camouflaged, isn't it? (More bird sounds. A student imitates the bird sound.)
>
> ST: (Student makes a sound: rrrrrr rrrrrrr) I can imitate a bird call.
>
> ED: And hear this one. It is saying teakettle teakettle teakettle teakettle….

Several additions to the continuity of the field trip occurred here in that Ms. Freeman noticed and recognized the sound of a bird call. She then mentioned that the bird was well camouflaged, meaning that it was not visible. The student's imitation of the bird call was followed by Ms. Freeman's example of using words to imitate the particular sounds of the bird call.

Finding a camouflaged frog. The students had not moved very far from the education center and were still engaged with finding things. They had found so many animals and plants that it took them awhile to move toward the meadow. As they did so, they were becoming comfortable with looking for and finding animals and plants using their sense of sight.

The students were very excited about finding a green tree frog in the vicinity of the education center. In this excerpt, Ms. Miller accessed her prior knowledge of green tree frogs, and identified the frog. This identification was then confirmed by Ms. Freeman.

ST: Oh, there's a frog! There's a frog!

ST: There's a frog..

TE: Ohhh! It's a tree frog.

ST: And a spider.

ED: You know what? Please give me "five". I have my camera and if you could remind me to take pictures of things. Because otherwise I will forget…Where did it go?

ST: It is a tree frog. (Echoes the teacher's prior assertion.)

ED: This is called a green tree frog.

ST: (talking together…) We can touch it?

ED: Actually we are not going to catch this one. I will let you know that we will probably see more of them later on today. I'll give you an opportunity later. (Students are talking loudly on top of each other)….Come on let's go.. (Everyone is bending over and looking at the frog. The students move away to another area quickly, leaving Ms. Freeman behind. Students are talking in distance. Everyone moves to the next area.)

ST: Oh look!! Another tree frog!

ED: Look at how well camouflaged it is!

These frogs were well camouflaged, so the students really had to pay attention to find them. Ms. Freeman made sure to let the students know that they would have more opportunities to touch similar frogs later in the field trip and thus adding some anticipation to the field trip. She also asked students to give her "five", enabling the group to interact in a circle.

Looking at daddy-long-legs and spiders. Right after the frog sightings, Ms. Freeman found a daddy- long-legs, and students came running to see it.

ED: This is a daddy-long-legs.

ST: (real loud) A daddy-long-legs (running over to the group).

ED: Yep! a daddy-long-legs.

ST: I saw a daddy-long-legs before. (The student looks at something.)

ST:….A spider.

ST: There goes a big spider…and I see a snake hole.

The students found many daddy-long-legs during the field trip and examined them closely. One student accessed his prior knowledge of daddy-long-legs. Another student found a hole and proposed that it was a snake hole, also accessing his prior knowledge of the outdoors.

The student found many insects and examined them in the small magnification boxes that Ms. Freeman had distributed. After one student caught a large spider, everyone came over to take a look at it. Ms. Freeman took a picture of the student with his spider.

ST: Look at that big spider….

ST: That is a tarantula! (Everyone is talking.)

ST: Where's the spider?

ED: It won't bite you. Put your cap on top of it. Just trap it with your container.

ST: We got the spiders.

ST: That is a big spider.

TE: I want to see that.

CH: Look through the magnifying glass on top. (Students are wandering around and looking for more insects in the pathway between the forest and the meadow. It is a grassy area, and they wander around in it.)

ED: Do you want a picture of you and your wolf spider?

ST: Cool! (Students talking on top of each other)…Let me see…Wow! You caught this?

One student called the spider a "tarantula", accessing his prior knowledge of spiders. Ms. Freeman made sure to reinforce the importance of student findings by taking pictures that would create memories of the field trip. She also identified the spider as a "wolf" spider for the students.

Finding and describing animals. All of the students worked really hard to find insects to put in their magnifying boxes. Ms. Freeman had indicated early in the field trip that students should describe what they found and not try to name things right away. She was careful to model making observations about the size, color and shape of "something" in the following excerpt.

ST: I don't know what it is.

ST: What is this? (to Ms. Freeman)

ED: Oh, awesome! It is an awesome bug or something. Look at how really fat it is, and really muscular…

A few minutes later, the students also found an interesting spider and described it as a "small, little" spider, illustrating attention to Ms. Freeman's descriptive observations of insects. An interesting-looking mushroom was then described by Ms. Freeman with technical terms.

ST: Oh, a small, little spider.

ST: Got it.

ED: Oh, you found a puffball. Those are spores.

ST: Look! A mushroom!

ST: There is a mushroom.

ED: Those are the spores…You can puff it out and spread some new mushrooms…It looks like it would be fuzzy.

ST: That is cool!

This is one example of many in which Ms. Freeman expanded on the initial descriptions with interesting information about the life cycles and habits of the plants and animals found in each habitat.

Exploring meadow soil. At the edge of the forest, Ms. Freeman distributed spoons for students use as they explored the characteristics of forest soil. Students were asked to make observations and come up with four descriptive words for the soil. Ms. Freeman suggested that they should talk about how it felt and what it smelled like. At one point in the exploration, one student noticed something that was green and wondered what that might be. Another student proposed that it might be moss, another example of accessing prior knowledge.

> TE: What does it feel like? Use some words to describe it. You have to touch it.
>
> ED: When it is your turn to come up with some words, you can…
>
> TE: What does it feel like?
>
> ST: This one is soft.
>
> ED: That one is soft? What if you rub it between your fingers, do you feel anything else? Any other words you can use to describe it?
>
> ST: Moist.
>
> ED: Make sure you tell (the chaperone) that word.
>
> ST: Playdoh?
>
> ED: What if you rub it between your two fingers?
>
> TE: Use your magnifying glass.
>
> ST: What is that green stuff?

ED: Oh what is that green stuff?

ST: Moss?

ST: They said it was mold.

ED: Mold is green. If you put that under a microscope you will see that it is a plant.

This discussion illustrates a typical interaction among the students, the teacher as chaperone, and the site educator during an activity. During this particular activity, Ms. Freeman directed student attention to the use of their senses to make observations of the soil. She asked students what it felt like, how it smelled, and what it looked like. The teacher and chaperone followed up on these suggestions with the students, by asking them leading questions to support student observations and use of their senses. Students were thus well supported during field trip activities. They actively interacted with all of the adults throughout the field trip.

During this activity, students seemed unsure of making observations of the soil by using all of their senses. Ms. Freeman helped them by making the word lists a competition between the two sub-groups of students.

Collecting specimens in the forest. As the students walked into the forest, they searched the forest floor for interesting looking things to put into their “super-sorters” which were empty egg cartons. At the end of the forest walk, Ms. Freeman examined everything that had been found and further identified special characteristics of each item.

ST: This is a big mushroom right there.

ST: Oh, look at that!

ED: Cool! That mushroom looks like a turtle!

CH: Put that one back down. Don't pull any more out of there. You don't want to kill the mushroom.(The students are talking and everyone is walking along the path slowly, looking at things to put into the super sorter, pretty intent on finding things.)

ED: Let's see if we can get in a small circle right here. Oh what did you find there? Bring that over. That is a cool looking mushroom. It almost looks like a turtle shell. Look at that! I thought at first you were looking at a turtle, but it turns out it is a mushroom. I need everyone in a small circle and give me "Five".

In this segment of the field trip, the forest floor was covered with leaves, which contrasted with the grass and meadow vegetation that students had just explored. By this time, the students were quite comfortable looking for and finding things to discuss. Ms. Freeman's description of a mushroom as one that looked like a turtle provides another example of plant and animal camouflage references that contributed to continuity within the field trip.

Identifying collected items. Students were very engaged as Ms. Freeman shared more descriptive information about the items that they had collected in their super sorters. Students remained very responsive to discussion points made by Ms. Freeman as she went from item to item. Students had found an insect gall (insect home) and a sweet gum ball, which were both discussed in detail by Ms. Freeman. The following excerpt illustrates quick changes of topic beginning with people who visit the site and ending with another interesting mushroom sighting and recognition of a bird call.

ST: Do other people come here?

ED: Yes, we have other schools come here and but we also have scientists too who come here to look for animals. How about what you have in your containers. Do you have anything that you are kind of curious about? Did you find anything like this? This is really cool ‘cause it looks like a berry. This actually is where an insect lives….It is an insect home. How about this thing? Do you know what this is? It is called a gum ball. Do you think it is something you would eat? It is called gum ball, because it is from the sweet gum tree. Do you know why it is called the sweet gum tree?

ST: No.

ED: Because it is filled with sap. What is sap?

ST: It is stuff that comes out of a tree...

ED: And if a bug gets in it, it would turn into a fossil of amber….

If you put a tap at the bottom of the tree you can get syrup that if you boiled it down you could get from a maple tree. It would be maple syrup... Are you the ones who rolled this log over? You need to roll it back. We don’t have a whole lot of time left in the forest, because we definitely need to get to the wetland…(cool bird sound)….Did you hear that noise? That was a woodpecker.

ST: In the woods?

ED: It wasn’t the sound of the woodpecker pecking on wood, but rather its song.

ST: What is this?

ED: That is another kind of mushroom.

ST: Oh. (They are all bending over to look at things and have spread out a bit.)

ED: Come up this way a little bit.

ST: I think that is a bird or a rattle snake…

CH: (laughs) A bird or a rattlesnake?

TE: A bird or a rattle snake is quite different.

CH: I think it was a bird…

Although there were many bird and insect sounds throughout the day, they were not always discussed. The student's suggestion here that the bird call might be a rattlesnake or a bird is an example of a quick reference to prior knowledge of natural sounds in response to the sound. The interaction surrounding the bird call was brief, without recognition of student interest and ideas about bird calls. Although there were several moments during which bird calls or other sounds were discussed, there seemed to be an overall predominance of visual and tactile cues during the field trip.

Exploring forest soil. At the end of the forest exploration, students were asked to explore the soil and compare it to the other soil close to the meadow area. Students again actively engaged in digging in the soil, while interacting with the chaperone and their teacher. They also found more spiders, a bird feather, a seed from a beech tree and a pine cone. One student asked if the seeds in the seed pod were edible, evidence of that student making a connection between seeds in the outdoors and food.

ED: Do you have any other interesting things? A seed pod, this is really cool. Heh guys, look at this! See, these are seeds from a seed pod. What is really cool……

ST: Look, a bird feather!

ST: Are those like the seeds that you eat?

ED: You know what? Sunflower seeds are seeds, but not like these. These are seeds from a seed pod.

This excerpt provides more evidence that individual students engaged in making observations while using prior knowledge, in this case, the fact that seeds are often edible.

Finding flora and fauna enroute to the wetland. As we hiked through the meadow area to the wetland, everyone continued to find things and make observations. The chaperones were actively engaged as students discovered new plants and animals of interest to them.

ST: Ooh! a dandelion!

TE: Very nice. (loud cricket)

ST: Ooh look!

TE: Very nice flowers.

ST: We found more …

ST: There is a dragon fly…

ST: Where?

ST: Come on slow pokes….

TE: Keep walking…

ST: Where is the meadow?

TE: This is the meadow right here...(loud cricket and student talk.)

TE: Come on! Let’s get to the wetlands….

ST: I thought we were going to the woods and a path.

(Students are walking along the fence around the parking lot.)

ST: I found a lady bug.

CH: The lizard is right there.

ED: So if you would like to stand here you can see it. It is called a six-lined race runner. There is a toad.

During this short walk, different animals were found and discussed by everyone. Student interest in finding things continued even without a structured activity.

Looking at the wetland from the deck. As the students moved onto the deck, they asked a series of questions that showed their concern about being high above the water and wetlands on the deck. However, they kept making observations and spotted a daddy-long-legs as they walked onto the deck.

ST: Ok, see the daddy-long-legs?

ST: ooh… whoa..(student chatter in the background).

ST: This is like a….Can we go down on that bottom deck?

ED: That is where we are going to be heading now. (Student chatter)

ST: Are we going to step on the wetland?

CH: Yes.

ST: I see a big white bird.

ST: I see a snake down there. I see a turtle.

The wetland area was so far away that the observation made by the student about seeing a snake and a turtle was improbable. As soon as the students looked out over the water, they noticed a big white bird flying over the wetland area. Ms. Freeman had noticed the bird too, and identified it as a snowy egret.

> ED: Ok, look way out in the water and there is a fence in the water. There is a big white bird. It is related to the great blue heron. It is one of the egrets. It is a snowy egret. See where all the grayish blue water is….
>
> ED: Look! There's one flying over the marsh. See it flying? Yes, honey?
>
> ST: I have a question…It looks like a painting of the moon
>
> ED: Sure..Yes, doesn't it look like a painting?
>
> ST: Where am I supposed to be?
>
> (The students are wandering around the deck looking over the wetland.)
>
> ED: See that white bird landed.
>
> ST: Are we going down there?
>
> ED: We are going to go down on that trail down there.
>
> TE: We are going to walk down there guys
>
> ST: Are we going to fall down?
>
> ST: Are we going to jump?
>
> TE: I am not going to let you go.

This excerpt was dominated by a combination of observations and sightings and questions about how we would get down to the boardwalk. This was not surprising, as the deck was high above the wetland. Ms. Miller made sure to respond quickly to allay student fears as they wondered about how they would get to the lower level.

Identifying types of wetlands. The students walked a short distance through the forest to the beginning of the boardwalk. Two brown-colored, very well camouflaged frogs were identified as "green" frogs by Ms. Freeman and a student. After discussing the frogs, Ms. Freeman began to talk about wetlands in detail with the students.

> ED: Yes, they are brown (colored) frogs, but they are actually called green frogs. Ok, now, I have been mentioning a lot that we are going to a wetland…So what is a wetland?
>
> ST: Some place that has water?
>
> ED: Are we in a wetland?
>
> ST: Yes.
>
> ED: Your chaperone and teacher have a clipboard with a picture of different types of wetland and I want you just to look at the plants. And figure out which of these wetlands we are in and look at what kinds of plants that we see here. Which of these plants look most similar? Look at what kind of plants do you see here? You see that we have trees in this wetland? How many people see trees?
>
> ST: Yes.
>
> ED: There is only one kind of wetland that has trees and it is called a swamp.

The trees in the swamp area were quite large and close to the boardwalk area. Although there were many animals sighted from the boardwalk, there were also quite a few different types of vegetation in the wetlands. Ms. Freeman pointed out different kinds of plants throughout the boardwalk and assisted student observations of change in their surroundings as they walked along.

Measuring the depth of the mud. After going only about twenty feet onto the boardwalk, Ms. Freeman stopped and asked the students how deep they thought the mud was next to the boardwalk. They made some guesses that varied from an inch to the top of their heads to “all the way down”.

ED: If I fell off, how deep do you think that I would go?

ST: A little bit like an inch.

ED: How far do you think I would go?

ST: Just to the tip of your head.

ED: Ok, what did *you* think?

ST: I think you are going all the way all the way all the way down.

ED: All the way down?

The students were quite surprised when Ms. Freeman pulled up a pole from the mud that was about ten feet long. She told the students that the soft mud found in the swamp could be as deep as thirty feet.

ED: Am I allowed to step off the boardwalk? (She leans over and pulls out a pole from the mud very slowly about ten feet tall.) How deep would I go? All the way!! How deep would I go? Some of our mud here is thirty feet deep.

TE: That is like five Mr.B’s on top of each other. That is how deep.

ST: Whoa!

In this example, Ms. Miller assisted student understanding as she translated the depth of mud into a length they could understand. She said that thirty feet was five times the height of a teacher (Mr. B.) at school. So although she had participated in the field trip in the role of chaperone, this example illustrates her continued involvement with her students as she facilitated their learning process.

Looking for wetland animals. Ms. Freeman spent a few minutes discussing the animals that lived in the wetland. She reminded the chaperones and students that they had a list of animals on the clipboard as she shared some information about beavers and their homes.

> ED: As we are walking on this trail we will be looking for some of the pictures on that sheet…and somebody noticed that the beaver is listed on that sheet. Do you know why beavers are listed? Beavers like to eat bark and leaves…The beavers are sleeping right now. They are in their lodges, but we will be able to look at the bark you can see where it has been chewed on.

The worksheets on the clipboard were designed to reinforce what was seen from the boardwalk. The worksheet illustrated the different types of vegetation found in the wetlands based on the type of habitat. The picture showed the slope of land from the highest in a swamp to lowest in open water, with gradations in plants and animals as the water level rises. The pictures of swamp, high marsh, low marsh and open water were to be filled in with actual sightings in each area as the group walked along. In addition to providing a pictorial representation, the worksheet created an opportunity for interaction among students and chaperones/teachers. It also provided a record of what was found and could be used for further interaction after the field trip. However, in this case, it was not used in that way by the site educator or the teacher.

Spotting a snake. As the students moved along the boardwalk, some were looking at trees with chewed bark, and the remains of an old beaver lodge. Two boys at the back of the line spotted a black rat snake and hollered out excitedly.

ST: I see a snake! I see a snake!! (pretty loud) Oh- oh- oh- a snake, oh!

TE: Good job (Student name)!

ST: I found it!

CH: Good job!

ED: This is a black rat snake. It is our largest snake.

ST: What's that? (pointing in the vicinity of the snake.)

ED: They eat birds and rodents…rats, squirrels muskrats. And they can be like six feet tall.

CH: Who found that? Congratulations!!

TE: (Student name) found it. Good job (Student name)!

CH: Well done!

ED: Nice and it is climbing up a tree. That is often times, our snakes are up in the tree.

ST: Would he bite?

ED: He might try and scare me away. You might try to scare them away, they tend not to bite. If somebody came real close, what they actually would do is…if you pick them up they would poop on you. Yes, it stinks and it is nasty.

ST: Where does it come out?

ED: Where it comes out is if you look at the tail where the body is kind of fat and then right where it starts to get thin is where the poop would come out.

ST: Where is the spider?

ED: Oh, yeh, he is right here…and they try to be camouflaged. If you were walking and not paying attention would you walk right past it? Think about how many of us walked by and didn't see it. Because somebody up front was saying "Can we go now? Can we go now?" That is why the slow pokes find everything. You guys, I already told you earlier we weren't going to see one.

The students' excitement over finding the snake was evident. They were congratulated by the teacher, site educator and chaperone on finding the snakes. Ms. Freeman reiterated that snakes are hard to find because they are well camouflaged and answered student questions about the snake. She also noted that maybe it was not surprising that the students walking more slowly at the end of the line were the ones who found the snake.

This entire interaction is one example of the intense desire of the students to find animals, and particularly snakes, during the field trip. Ms. Freeman had cautioned students repeatedly that they might not find snakes because of they are commonly camouflaged as protection from predators. As a result, students may have been looking harder to find them. Or the slower pace of movement at the back of the line may have given students more time to really look around at the environment. The site educator contributed to continuity within the field trip in these discussions, by continuing to share the key characteristics of the animals and plants at the site in her descriptive practices, and in her continued focus on making observations during the final segment of the field trip. The newly acquired expertise of the students in making observations and finding things of interest also may have assisted their success in finding snakes during the wetlands boardwalk segment of the field. Another element that may have contributed to the sighting of well-camouflaged snakes was the nature of the boardwalk hike. Student interactions were limited by the single file formation of movement, increasing the likelihood that stimulation of the senses (especially visual and aural) would be intensified for participants.

Thinking about tides. The discussion topics turned to tides, otters, snakes, and birds as the group moved forward into the next habitat area. Ms. Freeman continued to ask students leading questions to engage their thought processes. This excerpt begins with Ms. Freeman modeling making observations about a bird that is flying by.

> ED: A little bird is flying in the plants if you look carefully you can see a little yellow on its tail.
>
> ST: Every day, how much water do you think comes in? How often?
>
> ED: That's a good question (to student). How much water does an otter need to swim? This river actually floods. How often do you think it floods? How much water do you think comes in? How often? This is the (River name). It floods two times a day causing tides. Are you learning about the solar system and things like that? Well, the moon makes the tides. We are at low tide here. Give me some evidence. Look around. Can you see how high the water got recently?

ST: Uh…. if I look at the post holding up the boardwalk?

ED: How high do you think the water got? How much water?

CH: (Looking at the posts.) They are all dry. I am looking for moisture.

ST: (points at the high water mark on the post)

ED: Yep! Right there. See how high that water got? So now at high tide, where would the otter be?

ST: There are some bugs climbing up this thing.

ED: Yep

During the discussion about the tides, Ms. Freeman asks students to make observations that will provide evidence that the water rises and falls in the wetlands. Here she is modeling the scientific process of looking for evidence to support claims. In referencing discussions about in-class study of our solar system, she is encouraging students to think about making connections between what they observe in the world and what they learn in school and science class in particular.

The next excerpt illustrates the very strong interest in snakes that students maintained throughout the field trip. One very persistent student wondered if the class visiting the site on the prior day had spotted a snake. He was curious about whether or not the other group of students who had participated the prior day had successfully found any snakes.

ST: Did the other group find a snake?

ED: I don't know we will have to ask them.

ST: No, the other day…

ED: One person saw a snake yesterday. It was a ribbon snake. Now this is this still a swamp here? Where are the trees?

ST: Yes.

ED: Are these trees?

ST: Ummm….

ED: This is the low marsh. Sometimes people call them yellow pond lilies. This is a marsh. This plant- you can see (pointing) goes all the way out there.

In this interaction, Ms. Freeman identified yet another kind of snake. She then redirected everyone's attention to the characteristics of the wetland habitats in terms of plants. This is another example of science vocabulary presented during Ms. Freeman's discussions about plants and animals, with repetition of terms used by environmental scientists to describe particular wetland habitats. Ms. Freeman was careful to draw students' attention to the particular plants found in each type of wetland area in each section of the boardwalk hike.

Finding more snakes. The students made more observations of their surroundings as they moved further along the boardwalk. Right after entering the low marsh, another student (again at the end of the line) found one snake and then two.

ST: I see a snake….oh! Two snakes!

ED: This one is too far away to touch. This one is a queen snake. It is a very small snake.

ST: Ooh! Cool!

ST: You are some snake finder! We are the snake finders. The other class didn't find any.

ED: Queen snakes. I am glad that we have a snake finder. Did you write that one down?

The queen snakes were grey-green in color and were about nine inches long. They blended very well into the environment, and provided an excellent example of camouflage based on color.

Ms. Freeman's reminder to students that the queen snake should be added to their list of animals found during the hike is an example of her interest in reinforcing observations with written work. These actions, because they had been repeated so frequently throughout the day, also contributed to continuity of the experience within the field trip for the students.

Making observations while walking along the boardwalk. After everyone got to look at the snakes, we moved to the last section of the boardwalk. Students continued to chat about what they were seeing and hearing along the boardwalk.

ST: Oh look at that! A lightening bug!

ST: There are lots of frogs!

ED: Oh, yeh, you know what that white stuff is….

ST: It is bird doo-doo.

ST: Heh, y'all look at that ! See that bird?

ED: Yes, look at the bird! It looks like it is eating an insect.

ST: Look at the frog!

ST: Look at the bee!

ST: Hey, it jumped right down. (There is relative quiet for a few minutes.)

ST: By the top……..(Sound of walking on boardwalk. A few more minutes of relative quiet.)

ST: I hear something up there…(pointing up the hill)

ED: I am glad you guys in the back are doing a good job! It is running up the hill. Maybe it is a squirrel?

In this excerpt, students remained interested in finding plants and animals to the very end of the boardwalk. They were very quiet, which may have enabled them to hear sounds more acutely as evidenced by one student's observation of a sound up the hill that might have been an animal. Ms. Freeman's positive comment about student attention further supported their skill in making observations.

Touching little green frogs. As we neared the end of the boardwalk, there were many little green tree frogs on and within reach of the boardwalk. Ms. Freeman suggested that if students wet their fingers, they would be allowed to touch the little green tree frogs that were everywhere, on plants and the boardwalk posts. The students spent some time watching and touching the frogs, and were quite enthralled with their color and size.

As already mentioned, the plants along the boardwalk had changed as we walked, and a stand of cattails dominated the last section of the hike. Ms. Freeman discussed their structure, history and characteristics as students looked closely at a cattail that Ms. Freeman had dissected for them.

Summary of student actions. In summary, throughout the field trip the students made observations, participated in discussions, engaged in hands-on explorations of habitats such as grass, soil, forests and wetlands, and used their senses of sight, hearing, and touch as they explored the environment. The field trip design also involved active explorations of the environment during which students used a variety of simple tools that expanded the ways in which they interacted with the environment. Student engagement in these activities varied by individual, but most of the students in this group exhibited interest in exploring the environment in the small group led by Ms. Freeman.

In the next section, I describe each of the student interviews in terms of the quantity and quality of student discussion points, written work and pictures drawn at the end of the interview. These descriptions were part of the process of developing an understanding of the students' meaning-making process. I particularly was looking for what students remembered and talked about the field trip and any connections that they made with prior experiences in and outside of school.

Student Interviews

I interviewed the eight students who agreed to participate in the study in small groups of four students each. The first interview occurred about nine days after the field trip on October 13th, and the second one occurred a few days later on October 17th. Narrative summary descriptions of the interviews including excerpts from the transcripts are in Appendix D. In this discussion, I focus on students' written work and the pictures that they drew during the interviews. The following interpretation section incorporates quotes from the transcripts in the analysis.

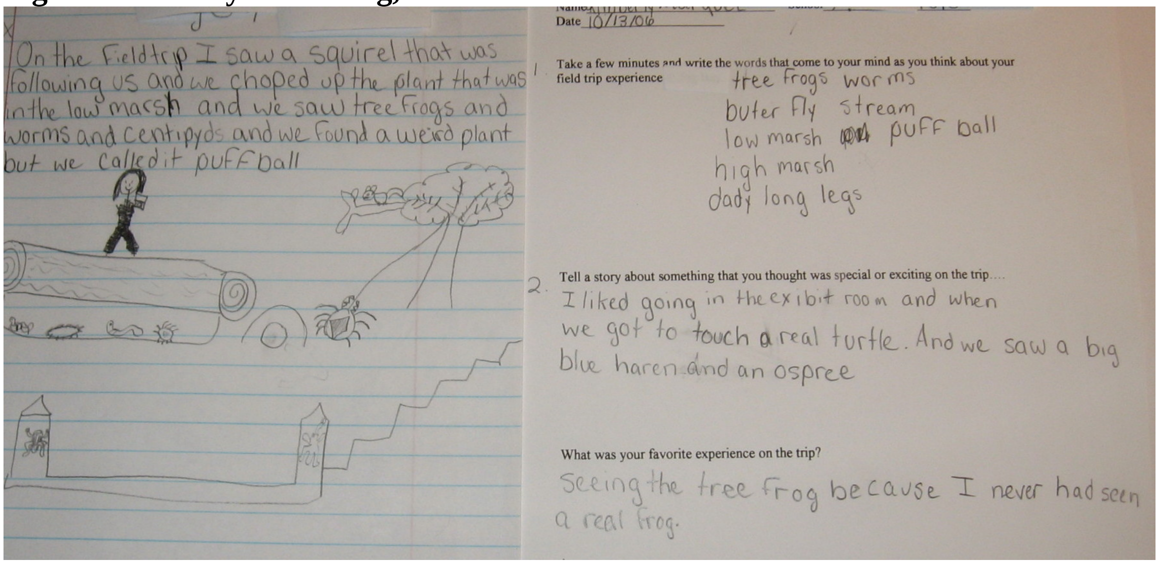
During the first two interviews, which occurred within two weeks of the field trip, students shared their excitement about different aspects of the field trip verbally and in answering the questions on the interview worksheet. They spoke very excitedly about the field trip with each other and with me throughout the interview process, and settled in to the small group process relatively quickly. Students shared their ideas sometimes in pairs, and assisted each other with spelling and remembrances as we worked together.

I had intended for the worksheet to provide a starting point for discussions, as this had been a successful strategy during the pilot study. However, during the first student interview, students did not discuss their written work extensively. The second group of students spent more time talking together about what they had written on the worksheets. I had designed the worksheet questions to enable students to think about their experiences in different ways. The first question asked students for individual words that came to their minds when thinking about the field trip. The second question asked students to use sentences and write a “story” about some part of the field trip that they thought was interesting. The third question asked students to describe their personally favorite aspects of the field trip. I had decided on using these three questions to give students a range of ways to think and write about the field trip.

I developed the following narrative descriptions of student worksheets, drawings and journals for the first step of my analysis of the interviews. I then developed a table (Table 5.1) that included direct quotes from the worksheets to summarize the key points from student written work.

Becky generated the longest list of words and included habitats, insects and frogs on that list. She liked the exhibit room and touching the turtle, and mentioned that she got to “see” a frog for the first time. Her pictures reflected her focus on the marsh and animals on her word list, but also included a detailed drawing of the log-rolling activity. Appreciation to the teachers was expressed in the interview drawing (See Figure 5.1).

Figure 5.1. Becky's Drawing, Journal and Interview Worksheet.



The girls mentioned rolling logs over more frequently than did the boys. This difference emerged as the students wrote and made drawings of their field trip experiences, and may have been a reflection of a difference between what the girls and boys did during the field trip.

Afia described a range of activities and animals seen including daddy-long-legs, insects, snakes, tree frogs, grasshoppers, beetles, and a red-eared turtle. She was the only student who mentioned a red-eared turtle and the soil exploration. Her interest was in snakes, tree frogs, turtles, and beaver tracks and seeing the turtle in the exhibit room.

Marianna portrayed enthusiasm for the field trip in her drawings and written descriptions. She made a connection between the relatively small size (less than 1" length) of green tree frogs, and the size that a "baby" frog (of the larger species) might be. She mentioned the green frogs and the deck as her favorites in addition to insects, worms, daddy-long-legs, and "bitten" beaver logs.

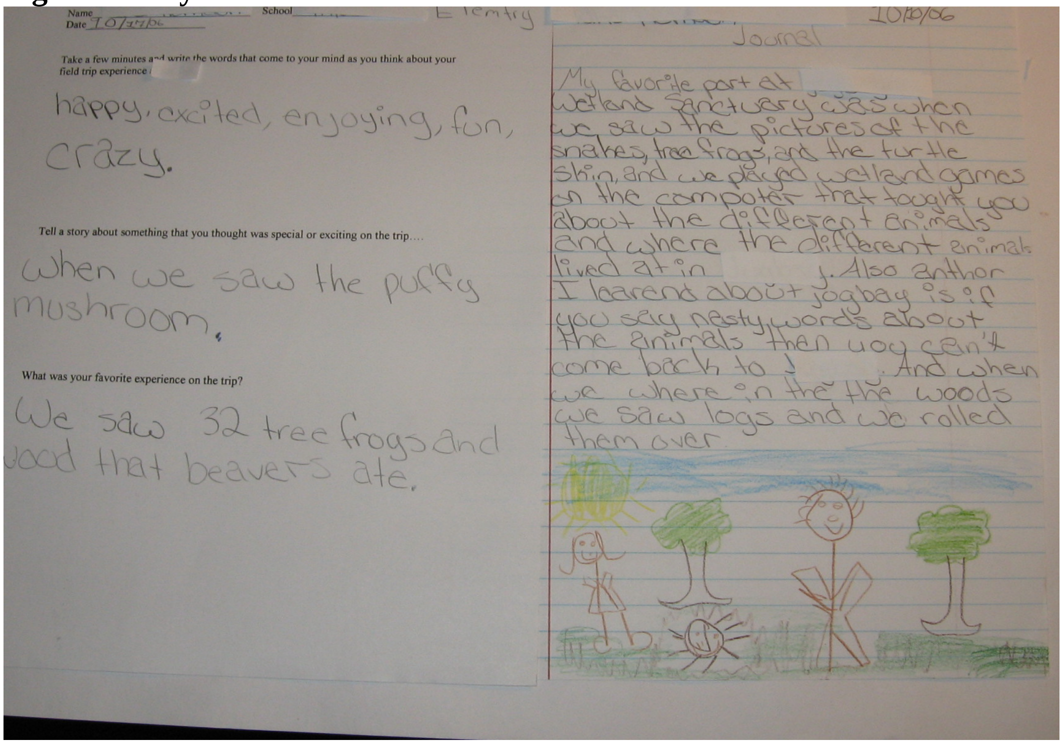
James made connections between habitats (wetlands, forest and fields), and animals in his description of his favorites and in his journal writing. He listed snake holes and beaver houses in addition to insects, frogs, animals, the blue heron, waterstriders, and the boardwalk in his written work. In his journal, he stated that he liked the wetlands and the animals found there: two snakes, treefrogs, and beaver holes. In connection with the forest, he mentioned beetles, spider, pinecones, red ants, and more treefrogs and lizards. His picture of a smiling boy included tiny animals nearby. In the second interview, James quietly reflected while drawing and made the connection between “Character and Nature”, which had been presented that day during language arts.

Ade wrote about the fact that the field trip made him happy. He mentioned frogs and toads and a puffy mushroom as his favorites. He engaged easily with another student in drawing a picture of two snakes on a tree branch and wrote about the solar system in his scientist journal. He asked three questions about the solar system wondering what happened to the other planets and how hot the sun is.

Niles wrote about frogs, snakes, and deer tracks. For his science journal he made a connection between making shoes, cars, and motor cycles and scientists. He was the other snake finder and drew the “queen” snake with a crown on its head.

Lynda wrote that she was happy, excited, enjoyed the field trip and had fun. She liked the puffy mushroom and the tree frogs and the wood eaten by beavers. Her journal notes on the field trip were lengthy and included a colorful picture of two people and two trees at the bottom. She wrote about the exhibit room and using the computer there and about rolling logs in the woods. (See Figure 5.2.)

Figure 5.2. Lynda’s Worksheet and Journal.



Name School Elemtry
Date 10/27/06

Take a few minutes and write the words that come to your mind as you think about your field trip experience

happy, excited, enjoying, fun, crazy.

Tell a story about something that you thought was special or exciting on the trip....

When we saw the puffy mushroom.

What was your favorite experience on the trip?

We saw 32 tree frogs and wood that beavers ate.

10/30/06
Journal

My favorite part at Wetland Sanctuary was when we saw the pictures of the snakes, tree frogs, and the turtle skin, and we played wetland games on the compoter that tought you about the different animals and where the different animals lived at in . Also anthor I learend about jogbay is if you say nasty words about the animals then you can't come back to . And when we where in the the woods we saw logs and we rolled them over.

Nyah also expressed happiness in her word list and wrote about the mushroom with air and the green and sticky thing on the boardwalk. She wrote lengthy journal paragraphs about scientist and the field trip. She was interested in the planet, Pluto, and how cold it is there. She was the only student to mention the depth of the mud and liked the deck, green tree frogs, and rolling logs. She also was the only student to mention seeing (wild) rice in the wetlands.

<u>Summary of field trip connections on worksheets, journals and drawings</u>. I developed a summary table (Table 5.1) of the interview worksheets, student journals and student drawings to assist in the analysis of all of the data.

Table 5.1. Data Summary of Interview Worksheets, Student Journals and Student Drawings

Student	Contents	Key points
Becky: Worksheet Questions	1) number of words=9; treefrogs, worms, buterfly, stream, low marsh, puffball, high marsh, dady long legs	Longest list of all. Spelling okay in general.
	2) I liked going in the exibit room and when we got to touch a real turtle. And we saw a big blue haren and an ospree	Exhibit room, touch turtle, see birds.
	3) "Seeing the tree frog because I never had seen a real frog."	Real frog
Becky: Picture	Site slogan and drawing of several locations: the deck with three people, three trees, (one with a big hole), a green frog, clouds, an osprey flying, the sun and the moon.	Thank you for the field trip and nice overview of things important to the students.
Becky: Journal and Picture	**Written Work: "**On the field trip I saw a squirrel that was following us and we chopped up the plant that was in the low marsh and we saw treefrogs and worms and centipyds and we found a weird plant but we called it puffball." **Picture:** of the log rolling activity with centipedes, worms, beetles and salamanders under it. A spider attached to a tree, and a squirrel on a branch.	Interest in mixture of plants and animals, connections with locations made. Very detailed picture of two scenes.
Afia: Worksheet Questions	1) number of words=sentence; "I show DaDe long legs and we cath insects."	Phonetic spelling, shows interest in insects.
	2) "I like going in the exhidit room and when we got in thir we show a trdr."	Exhibit room and the turtle.
	3) "Pking up worms and pone cons what ave it and my fri thig is gong whit Ms. Diane."	Liked worms, pine cones and the site educator.
Afia: Picture	Site slogan and drawing of a large building, clouds, a butterfly, two trees with holes in them, a smiling fish and water.	Nice site overview and thank you for the field trip.
Afia: Journal and Picture	"My favorite part when we was in the wetland we saw snakes and wet tree frog and dear tracks and grasshoppers and beetle and a red earred tuttle and bever tracks and we saw soil and we saw we tot to catch animals and we digged up soil." **Picture:** of a boy	Interested in the snakes, tree frogs, turtles, beaver tracks. Mentioned soil and catching animals. Phonetic spelling of words.
Marianna:	1) Number of words=5 (some phrases);	Interest in insects, worms,

Worksheet Questions	insect, green frogs, daddy-long-legs, bitan beaver log's, worms.	the logs that had been chewed by the beavers. Some phonetic spelling.
	2) "I liked when I saw the water marsh and the poisn ivy and I also like when I saw the Daddy long legig.	Interest in the marsh boardwalk, daddy-long-legs and insects.
	3) My favorit was when I saw green frogis. And when we went all the way to the top of the deck.	Favorite was the green frogs and the deck.
Marianna: Picture	Site slogan and drawing of several locations: the deck with three people, three trees, (one with a big hole), a green frog, clouds, an osprey flying, the sun and the moon. Worked with student 1 on this jointly drawn picture.	Thank you for the field trip and nice overview of things important to the students.
Marianna: Journal and Picture	"I liked when we went to the high marsh and we saw frogs but they were little their were like a baby one. When I toched it I jumped up. Every one was laughing. And then I started to laugh. We had so cool adventures. **Picture**: Drawing of the student and her friend with a boardwalk pole in between them with a little green frog on top of it.	Enjoyed the high marsh and frogs. Had fun with her friend.
James: Worksheet Questions	1) Number of words=6 (some phrases included); insects, frogs, animals, beavers houses, waterstriders, snakeholes.	Mix of mostly animals. Spelling good.
	2) "When we were about to go to the wetlands we were on a boared walk and we saw a blue harron.	Wetlands, boardwalk, blue heron interest. Good attempts at spelling of words.
	3) "When we went to the wetlands, the forest and the field because we so all kinds of animals wet frogs and insects."	Three locations (wetlands, forest, field) mentioned and connected to animals generally.
James: Picture	Site slogan and drawing of a large building, clouds, a butterfly, two trees with holes in them, a smiling fish and water. Worked with student two on the picture.	Nice site overview and thank you for the field trip.
James: Journal and Picture	"My favorite part was when we went to the wetlands. I really like when we found two snakes, treefrogs, beaver holes. I also liked when we went to the forest and we found bettels, spiders, pinecones, red ants, and more tree frogs, lizards."	Liked the wetlands and animals, and liked and listed the forest and animals.

	Picture: Drawing of a boy in a striped shirt, smiling with little insects, snakes, spiders, and a worm on the ground nearby.	
Ade: Worksheet Questions	1) Number of words=2 (one phrase) happy, filled with joy	Expressed enjoyment of the experience.
	2) "Smoke came out of a puffy mushroom.	One mushroom.
	3) "We got to touch the frogs and toad."	Touching frogs and toads.
Ade: Picture	Drawing of two snakes on a tree branch. One of the snakes (portraying the "queen" snake) was drawn with a crown on her head. The picture was drawn jointly with Niles. Lots of conversation between them as they worked together to portray two snakes.	These were the two students who found the snakes. They had to work carefully on the picture because the snakes were close together. They had a lengthy discussion about colors.
Ade: Journal and Picture	"If I were scientist I would look out into the solar system. I would see if a rock was going to cash in to earth. I would see if there was a shoting star. I would what hepped to the other plantes. I would how hot the sun is.	Interested in the solar system. Two sentences are missing the word wonder, but good questions about the solar system anyway.
Niles: Worksheet Questions	1) Number of words=two sentences. "I was insidit of my eye and saw a snake."	Seeing a snake.
	2) "I like that I tuch a frog."	Touching a frog.
	3) "Seeing a dire trak."	Seeing a deer track.
Niles: Picture	Drawing of two snakes on a tree branch. One of the snakes (portraying the "queen" snake) was drawn with a crown on her head. The picture was drawn jointly with Ade. Lots of conversation between them as they worked together to portray two snakes.	These were the two students who found the snakes. They had to work carefully on the picture because the snakes were close together and had a lengthy discussion about colors.
Niles: Journal and Picture	On scientists: "I wud make pars of shoes and cars and modr sikos. Picture: stick drawings of shoes, cars and motorcycles.	Association of making things like shoes, cars and motor cycles with science.
Lynda: Worksheet Questions	1) Number of words=5; "happy, excited, enjoying, fun, crazy."	
	2) "When we saw the puffy mushroom."	

	3) We saw 32 tree frogs and woood that beavers ate.	
Lynda: Picture	This student drew four trees, grass and clouds. She started out working with another female student, Nyah, who got upset and left the room over a disagreement that occurred while they were drawing.	Depiction of the forest, four trees, clouds and grass
Lynda: Journal and Picture	"My favorite part at the (site) was when we saw the pictures of the snakes, tree frogs and the turtle skin, and we played wetland games on the computer that taught you about the different animals and where the different animals lived at in (the site). Also another thing I learned about is if you say nasty words about the animals then you can't come back. And when we where in the woods, we saw logs and we rolled them over. **Picture:** small colorful drawing of grass, the sun, two people and two trees at the bottom of the page.	Liked the information in the exhibit hall and the tactile pieces, the computer game. Interested in habitats, nasty words sunk in and log rolling in the woods.
Nyah: Worksheet Questions	1) Number of words=5 (1 phrase); "happy, in joy, insixed, fun, cracey."	Affect words and insects. Some phonetic spelling.
	2) "I like the mushern that has air."	Mushroom was interesting.
	3) It is it's thing that is green and when you open it was sticky.	Liked the green and sticky thing.
Nyah: Picture	This student started to draw a tree and then left the room suddenly because of a disagreement with her classmate.	Side effect of stress in her life according to teacher.
Nyah: Journal and Picture	**Science:** "If I was a scientist I will go up to Plouto and chop off a little pice over plout in give it to my mom because in this class we talk about plouto a loot in my class so that when I go to plouto I want to see how cold it is." **Picture:** A drawing of a girl on top of a circular planet with spots on it.	Image of a scientist working on Pluto. Wonders how cold it is and wants to bring a piece home to her mom.
Nyah: Journal and Picture	**Field trip:** "I like about the field trip because we had fun and when we went to the high marsh we saw how dip the mud was and it was taller then our teacher. Then we went to the woze and we got to	Had fun, saw how deep the mud was in the high marsh. Rolled over logs and caught worms and a spider. Liked the deck and tree frogs.

	rol the logs over we picked up the worms and I cote a spider. Then we went on the deck to look at rice and we saw some tree frogs." **Picture:** A drawing of a girl and the puffball mushroom, a spider and the log after it was rolled over.	
Interview Dec 6 Nyah:	During this interview the students worked on their drawings throughout our discussion.	The student remembered a lot of detail about the field trip and was excited about going back in the spring.
	Picture: This was a picture like the one Nyah had started during the October interview. She drew two trees on either end of the page, with big circular holes in them. Then she added two trees behind the one on the left and one tree behind the tree on the right hand side of the page. There was a log in the middle of the picture on the ground, and a puffball mushroom giving off its smoke.	A picture of trees with holes described as owl holes by the student when asked what they were for.
Interview Dec 6 James	During this interview the students worked on their drawings throughout our discussion.	Student was very quiet but industriously working on the picture and concept.
	Picture: This picture resembled the one drawn by Nyah during her interview that day. This student added a man and a spider on the ground in between the two trees at the edges of the paper.	This student mentioned "Character vs. Nature" while he was drawing.

Interpretation in Terms of Dewey's Characteristics of Educative Experiences

Dewey's characteristics of educative experiences provided a framework for interpreting the students' meaning-making processes to develop an idea of their perspective on the process. Dewey's idea of the importance of developing continuity in learning experiences, active and passive elements of an experience, the interactive nature of an experience, and connections to subject matter informed the interpretation of student actions and reflective process during the interviews.

The following assertions are based on the above analysis (see Table 5.1) of the verbal and written work during the interview process for eight student participants in the study. Students mentioned different aspects of the field trip, which are listed below from highest to lowest frequency of mention.

1) Wetland plants, habitat descriptors and associated animals were mentioned and drawn the most frequently of all with snakes and green tree frogs, beavers and their homes mentioned the most. (All students)

2) There were many references to insects/long period of time catching them, describing them. (See students Becky, Afia, Marianna, James, and Nyah)

3) Insects, daddy-long-legs and the "puffy" mushroom were of great interest, with repeated mention and drawings made by students. (See Marianna, Ade, Nyah)

4) Female students mentioned the log rolling activity frequently. (See Becky, Lynda, Nyah)

5) The study of the solar system was mentioned most frequently by two students who wrote journals about scientists. (See Ade, Nyah)

6) There were few references to the soil activities. (See Afia)

7) A few students connected the habitat with plants and animals living there. (See Becky and Lynda)

Student lists of field trip "favorites" revealed that they remembered and liked the frogs the most. Students said they liked: *seeing* a real frog, picking up worms and pine cones and going with the site educator, *seeing the green* frogs and going to the deck, going to the wetlands, the forest and the fields and seeing all kinds of animals, frogs and insects, *touching* the frog and toad, seeing a deer track, seeing *"thirty-two"* frogs and wood that beaver had eaten, seeing the green, sticky thing on the boardwalk. In this one sentence, the high frequency at which students mentioned frogs is illustrated in addition to different ways in which students used their senses during their encounters with frogs and other things.

These student communications are evocative of Dewey's (1934/2005) definition of experience as the "result, the sign, and the reward of that interaction of organism and environment, which when it is carried to the full, is a transformation of interaction into participation and communication."

Verbally, many of the students echoed their written favorites during the interview, showing consistent thought processes. Some students verbally elaborated on their written ideas. Students expressed many details of their outdoor experiences during the interviews providing evidence of the level of engagement during the field trip and of their capacity to remember.

The students communicated their ideas verbally with fluency during the interviews. One student, remembered asking the site educator a question about distance that showed higher level thinking: "And we asked Ms. Diane where it was going and she said it was going to the Bay river and that was when we asked her how long does it take to get to the Bay river. She said it would take ten hours, but for the low marsh and the high marsh to rise it takes about six hours."

This contrasted with the written worksheets, on which many of the students used phonetic spelling of words. Some students had difficulty reading the directions together. In general, written answers during the interview were shorter than the student journal paragraphs that had been written in class before the field trip.

Several students mentioned that they had taken the site educator's advice and visited the sanctuary's website before the field trip. One student talked about her desire to go back to the site with family members. This shows that the experience had inspired interest in the site and sharing the experience with others.

Evidence of Active and Passive Elements

As noted above, the students participated in many activities during the field trip. During the interviews, students mentioned verbally and in writing the field trip activities using tools such as magnifiers, spoons, and sorting boxes. They remembered finding bugs, frogs, spiders, and snakes, and used descriptive words verbally and in writing. They talked about plants that they had found during the field trip. For example, several students remembered a sticky green thing and said that: "I stuck my nail into it and held it on my palm."; "And it would stick on you without falling."; "It was real sticky – it was like glue." Many students mentioned the puffy mushrooms that were found in the forest.

Students talked about reflecting on the field trip experience during the interviews. One student mentioned that he just "sits and thinks about the field trip site when he is outside during recess". Another student reported on-going reflective moments during recess: "When I see bugs, I think of (the field trip site). I just sit there and think all day."

Evidence of Continuity

The teacher did not make explicit connections to the field trip before or after the experience during the classes that I observed. However, the site educator visited the classroom a week before the field trip with the explicit intent of what Dewey described as "setting up desires and purposes" (Dewey, 1938/2007, p. 38) to propel the students' interest toward learning about the plants and animals they might see. The list of student actions during the field trip illustrates some elements of continuity that were built into the field trip. In almost every segment of the trip, students used different tools as they participated in some type of hands-on exploration of the environment.

Students investigated the environment throughout the day by using the tools, with the goal of finding interesting things. Both plants and animals were the subjects of the investigations. Students made observations and became very engaged in the process of finding things and then describing them. During the boardwalk segment, the students did not have tools, but continued to make observations. During the interviews after the field trip, the students remembered many details about the various habitats and the plants and animals they saw there.

Connections between outdoor experiences at home and the field trip. Students in each interview talked about what they do when they go outside at home. The stories showed a variety of experiences, with some connections easily made to a forest habitat or to frog and snake encounters in particular. Many of the activities also involved special friends, parents, grandparents, brothers and sisters.

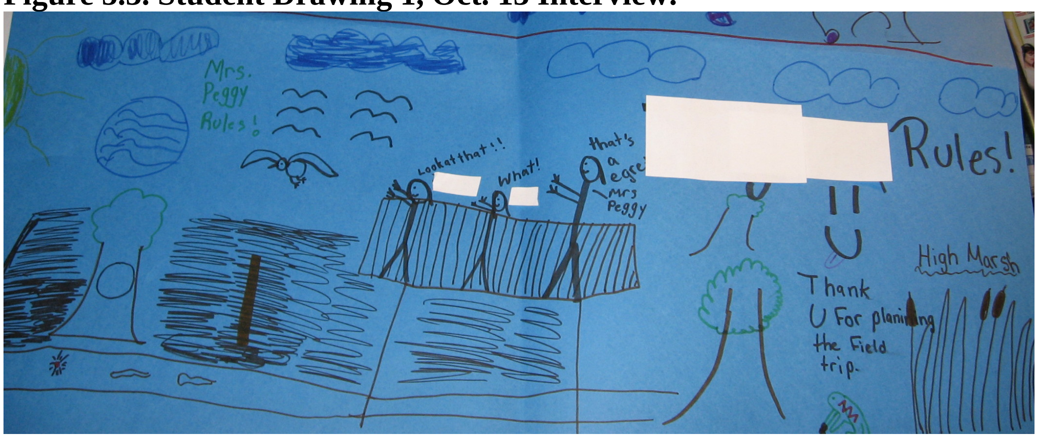
One student said that she would like to come to the site with her mom and dad:

> ST: Do you all have other people come there? (More student talk--on top of each other.) Because I am going to tell my mom and dad and sister when they come from el Salvador to go there cause my mom knows the directions
>
> ST: My brother, my mama, they want to come there (Interview, October 13, 2006)

Evidence of Interactive Nature of the Experience

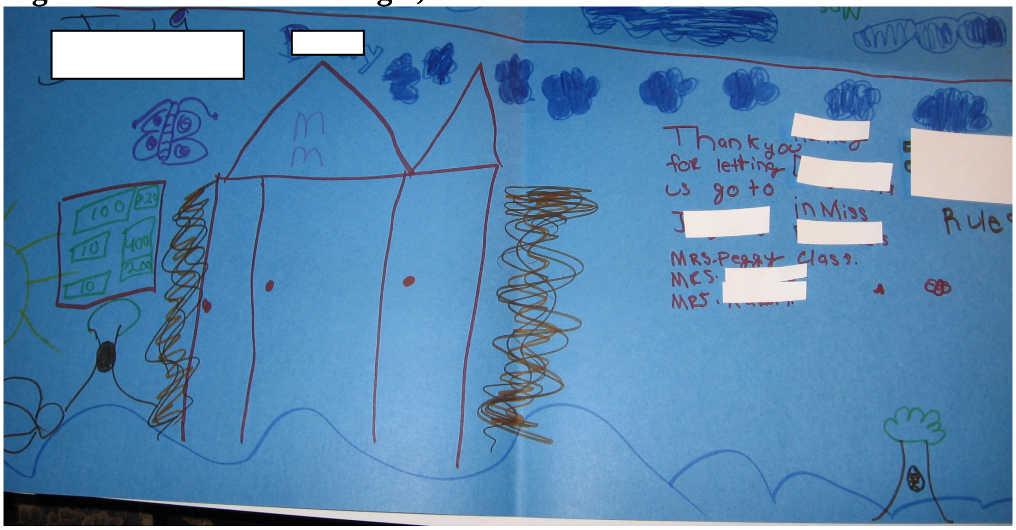
The complex drawings that the students made during the interviews provide evidence of their interactions with the physical context of the site, the sensory qualities of their experiences there, and their interactions with the site educator, teacher, and each other. For example, the drawings from the first interview (See Figures 5.3 and 5.4) depicted particular aspects of the site that show the students' interest in plants, trees with holes, insects, animals, and the outdoor environment.

Figure 5.3. Student Drawing 1, Oct. 13 Interview.



In Drawing 1 (Figure 5.3.) two students depicted the elevated observation deck with three people on it, three trees (one with a large nest cavity in it) a green frog, clouds, an osprey flying, the sun, thee high marsh, insects and snakes.

Figure 5.4. Student Drawing 2, Oct. 13 Interview.



In Drawing 2 (Figure 5.4), two students depicted elements of the outdoor environment, including: clouds, a butterfly, two trees with holes in them, a smiling fish, and water. The students indicated to me that the large building depicted the education center. The artists also included a "thank you" note to the site educators.

In these drawings, the students thus represented important elements of the overarching outdoor quality and also some of the details of the outdoor experience that they remembered best. These elements were also illustrative of many of their interactions with the environment. The high level of detail in the drawings, including birds in flight being viewed from the deck, trees with holes in them, butterflies, insects and the high marsh complete with cattails, illustrates the deep level of engagement between the students in the outdoor environment of the field trip.

<u>Evidence of Subject Matter Connections</u>

Although the students did not have the opportunity to experience explicit subject matter connections between the field trip and science topics in the classroom, they described some connections between the two as they made meaning of science in general and the field trip experience during the interview. For example, they discussed the concept of a scientist as someone who studies animals to "see how they were made and see how what they came from" and to the concept of science as "learn(ing) about different things in the world."

In response to my question about any connections that they might make between classroom science and the field trip, students shared some examples of different ways that they connected science and the field trip. The following excerpts from the transcripts were selected as examples of different ways in which students made connections.

> ***Excerpt 1:*** ST: If I was a scientist I would expect to look at animals and stuff and see how they were made and see how what they came from or ummm (thinking).
>
> ***Excerpt 2:*** ST: I like science 'cause we learn about different things in the world. Sometimes I get a science book at home and I learn about (the site) 'cause we got this little picture in the science book and I look at it and I see how the…umm…the tree squirrel and snakes and the beavers have to stay in different homes, so they don't attack each other….
>
> PP: That's great! It sounds like you studied that at home. What about in class?
>
> ST: In class, we don't do so much about (the site) but we have learned about planets and stuff like that and Mars and Venus and how we can't live there cause it is too hot and too cold.
>
> ST: I went to the website and I saw the picture of (the site).

ST: Me too. 'Cause I wrote it down. But then I didn't get a chance to look at it.

ST: Math is a little bit related to (the site). I mean science is…. It is almost like (the site) because science and (the site) mix……..They kind of come together, but (the site) is somewhere that you go to and science is what you do in class.

Thus, there was a range of ways in which students made connections between the field trip and other experiences during the interviews, even in the absence of direct connections in the classroom. In the second excerpt, a dialogue between multiple students begins with a student talking about making connections between a book and the animals she saw at the site. Another student talks briefly about studying the solar system. Then several students mention that they went to the website for the site, after jotting down the address during the pre-trip orientation.

In the very last comment in the second excerpt, the student noticed the difference between science in the classroom and at the site. This comment shows his tentative understanding of differences in his experiences in both contexts while studying science.

To expand the interview discussion a bit further and to find out if these students had any understanding of what an experiment was, I asked the students if they had done any experiments in class.

ST: It was in third grade. It was goop. And she put some of it on your hands and said you could touch it with your hands…and we put our fingers in it. And it stayed there for a little bit and it started clogging up the hole in the sink when we threw it away.

This memory focuses on sensory inputs from handling the “goop”. Another student described her experience in a different school with a frog.

> ST: The frogs, when we were in (another school), we were like playing there or discovering science…then my teacher said: “Let it go.” She said that it came from a forest.

These comments were the response of a female student who had moved from a school in a different county. She noted doing “discovery” science, playing with a frog, and remembered that it came from a forest. Although brief, these connections between prior experiences and the field trip were meaningful choices.

In summary, during our discussions about science in general, students made connections to the subject matter of the field trip in different ways based on their individual meaning-making process. Students made particular mention of the animals and habitats at the site as being related to science. They mentioned trying to access the site’s website for more information and looking for related information in books. Connections with classroom science were made with one student noticing differences between contexts, another remembering hands-on work, and another student making a connection with a prior experience with frogs.

An unexpected connection. During the last student interview, James worked very quietly, more quietly than he had ever worked before. As he finished up his drawing of the field trip, he said that the picture he was drawing was one of a “Character in Nature.”

> PP: Can you relate what you are studying now to the field trip?

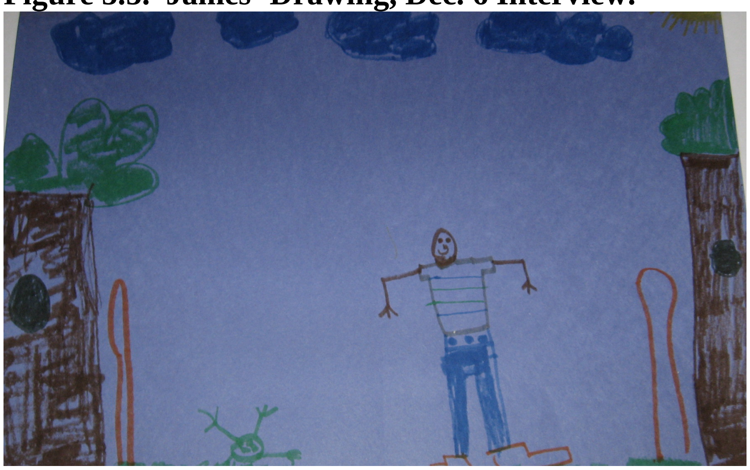
JA: “Character in Nature.” Because you all had a lot of grass and flowers and trees. Because it was us, and we were the *character*. And we had the trees and grass and flowers and that was the *nature*.

PP: So where did you get that from?

JA: From science.

His drawing supported his very succinct verbal description of a “Character in Nature.” (See Figure 5.5.) In between two tall trees with nesting cavities drawn in, he had drawn a picture of himself. He pointed to his picture of himself while he was describing “Character in Nature.”

Figure 5.5. James’ Drawing, Dec. 6 Interview.



James had indicated that the idea came from science, but would not elaborate on this connection.

During the teacher interview right after this student interview, I mentioned James’ reference to “Character in Nature.” Ms. Miller told me that the day before during language arts, she had been working with her students to develop concepts of “Character vs. Society,” and on the concept of “Character vs. Nature.” So it turned out that James connected his work in language arts class with his experience during the field trip. I think that this was an important reflective and integrative moment in this student's meaning-making process. He was thinking about the field trip, drawing a picture or visual representation of his field trip experience, and making connections with the concept of "Character vs. Nature" that had been presented in school during his language arts class.

Summary of the Students' Perspective

In developing the students' perspective, I incorporated what students did or experienced with what they wrote about the experiences, and what they said about the experiences. As a result, the students' meaning-making process emerged due to the coherence between what they did and what they remembered and thought about the field trip experiences. In the process, particular moments of meaning-making emerged as students made connections between the field trip and other experiences in their lives.

The Teacher's Perspective

This section focuses on the research question: What meaning does the teacher make of the field trip experience for herself and for her students?

To develop the teacher's perspective on her students' meaning-making process, I explored different ways in which she (pseudonym, Ms. Miller), contributed to the educative quality of the overall experience for her students.

In this section, I begin with descriptions of Ms. Miller's actions in the classroom and during the field trip. Interspersed in the descriptions are her comments from the interviews. These comments are used to develop Ms. Miller's reasoning and point of view on her students' meaning-making process.

There were three teacher interviews: on September 13th before the field trip, on October 13th shortly after the field trip, and an interview after the field trip on December

6th that included more of Ms. Miller's comments on the field trip and her views on teaching science.

Ms. Miller's comments are presented in a narrative summary here with a focus on her actions and decision-making process for science lessons, her perceptions of teaching various subject matter areas, her actions and reactions during the field trip, and an interpretation of her perceptions of the field trip in terms of Dewey's characteristics of educative experiences.

Teacher Actions and Decision-Making Process for Science Lessons

During the lessons that I observed, Ms. Miller used a variety of teaching strategies. These included encouraging student questions, eliciting hypothetical thinking and reasoning, using analogies, listening and responding to student thinking, and commenting about the learning process.

Encouraging student questions. I observed a science lesson on September 27th in which Ms. Miller encouraged students to ask questions while she facilitated a whole class discussion. This class session on the solar system was dominated by a combination of student questions and references to the science textbook. Ms. Miller basically went around the room and answered every single question and/or listened to what the students had to say about the solar system. She also interjected some facts about the solar system into the discussion. In the midst of a discussion of sunrises and sunsets, a student asked about the consequences of going to the sun:

TE: The sun actually comes up in the east and goes down in the west…

ST: If somebody goes to the sun, would they be fried?

TE: Yes—it is extremely hot. You would burn to death. (Classroom observation, September 27, 2006)

The class discussion continued on to planets that are too close to the sun. Then Ms. Miller finished up the lesson with an interactive model of the solar system. She developed a kinesthetic experience for her students by asking students to model the movement of the earth around the sun.

Eliciting hypothetical thinking and reasoning. In a lesson on living and non-living things on October 31st, Ms. Miller designed an interactive activity that enabled students to think hypothetically and to justify their reasoning verbally. For this particular lesson students were given a word on a post-it at the beginning of the class session. Ms. Miller then made two columns on the board. She wrote *Human* at the top of one and *Pencil* at the top of the other. The students were then asked to place their post-it words in one of the columns and tell the class why they put it in one column or the other. Some examples of student word placement and reasoning: *Dog* was placed under *Human* because "They eat and act like humans."; *Chair* was placed under H*uman* because "Humans sit on them."; *Fish* was placed under *Human* because "It is a real thing."; *Shirt* was placed under *Human* because "Humans put on shirts." As the number of words on the board increased, the reasons evolved. *Dolphin* was placed under humans because "It is a living thing."; *Spider* was placed under humans because "It is alive.", as were the words *Horse*, and *Butterfly*. The word *Cereal* was placed under pencil because "It is not human."; *Basketball* was placed under pencil because "It doesn't have a mouth or legs or anything."

After all of the words were up on the board, Ms. Miller praised student work and then said, “Let’s take a closer look at these lists now.” She proposed that a few words were out of place and asked for student input. After several adjustments the words under each column reflected “living” and “non-living” things. After several tries at guessing what the headings for the columns should be, one student suggested correctly that the headings were “living” and “non-living”.

Ms. Miller recognized students for their work with frequent words of praise. At the end of this class she recognized student reasoning during placement of the words by saying:

> TE: And by the way (four student names), you guys hit the nail on the head when you said it was a living thing or a nonliving thing. I made a list as you were working. You all had features (speaking to the whole class), but those four students--- You got it! Good job! (Classroom observation, October 31, 2006)

This lesson is one example in which Ms. Miller developed an approach appropriate to the students’ current level of understanding of the topic. She was very concerned about what students were thinking and saying, and taught from that standpoint. In one interview, Ms. Miller indicated that creating a situation to increase student interest in the topic was a priority. As a second-year teacher, she was doing a lot of thinking about ways to meet her students’ needs and experimented with different strategies as ideas occurred to her. For example, she designed the class session on living and non-living things during the playground session prior to the science class to ensure student engagement in the lesson.

> TE: (laughing) Yes! A lot of times it just is: Oh, my gosh, what am I going to do? I can't do that today and then I come up with something in my head…I just come up with something in my head. And like: Whoo! We made it through!
>
> PP: Was it successful?
>
> TE: Living and non-living? Yes, it definitely was. And from there they went on and made posters of living and non-living things...They had a homework assignment where I gave them scissors and magazines. They had to come in with five or six pictures of living and five or six of nonliving. That also helped me to understand--Oh, do they really see what we are doing? Oh, it worked! (Teacher interview, December 6, 2006)

Not only was combination of teaching strategies new, but Ms. Miller determined that they were successful in further developing student understanding of the topic.

Ms. Miller valued hands-on activities for her students. In the following quote, she discussed her preference for hands-on work for the students in relationship to the complex vocabulary words in the textbook.

> TE: But umm, right now we are doing cells and I am trying to make everything as *hands-on* as possible. Because I mean, you and I have seen the book, and it is very enriched vocabulary, it is really tough. (Teacher interview, December 6, 2006)

Her teaching innovations seemed to derive from a combination of her knowledge of the students and pedagogy in general, and her own creativity and ability to develop different teaching strategies for a particular learning goal.

Using analogies. During the lesson on cell part functions on December 6th, Ms. Miller asked students to develop their thinking about cell parts in terms of their school parts, people, and functions, effectively enabling them to think in terms of an analogy. We talked about that lesson plan in detail, beginning with the vocabulary oriented worksheet:

> TE: Actually I did take that from the book. I think it was Monday, it was just fill in the blank. A blank structure… and they had to fill in the words from a model in the book. And then yesterday they had a substitute. They went over what the parts were and labeled them on the cell sheet and colored them in. And then today I was trying to go over it again and again, just to get it into them. Then I was trying to relate it to the school and I thought it will be more helpful for their understanding exactly what it is. 'Cause all those words. I mean all those words: it's a lot for them to take in.
>
> PP: So when did you decide to draw an analogy between the cell and its parts and your school and its people/locations?
>
> TE: I kind of thought of it last night and typed up a quick sheet about how we were going to do it. (Teacher interview, December 6, 2006)

This is another example of a beginning teacher building her pedagogical content knowledge through worrying about her students' learning and trying something that she thinks might help. Here she used an analogy to enable her students to understand functions of the parts of the cells through a comparison with a real setting, their own school. She made this decision in response to her concern that students would not be able to fully understand the cell function vocabulary words, and that her students would benefit from a different approach to the subject.

Listening and responding to student thinking. At other times, Ms. Miller indicated that she used what students said and common sense to come up with answers to questions about the subject matter.

> TE: I don't know, I just ask the students. I am not always sure about the answer either. So just listening to what certain people say, I am like--Oh, you really did hit on it! I'll take your definition. I'll steal their answer. I wait until I hear a really good one and I go "I like that!" (Teacher interview, December 6, 2006)

She described her strategy of listening to students and supporting their thought process during question sessions:

> TE: Sometimes I do it so that I don't tell anyone they are right. I am just, alright, I am picking six people and I want to hear what you are going to say. I am not going to smile, frown. You are not going to know who gave me the right answer. And they all kind of sum it up together… I like what he said about that and that kind of fits into what I am trying to think and so, sometimes, just to be silly, I'll say…(student) you were so far off, I don't know where you were. And they laugh and they know he was off but

they know that I won't say you are so wrong. Then it is not too bad that they are off. (Teacher interview, December 6, 2006)

Attending to her students' emotional status. Ms. Miller indicated that she dealt with the many different challenges every day, which affected her planning and implementation of teaching strategies. In response to my question about how she made teaching decisions, Ms. Miller said that it is almost always based on how things were going on a daily basis, or the *mood* of the students on any particular day:

> PP: What are your teaching strategies? How do you design the lessons?
>
> TE: Ok. Really, most of the time it is, like on my feet. Ok, this is how we are going to do it. A lot of times it depends on how the rest of the day has been, if it has been awful, oh man I planned this thing, then I don't think we can do it.
>
> TE: Plus I never know how they are going to react. So it is like-- Don't plan anything, 'cause it is not going to happen the way I want it to. They are winging it. I am going to wing it. And I try not to put them down…I mean like I am silly about it. I am like "no" but they know it is in a joking manner. You know and they understand. But they don't get discouraged about it. (Teacher interview, December 6, 2006)

Although Ms. Miller said that she does not plan anything here, I think that she is referring to her own priority on remaining flexible and responsive to her students every day, and the need to adjust teaching strategies as needed.

Commenting about learning processes. Ms. Miller was willing to be a learner alongside the students, and made statements about what she did and did not know openly to the students. Sometimes it seemed as if she was assisting the student learning process with these comments to make them feel comfortable that they were not the only ones learning about something. During the solar system class session opening comments she said:

> TE: This is not my favorite kind of science but I am learning to like it a little bit more.
>
> ST: I like astronomy!
>
> TE: Good! You can help us out with it...I need somebody to read that first little paragraph…Nice and loud. (Student?) Start under: How do the sun, earth and moon move?
>
> ST: (very quietly reading from the text: a little halting but not bad.)
>
> TE: (interjects the correct words. Student reads about five sentences.)
>
> TE: Ok stop there. Raise your hand if you think the earth moves. I didn't know that until I learned it in school. (Classroom session, September 27, 2006)

This was not the only time that I heard Ms. Miller reference her own learning process to help make her students feel comfortable with their processes of learning.

Teacher perceptions about teaching other subjects. After observing several science lessons, I wondered if Ms. Miller had a favorite subject to teach. We discussed her interest in different subjects during the interview after the field trip:

> TE: Math is my favorite. If I could teach it all day, I would.
>
> I am not a Language arts person by any means. And I get frustrated.

> Trying to teach them…sometimes I don't always fully comprehend everything that I read. Luckily there is a teacher's manual.
> Trying to get them to understand it is a real challenge. Like not only for me to understand, but then to kind of try to relate it, I mean… We were doing themes. Like *Character vs. Nature*. I was like: Oh, my gosh. Alright cartoons, that is how we are doing it. So my whole lesson was cartoons today. But that is the only way we will get *Character vs. Character*. But there is no way that we are doing stories. Oh, *Tom and Jerry*, *Character vs. Character*...And then we did *Character vs. Nature.*
> (Teacher Interview, December 6, 2006)

Based on her comments, it was clear that she really liked teaching math, but struggled a bit with language arts. She mentioned her decision to have students explore a language arts topic via development of cartoons. Later she said that it had been quite successful. This was particularly meaningful because of the very thoughtful episode with James at the end of the last interview. His reflective mood and decision to connect his field trip experience with the concept of a "Character in Nature" from his language arts class is evidence of the importance of reflection time for students.

Because she had indicated that math was her preferred subject to teach, I asked Ms. Miller if she taught math differently than science. She answered that she does not, and proceeded to list some of the things that work well in both subjects such as hands-on activities, manipulatives, and small group work with competitive exercises.

> TE: umm..Math. Yes, and no. I mean we do try to do hands-on things with manipulatives. But a lot of times it gets to be too much. They are like:

> "He threw a penny at me." And it becomes too much. They like to split up into smaller groups and I do a lot of boys vs. girls. You guys have to really try hard, and they like competition a lot…Coming up to the overhead is the coolest thing in the world. They come up there and they are like too cool for the class. (Teacher Interview, December 6, 2006)

Although she was not as interested in teaching science, she transferred some successful strategies from math to science.

Teacher Actions and Reactions During the Field Trip

Ms. Miller maintained a positive and enthusiastic attitude toward the field trip and this research study from the beginning of our work together. Even though she had never explored a forest and wetland area herself, she had chosen to take the opportunity of the field trip for her students as one that would provide the students with a positive experience. During the field trip, Ms. Miller participated actively with the students in the roles of teacher, chaperone, behavior manager, and learner.

Role of teacher. In her role as the students' teacher, Ms. Miller translated the site educator's comments and descriptions into terms that she thought would be more familiar to the students as needed. One example of this occurred as the boardwalk segment was beginning, and the site educator said that the mud was approximately thirty feet deep. Ms. Miller quickly interjected that thirty feet would be the same as five Mr. B's stacked up, to which the students responded with an OOOh!

When the students made comments that indicated insecurity, Ms. Miller responded with supportive and positive comments. One example of this action occurred during a conversation on the deck overlooking the wetland area:

ED: See that white bird?

ST: Are we going down there?

ED: We are going to go down on that trail down there.

TE: We are going to walk down there guys.

ST: Are we going to fall down?

ST: Are we going to jump?

TE: I am not going to let you go! (Field trip transcript, October 4, 2006)

The deck was about fifty feet above the wetland area, jutting out from the steep bank, so it was not unusual that students might be wary of standing on it.

Role of chaperone. While in the role of chaperone, Ms. Miller was very attentive to students and made sure that the students followed directions for each activity. The chaperones were periodically asked to assist student searches for items, and then to write students' findings on the worksheets provided to each chaperone.

During the first segment of the field trip, Ms. Miller's enthusiasm was visible and audible as she helped one student catch insects. The conversation between this particular student and Ms. Miller during this "insect hunt" segment of the field trip was punctuated by the student's concern that he hadn't caught anything yet.

ST 1: I didn't catch anything.

TE: You are going to catch something…

ED: You have a long time.

ST 2: I got something!

ST 3: Look what I got!

In a few minutes, Ms. Miller assisted student (1) in catching one insect, and then another.

> ST: Can I get another one?
>
> TE: That is a big one, isn't it? Are you still trying to find him a girlfriend? I don't think you will be able to find both! You might want to let that one go. This area is different with tall weeds.
>
> ED: Oh yes, that is a cricket with two tails, that makes it a boy. (Field trip transcript, October 4, 2006)

After hearing that he had a male cricket, the student decided he wanted to find the cricket a girlfriend. Ms. Miller assisted with the capture of the second cricket with lots of enthusiasm. Working together, the second cricket was captured by Ms. Miller and the student.

> TE: I got it! I got it! You ready?
>
> ST: oh…. (a failed attempt)
>
> TE: Let's try again. Ready?
>
> ST: Don't chop its head off!
>
> ST 2: What are you guys doing?
>
> TE: Okay the big one is trying to get out.
>
> TE: I didn't chop its head off. Oh did he leave? No he didn't leave yet?
>
> ST 2: We didn't catch any crickets.
>
> TE: He might stay in. Ok, the big one is trying to get out. Ok go-go-go! Here you go! Alright!
>
> ST: Now I got two in there! (Field trip transcript, October 4, 2006)

The effort put into this interaction is a good example of Ms. Miller's careful attention to her students' well-being. She made sure that her student had the opportunity to fulfill his desire to catch a pair of crickets.

During the next segment of the field trip, students were digging for soil samples, and the chaperones were asked to write down descriptive words suggested by the students for the soil. A competition of sorts was set up between the two small groups of students working with the chaperones.

> ED: Oh, look at that! These guys have eight words. How many do you have?
>
> ST: One. Two.
>
> ED: You guys (the other group) are winning.
>
> TE: (Asks her group of students to work on the word lists…) So, tell me about color, what color is this?
>
> ST: Brown. (Several minutes go by with students talking on top of each other)
>
> ST: We got four.
>
> ED: You got four. Okay. I am going to give you another minute or so to look at the soil. And we will start heading towards the forest.
>
> ST: It feels so ….cold…
>
> TE: Cold? Ok we will write down cold. (Field trip transcript, October 4, 2006)

Ms. Miller actively engaged students with questions that enabled them to explore the soil using their senses and to add words to the list.

Role of behavior manager. As behavior monitor and manager during the field trip, Ms. Miller made comments when necessary to make sure that the students were following directions and paying attention. These comments were relatively infrequent over the course of the field trip, and mainly consisted of keeping students moving in the correct direction.

Role of learner. As for Ms. Miller's personal reactions to the activities during the field trip, she was very open in showing different levels of excitement and interest in the activities and the observations of plants and animals. In the course of the interview discussions and during the field trip, Ms. Miller frequently mentioned her own reactions to the outdoor setting and animals found there.

During the first interview as we were discussing the prior year's field trips, Ms. Miller mentioned that she had never been to the nature center before last year, and actually was not sure what she and her students would be seeing.

> PP: So because it was *your* first field trip, when they were talking about bears and lions and you had never been out there, right? So you were probably in it together?
>
> TE: Right, I had never. It was their first time and my first time…so I was like….I have *no* idea what we are going to go see. I just know that we will be in the wilderness. (Laughter) (Teacher interview, September 13, 2006)

She easily recognized in this excerpt that she would be learning alongside her students, and was quite comfortable with that aspect of the field trip experience.

Teacher's Perspective on the Field Trip

Ms. Miller's contributions to the quality of the overall experience for her students stemmed from her knowledge of her students and her ongoing efforts to work with them from where they were. I present below her reflections on a previous field trip and then consider her remarks in terms of Dewey's attributes of educative experiences: continuity, active and passive elements, the interactive nature of experience, and subject matter connections.

Reflections on a previous field trip. During the first interview in September, Ms. Miller reflected on her prior year's experience during the field trip to the same site and expressed her goals and analysis of the field trip process that she planned to experience again with a new group of students. The following quotes illustrate both Ms. Miller's own personal response to the field trip the prior year and her impressions about the activities and student responses during that field trip.

> PP: So last year how did it go? You got the funding and then you went on the trip…What was it like?
>
> TE**:** You mean as far as like the site? For me it was a new experience, I am not an outdoors kind of person. So, I was like, oh my goodness! We are taking these kids out to the woods! Umm It was exciting. It was pretty cool. Umm, I think, I wish that it could last a little bit longer throughout the day. I just felt like it was pretty short. And it was like… oh! We only have this amount of time and then you go to the next place. I mean because a lot of these kids are, like, they don't get to see that. They don't get the exposure to the outdoors and the wetlands and the forest and stuff.

> (Teacher interview, September 13, 2006)

In her analysis the field trip experience was too short. Her concern about the length of time that students spent looking at things was too short due to their relative lack of prior experiences in a natural outdoor environment. She continued with this point, in particular mentioning time spent looking at the salamanders.

> TE:……….and it's like: Whoa! We have never seen this thing. So could we stare at the salamander for ten minutes because it is nothing like what we have seen before. Again back to that assumption that people have that these kids know what that is. Where really they could stare at the salamander for about ten minutes and think it was fascinating. So I just wish things could slow down a little bit. (Teacher interview, September 13, 2006)

Ms. Miller was very clear that she thought that the students would benefit from more time making observations during the field trip experience, specifically because of the fact that the experiences were new to them. She then reiterated her belief that hands-on activities would be the best way for students to experience the outdoors.

> TE: Other than that I think it was great! I love it! More like *hands-on*, though. They do a lot of walking and I hear a lot of crying. Maybe not going so deep into the woods, you probably have to see what you are going to see. Even if it is just the simple, you know like picking up leaves. I know they picked up leaves last year. These kids really love like manipulative kinds of things. (Teacher interview, September 13, 2006)

During all of the interviews, Ms. Miller responded at length to my questions, sharing her insights about the students in the classroom and during the field trip. Her critique of the prior year's field trip experience are examples of her concern for her students' learning process during the field trip. The following list is a summary of Ms. Miller's concerns about the field trip experience for her students:

1) She would have preferred to spend more time at the site.
2) The students do not normally have the opportunity for outdoor experiences like these, so this was special and very new to them.
3) As a result of the newness or "novelty," they reacted negatively at first, but then warmed up to the experiences.
4) She thought that the field trip itself is too rushed; that the students do not get enough time to look at things.
5) She would like to have more hands on work, including manipulation of items.

Continuity. This study included science classroom sessions specifically to see the ways in which connections to science content and process during the field trip were made by Ms. Miller and her students. However, during the science classes before and after the field trip, there were very few connections made between science topics in the classroom and the field trip by Ms. Miller. The class session that was led by the site educator and designed to orient the students and their teacher to the experiences they would be having during the field trip provided the main connection between contexts for the students.

One outside influence on science topics in the classroom was the county's "pacing" guide, in which the scope and sequence of topics were designated by the county.

In addition, science time was restricted due to a focus on teaching math and language arts in the school to meet the NCLB requirements.

Active and passive elements. The hands-on aspect was one active element of the field trip of particular interest to Ms. Miller. She indicated in the interviews that she wanted more hands-on activities for the students during the field trip. During the interview before the field trip, Ms. Miller commented upon her own active participation at the pond during the Spring, 2006 field trip with last year's class.

> TE: I know that (the *hands-on* activities at the pond with the prior year's students) lasted for an hour...but I think they would like to do it more. Because some of them were like, you know, even *I* got the bravery to touch a tadpole…It takes a lot to do that like…I am almost twenty-five and it took me a long time to touch a tadpole!..(Teacher interview, September 13, 2006)

I had observed that field trip, too, and the moment to which she was referring. The main activity at the pond in the spring was to dip nets into the edge of the pond water and catch animals living in that habitat. During the April field trip, Ms. Miller's students had caught different amphibians and insects, in the life cycle stages of tadpoles and larvae. Most of these critters were gooey to hold and touch, and Ms. Miller had had a hard time reaching into the nets to pull things out of it. But she had persevered, and finally was able to pull out a tadpole, as she had indicated in her description of the activity.

Ms. Miller was also interested in the sensory aspects of the field trip. During the September interview, she asserted that her own reaction to the animals was similar to the student responses and referenced student use of senses.

> TE: And you want them to touch frogs and spiders and stuff? It also doesn’t smell the same way that it does here. It just heightened their senses a little bit……….I feel the same way that the kids do…like eeuwh………….(Teacher interview, September 13, 2006)

She also indicated that she understood the students’ reactions completely, as far as touching the animals. In the following excerpt from the pre-trip orientation, Ms. Miller again mentions that she would not touch the salamanders.

> TE: They are cool (reference to the salamanders in a plastic box). They are neat…I personally wouldn’t touch them…..(students talking in the background)….They are real. She wouldn’t bring toys. (Student) you alright? (Classroom observation, September 29, 2006)

In general the rough, and potentially wet and gooey skin of amphibians, seemed to generate more reaction from everyone. In contrast, during the Fall, 2006 field trip, Ms. Miller enthusiastically helped students catch beetles and crickets.

Ms. Miller seemed to be aware of the need for time for the setting to “act on” the students in ways that are similar to Dewey’s thoughts about passive elements of educative experiences. After the field trip, for example, she shared her perception about how she thought the field trip went for her students.

> TE: I mean the group this year wasn’t able to handle things this year quite as well as last year. It was organized, but it was hard because (the site educator) wants them to be quiet and walk through…I understand why she wants them to do this. This is a field trip. But they haven’t seen a lot of this stuff before. The kids are like, I want to touch it…and the site

educator is like, come on, let's go, no talking…So it was tough…and knowing that I have a "behavior" group. (Teacher interview, October 13, 2006)

Ms. Miller thought the students would benefit from having more time at the site and longer time periods when they were involved with looking at animals that they had never seen before. She wanted her students to take and have the time to look at the sights made available to them due to the outdoor nature of the setting. She interpreted their tones of voice and body language and decided that they needed and wanted more time.

Time to look at things was very important to the teacher as evidenced by multiple comments throughout the interviews. In the following quote Ms. Miller referenced the prior year's field trips and the need for more time for students to look at things.

> TE: Umm I think…I wish that it could last a little bit longer throughout the day. I just felt like it was pretty short. And it was like… oh! We only have this amount of time and then you go to the next place. (Teacher interview, September 13th)

Then, during the post-field trip interview in 2006, Ms. Miller expressed her frustration that the students did not get enough time to look at things when they were found.

> TE: When we were looking for the turtle in the fenced area, the kids are more like: "We want to stay here until we find the turtle" and it is like, let them spend twenty minutes looking for the turtle because to them it is fun…as minute as it may sound…. They are excited…This is just pure excitement to see a turtle…for them this is like Whoa! A turtle! A real

> turtle it is not a stuffed animal? So I think just taking our time. (Teacher interview, October 13, 2006)

In this example, Ms. Miller recognized again that seeing a real turtle might be an unusual experience for her students.

Interactive nature of experience. In several different ways, Ms. Miller mentioned the sensory experience as an important part of the field trip for her students. The senses of sight, touch and smell were all discussed as part of student feelings and reactions to new experiences.

> TE: And it is hard, I guess. If you live near a pond or a creek and you are constantly in there digging and touching that stuff: that is cool to you. No problem. But half these kids don't even have a pet. So they don't even know what it is like to touch a dog. And you want them to touch frogs and spiders and stuff? It also doesn't smell the same way that it does here. It just heightened their senses a little bit……….I feel the same way that the kids do…like eeuwh…………(Teacher interview, October 13, 2006)

Ms. Miller frankly shared her own reaction to touching things during the field trip, creating a basis of understanding for the student reactions. She also recognized that not many of her students had pets. Thus any animals would stimulate their desire to touch them.

> TE: This is a field trip. But they haven't seen a lot of this stuff before. The kids are like, I want to touch it…………. And like the boardwalk, no one listens to it…We, umm the green tree frogs were out like crazy that day

> and let me tell you that was one of the biggest highlights of the trip was touching the frogs. And they just wanted to touch them….
>
> TE: Look at the frogs…All right everyone got a frog because that was cool, them actually being able to touch it. Look, you guys if you touch it, I'll touch it. (Teacher interview, October 13, 2006)

Ms. Miller continued to assert that the experiences were new to students and that touching the frogs was a special opportunity for her students. In her analysis, there should have been more hands-on activities and less walking during the field trip to maximize student interactions with found animals and objects. Her focus on these aspects illustrated her recognition of students' needs which were related to the fact that they lived in an urban environment. With fewer opportunities to explore natural environments in a city, the novelty effect at the field trip site was magnified, and affected the amount of time needed by students to absorb new experiences in the outdoors.

Her thoughts about the field trip afterwards echoed her pre-trip comments that the students needed to have fun and experience the sensory aspects of nature at a slower pace, and her desire for a little more flexibility as things happen during the experience. These three points summarizes her perspective on many aspects of the student meaning-making process during the field trip. It seemed as though she focused on the interactive experience and sensory inputs, with subject matter connections less important to her than the experiences of being outdoors.

Ms. Miller's knowledge of her students was based on a combination of her observations of them and her understanding of their lives. In our conversations, she periodically described a particular student's behavior in school and than added her knowledge about difficulties in their home lives that might contribute to their behaviors. She was very responsive to the emotional status of her students, which was evident during the field trip and in the classroom. During the field trip meadow walk, one male student was despondent because he had not yet caught an insect. She kept talking to him positively and then assisted him in capturing some crickets. Another student expressed fear of snakes during the introduction and she was right there calming him down. When a student was worried about being on the deck, she reassured him that he would not fall, that she would not let anything happen to him.

Another example of her quick responses to the status of the students occurred during the class session on October 30th, when she quickly determined that a male student needed psychological assistance beyond what she could do in the classroom. As she quietly talked with that student to figure out what was wrong, she quickly redesigned the lesson. She asked her students to work individually on the worksheet and monitored their work while simultaneously calling the office for help.

She knew that this particular group of students had some very difficult situations to deal with that had the potential to affect their attitudes and behaviors in class. With many of her students facing difficult situations at home, she continued to try to understand and support student emotional crises on a daily basis. This knowledge seemed to contribute to her need to try new strategies to help her students learn. For example, during the September interview, she indicated her view of the field trip experience for her students.

> TE: I personally don’t care about assessing them. Only because I think it is good to get them to get out and experience something that they have never

> seen. You know to show them that there is something besides the city. It is not all bad out there and see some positive things. Because a lot of their lives are … (pause) structured around things that are bad…For them to get out there and see that no one can hurt you out here…just have fun and relax. I enjoy it more for that reason. You know, to just let them get their worries away for a couple of hours and just be kids and touch dirt you know …do whatever..get muddy…giggle..just have fun! (Teacher interview, September 13, 2006)

Again, Ms. Miller indicated that she wanted her students to experience something new, different and relaxing, and to have a positive experience. However, after the field trip, Ms. Miller indicated that the field trip had not been as enjoyable as it could have been for her for two reasons, her concern about student behavior and the lack of enough time for student interactions with the animals in particular.

Subject matter connections. Although Ms. Miller had indicated in the first interview that she would make an effort to integrate the field trip subject matter into the science curriculum in the classroom, there were no references made to environmental science or the field trip during the science lessons that I observed in the classroom other than the introductory session run by the field trip staff.

During the interview after the field trip, she mentioned how difficult it was to make connections between the field trip and the curriculum because the county required that astronomy would be the first science subject for the school year.

> TE: And now it is hard because now they have changed the curriculum. They put astronomy in the first quarter. It is tough. That first quarter it is

> hard to make connections….so it is like you can't really fit that in with the field trip. It is just hard to make connections when you are doing the sun and stars…(Teacher interview, October 13, 2006)

She felt that connections with the field trip were not possible at first in September because of the need to begin with astronomy as the science subject.

In another interview, Ms. Miller indicated that connecting science subject matter content in the classroom with the field trip was complicated by not only the mismatch between the scope and sequence of subject matter mandated by the county and the field trip. Another factor was the reduction in class time spent on science due to the school's focus on math and language arts.

Ms. Miller discussed details of the ways in which testing affected science in the classroom, especially when teachers did not take the time to work on science year after year.

> TE: I know we are supposed to talk about ecosystems and stuff, but this year we haven't even covered wetlands yet as it is in the pacing guide during the spring…Then a lot of times with behavior I don't even get to science. Because that is one of the first things I weed out. We have to get reading and math and workshop in because I have interventionists who come in. Other than that if we make it, we make it. If we don't, then sorry…………But I know that next year is going to be different because they will have the state assessment test in science…. Now that it is going to be something! Then it has to be taught. But it is hard, because I know sometimes in our science curriculum…I have come across things and I am

> just as guilty of it….but previous teachers have skipped science…So when you get to something they (the students) don't have knowledge that they are supposed to have. So then we have to go back to catch up. Ok, you have to start the next thing because we have a benchmark coming up. It is almost like we can never catch up. So I think in a way having this state assessment in science is going to be good… It is going to force everyone to teach science so in first grade they can't skip science…They will have to teach it. (Teacher interview, December 6, 2006)

In her view, the upcoming state assessments in science would force teachers to spend more time on science in the classroom.

During the December interview, Ms. Miller described struggling with the difference between working with the text (subject matter out of context) and curriculum and going on the field trip (science content in context). She said that the animals and plants *seen* during the field trip were not the same as those found in the science textbook and that made it difficult for her to relate the field trip experience to the curriculum.

> TE: Yes, I think we do plan to go. I don't know sometimes when I am there, I don't see the connection with the curriculum…but then again our curriculum is so different. They don't really see what is in our curriculum there. You know it is really more like the plants and the bugs…You don't really see a bird--you see them flying…So it is kind of hard for them to see that there. I don't know. It is just, sometimes I think how does this relate to our curriculum? (Teacher interview, December 6, 2006)

Her discussion about this difference was an important reflective moment in that she addressed a basic difference between the two contexts that was problematic to her. These comments reflect her awareness that science in the classroom was quite different than studying science in context. Both points provide insight into her experience of the field trip with her students, and are important explanations for her perception about making connections between the field trip and science in her classroom.

Because she had emphasized hands-on work during the field trip, I asked her about it in the classroom. She indicated that she does not do it as much as she would like to and talked about the difficulties she encountered when trying to do hands-on work with the students in her class.

> TE: I don't do it as much, because of behavior problems…A lot of it is that they don't respect property. I might have them watch instead of having separate groups. Just following directions until we can establish that as a whole. Which I would love to have them do their own experiments, but just following directions is difficult. (Teacher interview, December 6, 2006)

Basically student behavior while working with materials presented a challenge that she had not yet solved.

During the interview after the field trip, I asked Ms. Miller to talk about her strength or weakness in science compared to other subjects. In my effort to not affect the study results, I did not place emphasis in our discussions on the fact that she made no connections to the field trip, but chose to talk with her about how she made decisions as she taught science using the county's science curriculum pacing guide. She indicated that she was not as strong teaching science as she was in math, that there was little time to devote to science, and that she really needed to devote the science time to the subjects designated by the county in the pacing guide. These subjects were the solar system, living and non-living things, and cells and the use of a microscope.

Summary of the Teacher's Perspective

Ms. Miller worked diligently to meet her own stated goals for the field trip. These goals revolved around her perception of her students' needs and learning processes in that she wanted them to primarily have a fun, hands-on experience. Her perspective on the field trip process was dominated by her own understanding of the content. Other factors that emerged as important to her process of making connections with science in the classroom were her limited depth of knowledge in environmental science, outside control of the scope and sequence of science topics, limited designated time for science in the classroom, and her relatively few years as a teacher. She overcame some of these problems by transferring pedagogical strategies from math to science and through her careful responsiveness to her students.

The Site Educator's Perspective

This section focuses on the research question: How does the site educator perceive the students' experiences during the field trip?

As with the teacher perspective, I discuss different ways in which the actions and decision-making process of the site educator (pseudonym, Ms. Freeman) affected the educative quality of the students' learning process during the field trip. Descriptions of Ms. Freeman's actions and interactions during the pre-trip orientation in the classroom and during the field trip are interspersed with her own comments from the interviews.

Deweyan characteristics of an educative experience are the framework for the interpretation of Ms. Freeman's interactions and actions during the field trip process.

Site Educator Actions and Decision-Making Process for the Field Trip

The field trip had been designed by site staff in conjunction with teachers' input to maximize the students' potential to have a positive and effective learning experience during their field trip. Ms. Freeman as the lead site educator had developed a routine that was based on her experience over years of educating the public via this venue. Over time, the field trip process had been repeated so frequently that education staff were able to be flexible and respond to any unexpected circumstances during a particular field trip.

Ms. Freeman contributed to the field trip design in many ways including overall organization and management of the field trip, facilitating group discussions and educational hikes in her role as site educator, scientist and naturalist, development of educational goals for the field trip including teacher input into field trip designs, and evaluation of the educational goals for the field trips. Narrative descriptions of these components are followed by a summary table of the components (See Table 5.2).

Organization and management of the field trip. Ms. Freeman had indicated several times that establishing good communication with the teacher was a fundamental part of the overall process. In addition to the field trip application, teachers filled out a survey about their preference for science content to be addressed by the field trip experience. The field trips were then designed by site staff to include these preferences, which were usually predicated by the school's science curriculum. Because many of the field trips originated in local schools, Ms. Freeman had become very familiar with the school curricula and developed different field trips to match science topics addressed in different grade levels. Ms. Freeman indicated that the teacher's "buy-in" to the field trip was crucial to the success of the trip.

> ED: When I look at my style of doing EE, I learned long ago that if you don't have the teacher's buy-in, it is not going to be a successful trip no matter what. (Interview, October 17, 2007)

She indicated that in her experience, just using good teaching strategies was not enough to ensure a field trip's successful outcome for students.

Roles as site educator, scientist and naturalist. Ms. Freeman played three different roles in her work that contributed to the quality of the field trips. As the lead educator at the site, she designed, implemented, evaluated, and promoted educational activities at the site. For this field trip, her understanding of the student population was based on prior field trips from the same school. She stated that the field trip activities were chosen to enable the students to experience the site, with less emphasis on content.

> ED: Just playing outside has nothing to do with studying the trees. So where does (the site) fit? I think we fit kind of in the middle. Overcoming some of the hurdles of being outside, but focusing on the science that we know. I think so. And then what happens, it is age and group appropriate, and with something like an urban school, you know that you are dealing with kids where the content is not as important as the experience. (Interview, October 17, 2007)

This reference to urban schools stems from her belief that students from urban areas have less extensive experience playing, exploring, and learning in natural outdoor environments than students who live in suburban and rural environments.

As a scientist, she had worked on different research projects at the site, designing research protocols, collecting data, and training program assistants and site volunteers to collect data. Marbled salamanders were the focus of one of her research projects. For this project, salamander movements on the site during the fall were being tracked. During the classroom session before the field trip, she referenced her work on this project the first time when she showed recently trapped salamanders with the class. Then during the field trip, when students were standing in the vicinity of the vernal pool where the salamanders laid their eggs, she mentioned the research project to the students again.

> ED: Now, do you remember in the classroom, I brought the marbled salamanders?
>
> ST: Yes!
>
> ED: This is where we find them…oh…. Let's get everybody back in the circle with feet frozen like trees. This is where the marbled salamanders on the rainy nights come out. *And* where they are going to be laying their eggs and some of you saw the post that says that BBC camera position? BBC is a film company that makes movies about nature…and they are coming out here to make a film about marbled salamanders. So that is where the camera sits. (Field trip, October 4, 2006)

As a naturalist, she was very familiar with the plants and animals that could be seen in the various habitats and shared many details about them with the students throughout the field trip.

Educational goals for the field trip. Ms. Freeman's dedication to developing interesting, age appropriate and meaningful experiences for participants during field trips was supported by her knowledge of ES and by her pedagogical content knowledge developed over many years of conducting field trips. In addition to leading field trips, she went into the schools and gave presentations the week before field trips to prepare students for their experiences at the site. These sessions in the schools served as advance organizers that prepare the students on multiple levels. Discussion points included what students should bring, wear, what they would be doing, what they could expect to see, and when they would eat.

Ms. Freeman's understanding of working with students at different grade levels was evident in her discussion points about moving from kindergarten and first grade level classes up. Working with students to develop their scientific vocabulary was also important to her.

> ED: Where is the science? Like the scientific method, and you do your background research, develop a hypothesis, you design a study, gather your data, etc? If you consider that process, how I look at a trip like this one is that it is the first step. Let's just gain some background information. If I was doing a kindergarten or first grade class, it is just being out there and gathering experiences. A little bit later on they can start making some hypotheses about what is going to happen to the trees for example. Just the process of making observations. Or the nature study just documenting what is out there. And sort of using vocabulary related to the subjects that we are doing to put a little more factual information in there. So that you get away from vernacular, even though I tend not to give them a name right away. There really are words to describe something. And the only

> way to get to the words is to make observations. (Interview, October, 17, 2007)

This excerpt is a good summary of Ms. Freeman's thoughts on her own educational approach to the field trip. She displayed sensitivity to developmental stages as she made educational decisions for the field trip. She also displayed her interest in teaching science through the process of making observations in nature and the use of scientific vocabulary.

Ms. Freeman indicated that she was interested in new developments in science education and made changes in the field trip based on those developments. She mentioned that publications of the National Science Teacher's Association (NSTA) had been particularly applicable to development of meaningful activities during field trips. She said that she reads mostly scientific journals, and that some education publications are not as easily applied to the study of nature and development of field trips.

> ED: The only one is through the National Science Teacher's Association. Of all the stuff that I read, they are the most interesting and have lessons that relate a little bit more to the outdoor setting. And it is because NSTA has a philosophy that is fairly easy to translate to the outdoors. (Interview, October 17, 2007)

The site educator thus indicated that she continues to explore science education literature, with the outdoor context in mind.

Student management techniques. Ms. Freeman had several favorite management techniques that she used consistently throughout the field trip when she needed the students' attention. One of these techniques involved asking the students to do five things.

ED: Okay, now I am going to ask for “Five”. You have to imagine that you are sitting down…What does it mean when we do “Five”? Your feet should be still…So what we are going to do hands and feet to yourselves. Also look at who is talking. Listen to who is talking. And don’t be talking. Those are the five..Your ears are listening, your eyes are looking and your hands and feet are still…(loud bird calls in the background).

ST: I want to go to the wetlands.

ED: Ok, I am going to ask for “Five”…you guys have already found some cool things and we haven’t even gotten away from the building! (Field trip, October 4, 2006)

This strategy was not only a management tool in that students’ attention was also redirected to their senses. As Ms. Freeman asked them to be quiet and use their senses, she helped students to focus their attention on the environment.

Field trip evaluations. Field trips at the site had been evaluated by site staff for the purpose of determining if any improvements were needed. Ms. Freeman mentioned that an evaluation of the field trips had been implemented several years earlier. Survey data were gathered from field trip participants, both teachers and students, as they left the site. As a result of this evaluation, the staff had decided to use different terminology during the field trips. They also decided to *always* do the boardwalk hike at the end of the field trip.

Ed: We asked the students after the field trip: What did they like and what did they learn? We got lots of great responses, but something they wished they had done or seen was that almost all of them wanted to see animals

> and wanted to take a hike. We also found that the boardwalk was always their favorite thing. No matter what we did, there was something about it. Instead of changing anything that we did, we decided to do the boardwalk at the very end, because it is so spectacular that no matter what else, they have a positive experience no matter what. And then we started making sure that we called everything an animal. (Interview, October 17, 2007)

In this description of the evaluation response, it is clear that the site staff were interested in participant responses and willing to make adjustments to the field trip based on those responses.

Table 5.2. Site Educator Contributions to Field Trip Design

Organization and management of the field trip	**Roles as site educator, scientist and naturalist**	**Educational goals for the field trips**
Preliminary communications with the teacher to plan the field trip; Choice of habitats visited and the order in which they are visited	Educator: Designs, implements, evaluates, promotes educational activities at the site	Interacted with teachers and participants to develop age appropriate, interesting, meaningful experiences for participants
Choice of student activities during the field trip	Scientist: Designs, implements, supports scientific research at the site	Used prior knowledge and experience to develop goals for field trips, while exploring current literature for new ideas
Use of behavior management techniques for the safety of the participants and the animals at the site	Naturalist: extensive knowledge of plants and animals supports educational and scientific explorations at the site	Employed results of informal critical analysis and formal evaluations to make changes and improve field trip experiences for participants over time

Contributions to Continuity and Development of Curiosity

Within the site educator's actions and philosophy there are many examples of her efforts to provide continuity and develop curiosity in the students as advocated by Dewey. She collaborated with the teacher, made connections to the school curriculum, reminded students of prior experiences, and provided repetition of vocabulary to instill curiosity about the subject matter.

Collaborating with the teacher. The site educator's intention to provide continuity and encourage students' curiosity was evident in her preliminary communications with teachers. She worked closely with them to design field trips on subject matter of interest to the teachers. She also made pre-trip visits to the classrooms to orient students to the site and to what they would be doing during the field trip. In order to ensure that field trips would be a positive experience, Ms. Freeman stated that reinforcing the teacher's intentions would ensure that the trip would be meaningful for students.

> ED: ….It involves knowing what the teacher is doing. You are reinforcing what the teacher is doing, so that it all builds toward something bigger. (Interview, October 17, 2007)

Ms. Freeman mentioned that most of the teachers worked well with their students to make connections between science in the classroom and science content related to the field trip. She shared one example where students had talked about how "wetlands are sponges" in class and then came to the site and saw a real wetland.

Making connections to school curricula. As noted above under educational goals, Ms. Freeman was aware of and tried to make connections to the school science curricula the students were likely to be studying at different grade levels. She was able, for example, to connect to Ms. Miller's students' classroom work during the boardwalk discussion, when she asked the students if they were studying the solar system and the moon.

> ED:……….It floods two times a day causing tides. Are you learning about the solar system and things like that? Well, the moon makes the tides. We are at low tide here. (Field trip, October 4, 2006)

This comment was based in her knowledge of the school curriculum and was designed to assist students in making connections with classroom science.

Prior experiences. In the following excerpt, Ms. Freeman references prior activities by reminding the students about the salamanders that she had brought into the classroom before the field trip.

> ED: I need everyone in a small circle and give me "Five."
>
> ED: Now… Do you remember in the classroom I brought the marbled salamander?
>
> Students: Yes!
>
> ED: This is where the marbled salamanders come out on the rainy nights in September. *And* where they are going to be laying their eggs. (Field trip, October 4, 2006)

The area where salamanders had been found was in the forest, in the vicinity of a large vernal pool. During the fall field trip, the pool was dry and covered with leaves. The only sign of the pool was an area of fencing that was used to trap salamanders moving toward the area where they commonly laid their eggs.

Repetition of terminology. Ms. Freeman quite frequently used scientific vocabulary and repeated particular words throughout the day as she made observations. The word and concept of *camouflage* were introduced repeatedly throughout the classroom introductory session and during the field trip. One example of the use of the term by Ms. Freeman follows.

ST: Oh look! Another tree frog!

ED: Look at how well camouflaged it is! (Field trip, October 4, 2006)

In response to the students' question during the opening segment about whether or not they would be seeing snakes during the field trip, Ms. Freeman introduced the concept of camouflage.

> ED: Animals that are nocturnal and that sleep at night are foxes, deer, rabbits, and beaver. Those are out during the night. We won't see those today, but the animals that are out during the day we will be able to see: birds, snakes, and spiders and sometimes frogs, sometimes toads. If we are lucky snakes will be out. But will we see them? The question is will we see them? Will you look for them? We will have to work really hard at it. (Field trip, October 4, 2006)

These comments set the stage for the day with a challenge about seeing animals that are well camouflaged, so well camouflaged that they might be difficult to see.

Active and Passive Elements of an Educative Experience

The site educator was very conscious of the importance of actively engaging the students in thinking about what they were doing and seeing. Ms. Freeman consistently modeled the processes of noticing and describing interesting aspects of the environment. During the interview after the field trip, she stated:

> ED: One of the things that I try to do with the bug collecting is a process. When they all want to know what something is or whenever they give me something, I always say something that *describes* it. Like, look at the antenna on this one. Or look at the color of this one and the shape of that one. Kids do know what they are looking at in terms of a beetle, spider, etc. After awhile I like it when the kid comes up to me and instead of saying “Is this an ant?”, they come over and say look it is a yellow striped one. They always want to know what something is, but they soon learn that I describe them before I tell them what it is. (Interview, October 17, 2007).

Ms. Freeman also discussed characteristics of an experience similar to Dewey’s idea that there is an active and a more passive element of an educative experience which can influence a person’s thinking in the long term (Dewey, 1916/2007). She stated:

> ED: …and that is where you get to…. You have to have kids have general experiences and later on they will put them to use.
>
> You know, all you can do is give them the experiences and just trust that when they are in their twenties…They will be making the decisions that you were hoping they would make.
>
> Sometimes that is what my general philosophy is. Even if they are not necessarily getting all of the information, it’s the fact that we are giving them something that later on they will be able to base their decision on

because they had that experience. So you make sure that the trip is *positive.* (Interview, October 17, 2007)

In addition to the educational goals for the field trip, Ms. Freeman also placed priority on the positive nature of the experience for the students and the potential future effects on their decisions.

Contributions to the Interactive Nature of the Experience

Ms. Freeman modeled how to use the senses to make observations about plants and animals for the field trip participants throughout the field trip. This modeling was the result of her decision to enable students to hear and see how a scientist would make observations in the outdoors. She particularly chose to make descriptive comments first, and then to name or identify the plant or animal. In addition, the investigative style of the field trip activities contributed to many opportunities for the students to find many different things and animals and then to hear many descriptions.

Ms. Freeman also made reference to environmental science concepts and/or particular words involved in the study of nature throughout the field trip. In addition, she demonstrated how to take care of plants and animals and shared her environmental education content knowledge in many ways. Descriptions of these categories of Ms. Freeman's interactions with students, and the environment, the quality of her expertise, and the frequency of these contributions are summarized in a table (See Table 5.3).

Modeling use of the senses. Ms. Freeman modeled making observations using a variety of senses including sight, touch and sound. In the following excerpt, she combined *listening* to the sound of the bird with the idea that it was so well camouflaged that it was difficult to *see.*

ED: I see it (the bird) all the way over there. (Points in the direction of a loud bird call). It is well camouflaged, isn't it? (More bird sounds. A student imitates the bird sound.)

ST: (Student makes a sound: rrrrrr rrrrrrr) I can imitate a bird call.

ED: …and hear this one. It is saying teakettle, teakettle, teakettle. teakettle….(Field trip, October 4, 2006)

In this interaction, the student took the initiative to imitate the bird call, and then Ms. Freeman modeled a common technique for birders in which a bird call is translated into word sounds.

Modeling use of descriptive words. The practice of making observations of animals and plants at the site using descriptive words was a purposeful strategy chosen by Ms. Freeman for field trips. She was very responsive to student findings and held animals so that students would have the opportunity to look very closely at them. The following excerpts were chosen as examples of the variety of descriptive words that were used throughout the field trip.

ST: What is this?

ED: Oh awesome! It is an awesome bug or something. Look at how really fat it is and really muscular…(Field trip, October 4, 2006)

Although some of the words were common vocabulary words, students may not have heard them used to describe animals and plants before. In the next example, Ms. Freeman compared animal tracks to dog footprints and human hands, modeling another common practice used by naturalists in identification processes.

> ED: And sometimes when you look in the mud you might see animal tracks and an otter's tracks are kind of round and look like a dog's footprints…but there are also footprints that look like a person's hand and that is probably the raccoon.…. there are footprints of the otter. (Field trip, October 4, 2006)

With these comments, Ms. Freeman drew the students' attention to areas of interest in the muddy areas next to the boardwalk. In the next example, Ms. Freeman focused on the colors and patterns of insects, with a fine degree of attention to detail in the structures and colors.

> ED: Look at how long and skinny the abdomen is!...With three tails… a girl…with three tails.
>
> ST: a grasshopper.
>
> ED: Look at that one with a white stripe down the back……
>
> ED: Look at this there is a really interesting dark insect hiding on this goldenrod. (Field trip, October 4, 2006)

Ms. Freeman thus modeled making observations clearly and repeatedly throughout the field trip.

Referencing prior observations. Ms. Freeman also contributed to the continuity of the field trip by referencing prior observations, asking students to remember things they had seen earlier during the field trip. For example, in the next excerpt from the end of the boardwalk, she reminded students of the very first green tree frog they had seen in the grassy area outside of the education center.

ED: Oh, look right there on that cattail. Yep, another little green tree frog. Remember we saw the green tree frog earlier? (Field trip, October 4, 2006)

Again, these actions provide examples of her support of student construction of knowledge by stimulating connections with prior experiences. The example also shows the site educator's interest in keeping the students actively thinking and remembering what they were seeing and doing.

Taking precautions for students and for the site inhabitants. The field trip process involved thoughtful preparation on the part of the site educators to ensure the safety of the field trip participants and the plants and animals at the site. Ms. Freeman made cautionary comments throughout the day to ensure student awareness and avoidance of potential hazards in the outdoor environment.

ED: We actually can touch a lot of things…but first you need to know what poison ivy looks like. Most people are allergic to poison ivy and itch, so we'll make sure that you know what it looks like. (Field trip, October 4, 2006)

Because students were encouraged to touch things as they explored the environment, the cautionary comments were necessary and also educational.

In addition to protecting students from potential problems, Ms. Freeman also talked about protection of the plants and animals at the site repeatedly, beginning with the pre-trip session. She emphasized that the plants and animals would be left at the site during that session. These ideas were then reinforced during the opening segment of the field trip.

> ED: Remember, we are not a zoo. So we are going to have to, if you see any animals, we probably won't be picking up most of the animals. Ms. Diane and I are going to give you a special opportunity to touch some of the animals. And of course we are not going to hurt any of the animals, are we? Even spider and ants or mosquitoes, worms…..(Field trip, October 4, 2006)

Students paid attention to these comments and respected the request to take care of plants and animals at the site.

Interacting with the environment and with each other. Ms. Freeman shared her depth of knowledge about the site, the habitats and plants and animals via her on-going discussion points throughout the field trip. This depth of knowledge had been acquired over her years' experience at the site as an educator, researcher and naturalist. In the following excerpt from the post-trip interview, she mentioned how she listens to bird calls all the time.

> ED: I hear them all and people are always amazed that I can hear them over the kids 'cause that is how I bird by ear and that is how I identify things whenever I hear them. It is part of my general way of being out there. (Interview, October 17, 2007)

This is one example of her expertise as a naturalist and her own description of how she interacts with the outdoor environment.

She also paid a lot of attention to students throughout the field trip, and made sure that interactions were possible during the boardwalk. Because the boardwalk was so narrow, Ms. Freeman gave specific instructions for how the group should interact with each other while making observations from the boardwalk.

> ED: We are going to be walking on this boardwalk. You can see it is very skinny and I don't want you to fall off. You will not pass anybody and please do not step off the boardwalk. So if we see something interesting up here, how will we let everyone in the back see it? We will quietly move past and let the person behind us know what to look for. So remember as you walk, do not step off the boardwalk… (Sound of crickets pretty loud… sounds of students walking on the boardwalk…) (Field trip, October 4, 2006)

Not only were students able to show each other what had been found, but they also had the opportunity and increased responsibility to make sure that everyone saw the plants and animals of interest. The following excerpt provides two examples of sharing of information from person to person on the boardwalk during the field trip as an otter hole and frog are observed.

> ST: Look at the hole. (very loud clicking critter sound)…
>
> ED: I see the hole. We think this is where the otter lives. Some people have seen the otter around here. Look at the hole here. The otter goes swimming in the water here. And sometimes when you look in the mud you might see animal tracks and an otter's tracks are kind of round and look like a dog's footprints…but there are also footprints that look like a person's hand and that is probably the raccoon.…. there are footprints of the otter. (Everyone is walking slowly.)

CH: Otter hole…

ST: That is supposed to be an otter hole…………

ST: An otter comes out of there. (airplane sound overhead pretty loud.)…

ST: (talking together a little louder as plane gets louder.)

ST: Oh, look a frog!

ED: Oh, look right there on that cattail. Yep, another little green tree frog

Remember we saw the green tree frog earlier?

CH: (pointing) On the top..

ST: Look at the frog…..(Field trip, October 4, 2006)

As a result of passing the information along to each other, students supported each other, and took the responsibility of sharing information very seriously. A sense of community was fostered as individuals shared information and shared their excitement down the line.

Table 5.3. Quality and Frequency of Ms. Freeman's Interactions with Students

Interactions with Students	**Quality**	**Frequency**
Modeling using the senses	As the field trip hike progressed from habitat to habitat, commented on plants, animals, etc.	Throughout the field trip
Modeling using descriptive words	Comments about found items were descriptive words based on the sensory characteristics	Throughout the field trip
Making connective comments	Mentioned prior observations, directions and situations	Periodically during the field trip
Making supportive comments	Positive remarks about student findings; gave clear instructions to support student work during the field trip	Frequently during student activities
Modeling and demonstrating how to take care of plants and animals	Described plant and animal characteristics in terms of their needs during human contact	Before discussions about plants and animals and before the field trip
Sharing content knowledge	Camouflage, nocturnal animals, what is a wetland?	Related to expectations about which animals would be seen during the field trip and why they might not be seen
Questioning	Asked students questions that: stimulated thinking about content (what do you think about _____?, why does this happen?), descriptions (Is it soft?, Does it smell like?), process skills (looking, hearing, finding), remembering (the marbled salamanders, the hickory nut)	Periodically during each segment of the field trip and presentations

<u>Contributions to Subject Matter Connections</u>

Ms. Freeman's expertise in environmental science facilitated development of a field trip that incorporated this subject. For example, she made connections to science content knowledge, such as the concept of camouflage and information about plants and animals at the site, as well as to processes of science such as recording findings, using tools, and describing and identifying findings. Because the habitats at the site provided rich diversity of plant and animal species to explore, the opportunities to make connections with the subject matter encompassed a wide range of activities and discussions.

During the interview after the field trip, we discussed her understanding of the fourth grade curriculum at the school and different ways to make connections between the curriculum and the field trip.

> ED: With (this school) it kind of works okay that they were studying what makes things living and nonliving. That is why we do it slightly differently. How do we teach cells? We can't, so I will just give them a meaningful watershed experience. That is to get them out there and not worry about content. Get them to touch things. (Interview, October 17, 2007)

We talked about different approaches, and she mentioned that in the second grade curriculum in the same county (and school) sometimes it was easier to make connections with the social science curriculum.

> ED: In second grade they studied communities and geography in the social studies text. I think there are different ways it should be connected with science. (Interview, October 17, 2007)

<u>Recording what is found</u>. Ms. Freeman gave instructions about what the students and the chaperones should do during activities throughout the field trip. In the following example from the beginning of the field trip, she mentioned that she liked to gather groups into circles for discussions, and described her vision for the job of recording that the chaperones were asked to do.

> ED: I am just going to tell you some of the equipment that we have. You'll soon find that I really like circles and we are going to include our grown ups…We should just get into a circle. And one of the things is that we want to record. And we have a couple of options. I am going to give your chaperones a job of recording your observations on a clip board. Now we will split up the group into two small groups, each working with one recorder…(Field trip, October 4, 2006)

Periodically throughout the field trip, the chaperones recorded descriptions and/or the names of plants and animals on the record sheet, effectively providing a record of what the students found throughout the day.

Using tools. For many of the field trip activities, students used simple tools that were chosen to assist their investigations of the environment. The first tools distributed to the students were little magnifying glasses for finding things in the grassy lawn area outside of the education center. Ms. Freeman modeled using the magnifiers and then assisted students with their first efforts at using them.

> ED: So what do you use magnifiers for?
>
> ST: I couldn't see it and now it is bigger!
>
> ED: Right! It is used to make things bigger. Now I want everyone to bend down and to look at small things and look at it with your eye and then look

at it with the magnifier. Look right by you. Look at a water drop. (Field trip, October 4, 2006)

The next tools that were given to students were little plastic boxes with lids that magnified what was in the box. Students were again asked to come into a circle and then were given the “rules” for using the boxes.

ED: I need everyone to come back into a circle here, and I need to give you equipment. (fairly loud cricket sounds in the background.. multiple crickets.)

TE: Come into the circle.

ED: You are going to get to use these boxes, but I need to give rules for these boxes. These are for small animals. You are going to be able to catch some animals with these. You are not going to be jumping and running, you will be moving slowly. And when you put the lids on, put it on slowly so you don’t catch the animals’ legs in the box. If you don’t want to catch animals, that is okay. When you get back to school you can write in your journal about what you saw today to tell your principal about the field trip. So I am going to give each one of you…after you look at insects that you find, share them with a couple of people. They will then have to be released in a safe place. Is the middle here where everyone is walking going to be a safe place?

Students together: Noooo! (Field trip, October 4, 2006)

The idea that students would catch insects, look at them and share what they had found with others was described by Ms. Freeman at the start of this segment of the field trip.

She simultaneously asked students to be careful of their insects and to write about their experiences in a journal, both suggestions to extend student learning and possibilities.

During the soil exploration, students used spoons to dig up some soil and then to describe the soil, using their senses. Ms. Freeman introduced the soil exploration referencing the development of lists of descriptive words.

> ED: Now (addressing teacher and chaperone): In your sheets, do you have something written about the plants and animals? How about the water and the soil?
>
> TE and CH: No.
>
> ED: I am going to give you a piece of equipment, and I want you to find something to write about the water and the soil. Okay, you can work in partners. I am going to give the equipment to your teacher and chaperone. Please work carefully. (Digging in her bag.) These are our soil spoons. I want you to dig in the soil, but I want you to come up with four different things about the soil, not about the insects but about the soil itself. You might want to talk about how it feels, how it smells, or talk about the color. (Field trip, October 4, 2006)

Students were initially reluctant to dig in the soil and seemed unsure of words to describe it. It took a few minutes of coaxing by the chaperones and site educator for them to come up with descriptions of the soil.

Describing and identifying findings. Ms. Freeman made a point of listing the words, *ooh*, *nasty*, and *gross*, which she did not want students to use during the field trip. Instead, Ms. Freeman suggested to the students that they should make observations of plants and animals and use descriptive words like *tall*, *round*, *flat*, *cold, hot, sticky*, *brown*, etc. Early in the field trip activities Ms. Freeman described the process of naming the things that would be found during the field trip:

> ED: Now, when you find things, are you going to know what it is called? If you don't, it is okay if you don't remember the name. Use words to describe it, the colors and shapes. Don't worry about calling it by name. (Field trip, October 4, 2006)

In addition to asking for descriptions of things found, Ms. Freeman indicated that naming the plants and animals was not as important as making observations. In the following excerpt, she modeled describing found animals. Her enthusiasm towards students is also evident.

> ED: ….oh cool! Look at how long and skinny the abdomen is! Awesome! It has with three tails… a girl..with three tails.
>
> ST: A grasshopper.
>
> ED: Oh yeh, oh look at that one with a white stripe down the back..Cool! Look at this! There is a really interesting dark insect hiding on this goldenrod. (Lots of student chatter in the background and the insect sounds are in the background…) (Field trip, October 4, 2006)

Ms. Freeman was very positive as she worked with students, and often exclaimed *Cool!* and *Awesome!* when students showed her what they had found.

In the next two excerpts, Ms. Freeman's knowledge of the environment is evident in her responses to students as she makes descriptive comments, and shares more information about a disturbed area with students.

ST:…a snake hole.

ED: Snakes don’t dig holes. Snakes might live in a hole. This one is shallow. This is actually where an animal was digging and I don’t see any signs of it but often you see their tracks around the hole. This is where squirrels were digging. Probably there was a nut buried here. Sometimes you find the shells around. I don’t see any today. (Field trip, October 4, 2006)

In addition to facilitating discussions with students, Ms. Freeman’s skill at catching and holding amphibians or reptiles was evident periodically during the field trip. In the following transcript excerpt, she describes a toad as she holds it carefully for students to see.

ED: There is somebody here. A toad. You can see its throat moving when it breathes. Did you hear it make the little chirpy noise? You have to be quiet. I am going to let him go.

ST: Bye…(Field trip, October 4, 2006)

As previously noted, Ms. Freeman made sure to model behavior with the animals that supported their survival after encounters with humans.

Summary of the Site Educator’s Perspective

The lead site educator’s prior knowledge and experience working with field trip participants over many years contributed to the development of a field trip that was embedded with Deweyan elements of an educative experience, including continuity, active and passive components, a focus on interactions with the environment and with each other, and the importance of subject matter connections.

Ms. Freeman's comments throughout the field trip targeted student development of observation skills, knowledge about the environment, and understanding of scientific terminology. The design of the field trip supported student investigations of the environment, resulting in more opportunities for them to use their senses in interacting with found items. Ms. Freeman also made periodic suggestions that enabled students to make connections with their prior knowledge and school experiences in science.

CHAPTER VI: DISCUSSION

The three different participant perspectives of the field trip were central to development of an understanding of the students' learning process related to the field trip. In Chapter V, I developed the viewpoints of the elementary school students, their teacher and the lead site educator for the field trip. Because the study was motivated by my knowledge of and questions about the effect of informal educational programs on learning, my perspective was also involved. In this chapter, I explore my own viewpoint of the students' meaning-making process from the classroom science lessons through the field trip and including the interviews. In the process, I reflect on the participants' perspectives and the ways in which what the participants said and did affected what I thought about the learning process.

Crystallization of data as described by Richardson and St. Pierre (2005) involves looking at the student experiences from different angles to create a deeper understanding based on multiple participant perspectives. In developing my own perspective, I brought together elements of the perspectives of each of the participants to create a depth of understanding of the actuality and possibilities of the educative process for students involved in the field trip. Because perspectives in this study were developed in terms of the Deweyan characteristics of an educative experience, the following discussion also centers on those characteristics.

There were multiple actors with different but congruent goals related to the field trip. From the site volunteer group's decision to enable urban students to participate in a field trip at the site, to the school and teacher's decision to accept and participate in the field trip, to the site educators' ongoing development of effective field trips, to my decision to study the overall effect of the field trip, the perspectives emerged with variation in actions taken. These variations all contributed to the students' meaning-making process based on their field trip experience.

Active and Passive Aspects of Learning

I chose to begin development of each of the perspectives on the field trip experience by taking a closer look at the active and passive elements of the field trip and the classroom. This choice was made deliberately because of the fundamental relationship between the actions experienced by the participants and the potential educative quality of the experience. Dewey (1916/2007) speaks to this relationship in *Democracy and Education* by stating that: "We do something to the thing and then it does something to us in return: such is the peculiar combination. The connection between these two phases of experience measures the fruitfulness or value of the experience." (p. 117)

In the two contexts of the classroom and the field trip, the active and passive elements differed and are described in summary here. Although the contexts involved students in qualitatively different active elements, the consequences of the activities resulted in quiet moments that represent the learning process described by Dewey (1916/2007) as: "When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something." (p. 117)

In the classroom. In the classroom science lessons, the teacher initiated discussions with questions, or asked the students to think about the topic and ask questions. Ms. Miller used a variety of support materials for the lessons that enabled students to participate and access information in different ways. Most of the time, visual and kinesthetic activities supported more text-based activities. For example, she projected maps on the overhead projector, had students portray the earth's movement around the sun in a kinesthetic model, and involved students in an interactive word sort. Textbooks were accessed periodically and students were asked to read aloud and to look at graphics in the textbook. Although the classroom was quite noisy at times, the students tended to get very quiet when they were thinking about their work and answering worksheet questions.

During the field trip. The field trip experience provided a mixture of active and passive elements. The active experiences involved walking for over two hours through multiple different outdoor natural settings, investigating the environment using different tools, making and listening to others' observations and participating in conversations in small groups about plants and animals. During the field trip there were many moments when students were "undergoing" the effect of the outdoors……such as when they listened to bird sounds…..the moments when they saw a beetle that they had not seen before……when they wondered if they would see a snake…..or decided that the puffball mushroom was very different and interesting to look at…….or thought about the field trip during recess after the field trip.

Continuity

Continuity across experiences plays a key role in defining an educative experience versus a mis-educative experience. An educative experience provides forward impetus into the subject matter (Dewey, 1938/1997). Dewey states further that it is the responsibility of educators to: "be aware of the general principle of the shaping of actual experience by environing conditions” and that they also “recognize in the concrete what surroundings are conducive to having experiences that lead to growth” (Dewey, 1938/1997, p. 40). As the viewpoints of the classroom teacher and the site educator became more apparent to me, it was clear that both supported development of experiences that would lead to growth for their students, but in very different ways.

In the classroom. In the science lessons that I observed, the classroom teacher did not make references to the field trip and the study of the environment. During each science lesson, Ms. Miller concentrated on a series of science topics in the county pacing guide and designated for study during the first three months of school that year. The subjects listed for the fall were: the *solar system*, the study of *cells*, and *living and nonliving things* (Teacher interview, September 13, 2006). During the lessons that I observed, the teacher addressed each science topic as a discrete topic for discussion, and did not make connections between topics.

Although Ms. Miller had indicated in the first interview that she would try to connect with the subject matter of the field trip, she did not make any explicitly stated content connections with the field trip during the lessons that I observed. In addition the students indicated during the interviews that they had only discussed the field trip briefly the day after they returned to class.

As I experienced the classroom observations before and after the field trip, I saw no explicit connections being made to the study of the environment, or environmental science. As a result of this experience, I began to think about the whole learning process in a different way, beginning with an exploration of the teacher’s perspective. Connections with the subject matter were important to me because of my passionate interest in the environment and because of my own experience developing educational programs outside of formal education systems. In my experience developing programs for use in formal school systems, contact with the teachers had been fleeting at best. Now I was experiencing a reality check on the ways in which teachers think about studying the environment and/or making connections with environmental studies during field trips.

Several studies of field trips reviewed earlier differentiated between novice and expert teachers' approaches to field trips (Schneider, 2003; Tal, 2001). Recognition of the difference between novice and expert teachers also is found in science teaching literature. Barnett and Hodson's (2001) analytical point that expert teachers are better equipped to make connections across topics also was relevant to my discovery of lack of connections in the classroom and spoke to the fact that the teacher in this study was just beginning her second full year as a teacher.

Keeping this in mind, I revisited Kisiel's (2003) study of teacher motivation. In that study, most teachers said that they would make connections to the subject matter, but Kisiel found a wide range in what the teachers meant when they said they would make connections with the subject matter. Ms. Miller's intention of making connections and implementation of that intention was consistent with a more general connection to subject matter that was explicated in Kisiel's study. In my estimation, the connection was so general that, in practice, the field trip became another science topic. The subject of environmental science as presented during the field trip thus resembled the science topics in the county pacing guide.

However, even though Ms. Miller did not make science content connections with the field trip, I think that students benefited from Ms. Miller's teaching style. She created continuity in the classroom through her improvisational style, using different teaching strategies chosen to engage student interest. The students were also influenced by Ms. Miller's enthusiasm and willingness to participate during the field trip. This enthusiasm was evident when I first met her during the Fall, 2005 field trip to the same site.

Several of the science lessons designed by Ms. Miller illustrated her developmental process as she borrowed from past experiences and knowledge of teaching strategies to develop lesson plans that would effectively engage her students in learning. According to Barnett and Hodson (2001) this transfer of pedagogies is part of the developmental process for teachers as they become more experienced and move from being novice to expert teachers. Ms. Miller's improvisational style of developing lesson plans quickly in response to what was happening in the classroom are similar to Barnett and Hodson's (2001) descriptions of teachers as *bricoleur* or improvisers.

For example, Ms. Miller described trying new things on the spur of the moment in response to her students needs (Teacher interview, December 6, 2006). During two science lessons, observations five and six, Ms. Miller implemented teaching strategies that she had designed specifically to engage her students differently in science. These strategies were not completely inquiry-based, but did engage students in interactions other than with the teacher as the expert. Ms. Miller also used questioning strategies in the classroom to encourage students to talk about their own ideas in spontaneous ways, and created a psychological comfort level that was transferable to the context of the field trip.

During the field trip. From my perspective, continuity within the field trip was developed by the site educator's intentional repetition of particular pedagogical strategies. These strategies involved the use of similar investigative educational activities, repeated use of terminology important to developing an understanding of plants, animals, and their characteristics in the environment, and persistent development of the science process skill of making observations through modeling and repetition of terminology. The pre-trip orientation meeting with the students functioned as an introduction to the site educators, who then introduced the students to what they would be doing and what they should bring to the field trip the next week. The salamanders functioned as a stimulant for student curiosity about their future experiences during the field trip.

Ms. Freeman deliberately and explicitly provided students with multiple skill-building opportunities, which contributed to the continuity of interactions within the overall field trip experience. The multiple processes of investigating the environment, finding things, and hearing interesting information about what was found contributed to development of the students' curiosity as suggested by Dewey (1938/1997).

All perspectives: On camouflage and snakes. It was only after I worked through the observation and interview data from all of the participants that a high frequency of mention of camouflage and snakes became evident as a pattern in the data. This high frequency contributed to the continuity within the field trip and supported the students' meaning-making process.

In Appendix E, I have compiled the data from all observations and interviews related to camouflage and snakes into a narrative description. The student and teacher actions and perspectives on this theme are included in the narrative as examples of different ways in which students were engaged in investigating the environment and developed curiosity about camouflage and snakes.

All of the participants were actively involved with camouflage and snakes in some way during the field trip experience. Ms. Freeman played a leadership role as she repeatedly used the term *camouflage* in reference to finding animals, particularly snakes, during the field trip.

During the student interviews, *camouflage* and snakes played prominent roles in the students' discussions about the field trip. Evidence that the students had listened and understood the discussions and meaning of the word emerged during the student interviews as they talked about their experiences during the field trip. The importance of a reflective process after a field trip experience was clarified during the interviews due to particular moments when students made connections with their prior knowledge.

During the interview of the second group of four students, the word camouflage was mentioned right away. We proceeded to spell the word out on the board at the beginning of the interview. I assisted in the spelling at this point. At the end of the interview, Lynda took the initiative and wrote camouflage again on the board, spelling it correctly without assistance. This was evidence of her persistence and high level of interest in the discussion about the field trip.

The two *snake finders* also had participated in that interview and decided to draw a picture of the field trip together. They drew a picture of two snakes curled around a tree, just as we had seen them during the field trip. As the drawing process progressed, the students debated the color and shape of their snakes in the picture. When Ade openly disagreed with the other student's color choice of *peach*, the other student, Niles gave in and gradually changed the color to grey. When I asked Niles why he wanted to use those colors, the student replied that it was a *coral* snake, providing evidence that during his thought process he had accessed prior knowledge or experience of snakes, even though he knew that the snake was not a coral snake. In relating the current experience to an older one, the student was able to articulate the facts and ideas, part of a process of "opening new fields which make new demands upon existing powers of observation and of intelligent use of memory" (Dewey, 1938/1997, p. 75).

There was a range of activities and thought processes related to camouflage and snakes for the students, their teacher, Ms. Miller, and the site educator, Ms. Freeman. The frequency of mention provides evidence of the continuous character of the field trip. These experiences affected students as they actively engaged in the field trip, classroom, and interview experiences and contributed to their discussions about snakes and camouflage.

Interactive Nature of the Classroom and Field Trip Experiences

In the two contexts of this study, the classroom and the field trip site, the physical environments were quite different. However, Dewey (1938/1997) suggests in *Experience and Education*, that the physical environment should not be considered alone: "The environment, in other words, is whatever conditions interact with personal needs, desires, purposes, and capacities to create the experience which is had" (p. 44). Thus, there were other conditions to consider beyond the environments of the classroom and the field trip.

In the classroom. The setting was a traditional classroom setting, without any additional science-related tools, animals, plants, or projects sitting around the room. The interactions in the classroom science lessons involved the teacher, the students, texts, worksheets, maps, and the blackboard. The teaching strategies employed by Ms. Miller varied from lesson to lesson, and often involved whole class discussions. One consistent element of the lessons was Ms. Miller's questioning strategy. She often encouraged students to talk about their own ideas in spontaneous ways and asked both open and close-ended questions. I think that her frequent questions created a psychological comfort level for learning that was transferred to the context of the field trip. In addition, students were encouraged to talk together in-class, providing some scaffolding for the process of "thinking out loud" during the field trip (Chin, 2007). Evidence that students were comfortable included the students' willingness to participate and ask questions during their explorations.

Another consistent element of the interactions in the classroom was Ms. Miller's concern and careful response to the emotional status her students. During the interviews, she repeatedly discussed her observations of her students' emotional well-being and her daily decisions that were based on how the students were doing on each day. This concern played an important part of her classroom knowledge, which involved her interest in and knowledge of her students (Barnett & Hodson, 2001). She was very responsive to the emotional status of her students, in both the classroom and during the field trip.

Ms. Miller recognized the constraints of the urban environment in which her students lived. Her belief that the students in her class did not have background knowledge in a more natural outdoor setting such as a woods or wetland area played a role in her choice to participate in the field trip. This belief was corroborated when she first talked with the students about the field trip, and they said that they expected to see bears and lions.

During the field trip. The field trip was designed to ensure that students would have ways to interact safely with animals and plants in each habitat that they explored as they hiked through the outdoors. Students were encouraged to explore the environment in small groups, which encouraged conversations among the students and the chaperones. These conversations were punctuated by directions and discussions with Ms. Freeman. Students asked questions freely of both the chaperones and Ms. Freeman.

Sometimes students worked individually to find animals, and periodically they worked together as they made observations about what they had found. The frequency of interaction throughout the field trip probably varied by individual, but in general the students were very responsive and interested in doing things and in interacting with others. They also were relatively responsive to the “rules” which Ms. Freeman asked them to follow throughout the field trip, for their own safety and for management of group behavior.

Relationship between the context of learning and the senses. The use of the senses had greater depth during the field trip experience, with students responding to a wider range and variety of visual, auditory and tactile stimuli. These stimuli varied as the landscape progressed through a variety of habitats and environments. Even the education center had unusual visual and tactile opportunities.

Visual aspects. The teacher placed an emphasis on the sensory experiences of the students during the field trip in describing her expectations that they should have hands-on experiences and be given ample time to touch things. During one interview she focused on visual aspects of the subject matter in the textbook and compared that to what was actually *seen* during the field trip. She said that if students were *seeing* the same things in the textbook and during the field trip, it would be easier for them to make connections. This emphasis on visual perception is related to the way that textbooks used in classrooms are designed for students to create concepts of the world through visual representations that are out of context (Denzin, 1995). This type of learning contrasts with seeing and hearing and touching animals where they live, which is what happened during the field trip.

Tactile aspects. While analyzing the data and reflecting on the list of words repeatedly banned by the site educator, I noticed that they were reactive words such as *ooh*, *yuck*, and *eeuwh*. These words are reactive words to something seen, touched or smelled, such as amphibians and reptiles with wet, bumpy, gooey skin surfaces. The site educator had indicated that these types of words were fairly frequently heard at the site in the course of an entire field trip season. Site education staff also indicated that another motive for banning the words was that they wanted field trip participants to begin to use more descriptive, less reactive, and more scientific words.

During many of the field trips that I had observed during the pilot study, there were times when the banned words could be heard. During this study, one student thoughtfully asked if anyone had used the words that day. I interpreted his question as an indication that he had been sensitized to their use. This is evidence that the ban on particular words probably affected his thought process. But it also raises the question of what he learned from the ban. Based on the students' extensive use of descriptive words during their interviews, the exercise of the site educators' modeling the use of descriptive words and simultaneously providing a boundary for the use of reactive words seemed to have been an effective strategy.

The interactive nature of the boardwalk segment of the field trip from different perspectives. The walk on the wetlands boardwalk occurred at the end of the field trip, lasted about thirty minutes, and included many stops to make animal and plant related observations. During this part of the boardwalk, students looked, listened, and touched plants and animals while participating in discussions about the plants and animals.

Ms. Miller mentioned during the interviews that she thought her students had seemed bored by the time they were walking on the boardwalk the prior year, and that there was not enough hands-on quality work by that point in the field trip. I asked how she had determined that the students were bored. She said that her conclusion was based on their body language and extra chatter as they walked along. She wondered if there should be more *hands-on* work at one of the other habitats in place of the boardwalk.

These analytical thoughts are part of the teacher's viewpoint about the field trip process for her students. Ms. Miller also indicated that the boardwalk experience had been her least favorite. In addition to her concern that students were bored, she also wondered if the site educator's discussion points were at too "high a level" for students to understand. This comment is an example of her concern about her students' meaning-making process during the field trip.

However, in the very next sentence, Ms. Miller also recognized that the green tree frogs found at the end of the boardwalk were quite exciting for the students and for herself.

> TE: And like the boardwalk, no one listens to it…We, umm the green tree frogs were out like crazy that day and let me tell you that was one of the

> biggest highlights of the trip was touching the frogs! And they just wanted to touch them….(Teacher interview, October 13th)

These comments about students being bored on the boardwalk contrasted with the fact that during the student interviews, the students discussed many of the animals and plants found along the boardwalk enthusiastically and in great detail (Student interviews, October 13, 17, and December 6, 2006). Even though students *seemed* bored to the teacher, the evidence during the interviews suggested that they actually had been actively involved in using their senses of sight and hearing on the boardwalk. They remembered and made connections among many details of the plants and animals discussed and seen during the boardwalk segment of the field trip.

Because the teacher repeatedly described her perception of student "boredom" on the boardwalk, and because students did not indicate in their interviews that they had been bored, I began a long process of reflection about what really was happening on the boardwalk. As a result of much thought about the situation, I realized that the teacher's position in the line on the boardwalk may have played a role in her assertions that the students were not interested in the boardwalk experience. Because she was at the end of the single file line of students and unable to interact with more than a few students directly, she was more limited in her interactions with students than at other times during the field trip.

This lack of access to the students was quite different from prior interactions with students during the field trip. All day she had moved among the students, and had supported their learning process through encouragement and directions. As I thought about her perspective, I realized that it was possible that Ms. Miller's idea that students were bored on the boardwalk really stemmed from the reduced amount of interaction between herself and her students on the boardwalk.

The predominance of the use of senses, especially sight, sound, and touch affected the boardwalk experience for everyone. In addition, the experience on the boardwalk was less dominated by activity and more dominated by passive elements in which the participants were "undergoing" sensory inputs during the boardwalk hike. The single-file line of participants and the abundance of different habitats and unusual plants and animals along the boardwalk made the experience less interactive among humans. The quality of the boardwalk experience thus may also have affected prior field trip participants, who had ranked the boardwalk experience as the most *interesting* part of the field trip.

Ms. Miller's reflective thought process about the field trip included her ideas about the need for more time for the students as they looked at particular plants and animals and more *hands-on* activities, especially on the wetland boardwalk. Through these comments, she was critically analyzing the entire experience for her students in order to make it the best possible experience for her students. During the last interview, I asked her if she might want to participate more actively in the planning process for the next field trip. Her response was not immediate. After a reflective pause, she indicated that she might be able to work differently with the site educator on future trips, but would have to think about it. I interpreted the tentative quality of Ms. Miller's response as a reflection of her status as a beginning teacher unsure about the science content knowledge related to the field trip. I also think that she appreciated the leadership and depth of knowledge about the site of the site educator during the field trip instructional process.

Subject Matter Connections

In general, I did not observe explicit subject matter connections between the subjects addressed during science classes and the field trip. The exception was the session taught by Ms. Freeman, the site educator, just before the field trip. Ms. Miller's science lessons were very focused on particular science topics during the lessons that I observed. In addition it seemed as though the science topics were so different that it was difficult to relate them to each other, let alone the field trip.

Ms. Miller had indicated that it would be difficult to coordinate with the science curriculum in the county's "pacing" guide for science. During the interview before the trip, she said that the subject areas closest to the field trip were ecosystems and cell biology. Her situation reflects the current status of removal of curriculum control from teachers to more centralized control that is a frequent practice throughout the United States (Barnett & Hodson, 2001).

Although Ms. Miller had indicated in the first interview that she would try to connect with the subject matter of the field trip, she did not make explicitly stated content connections with the field trip during the lessons that I observed. Students indicated during the interviews that the field trip had only briefly been discussed the day after they returned to class.

Ms. Miller's statements regarding making connections with a field trip are similar to what other teachers have said about making connections between a field trip and the curriculum (Kisiel, 2003). In Kisiel's study, making curriculum connections was stated most often by teachers, but the meaning of that statement varied from explicit subject matter connections to experiences related to the curriculum. Kisiel mentions that the pressures faced by teachers to adhere to specific curriculum topics often are too great for explicit subject matter connections to be made. In some cases, teachers need to justify field trip time out of school and expenses, and thus might make a global statement that is difficult to follow-up on due to the range of topics to be covered.

Another factor may have been that Ms. Miller was generally uncomfortable teaching science content. Even though Ms. Miller's personal content knowledge of science was not strong, she indicated to me that her first response to the opportunity to take her students on the field trip, was: "Sure, why not", even though she had never explored a forest and wetland area herself.

Both Ms. Miller and Ms. Freeman shared with me their personal understandings that students from urban areas, who may not ever have experienced a forested or wetland setting on a river before, might have difficulty focusing on "learning goals" during the field trip. Because of this concern, Ms. Miller stated that her goal in taking the students on the field trip was to "enable them to experience something different and to have fun outside". She was very interested in student responses to things that were new to them and suggested that more time allowing the students to just look at things during the field trip might be more important than moving through the different habitats. She also stated that even though these subject areas were to be studied, the fact that the students are not reading on grade level was problematic to coordinate with the field trip subject matter for the wetland and forest.

Both educators involved in the study held the belief that the African American urban students had a deficit of outdoor experiences. However, I had found during the pilot study that many of the urban students had prior experiences in the outdoors with their families. Frequently the memories were linked to visits to see grandparents who lived outside of the city.

Within this study group, there were several students who talked about their prior experiences with animals, the outdoors and their families. During the interviews as students talked about their prior experiences, they made connections between the field trip and those experiences. Thus, assumptions that students from an urban environment do not have any prior knowledge of the outdoors may not be true. These assumptions might stem from euro-centric biases described by Carol Lee (2005) on the value of prior knowledge of young, African American students, contributing to beliefs that their lives are deficient in different ways.

What was the subject matter? Environmental Education? Environmental Science? Or Nature Study? Incorporation of environmental science into the educational effort at the site was one of the criteria for my choice of the particular site and educational field trip. I wanted to explore a field trip during which the environment was studied through explorations that incorporated the scientific process to develop an understanding of the ways in which education about the environment were approached by both informal and formal educators. It had been my observation that there is a complexity to educating about the environment that does not always result in explicitly stated environmental science learning objectives. For this particular site, the informational brochures and field trip descriptions used both environmental science and environmental education to describe the educational opportunities at the site. In the site's newsletter, natural resource conservation and naturalists were also mentioned frequently in reference to activities and research at the site.

Environmental science was implicit in the site educator's understanding of the environment, her depth of knowledge of science education in the pedagogies employed during field trip activities for the students, and her interest in the natural environment. Her experience as a "naturalist" interested in the study of nature was implicit in her passion for understanding the habitats at the site. However, Ms. Freeman did not frequently use EE, ES, or nature study in her discussions with the field trip participants. She mainly modeled the science process skill of making observations and discussed details about the habitats, plants and animals during the field trip.

Ms. Miller also did not discuss this particular field trip using the terms EE, ES, or nature study. Ms. Miller's goals for her students tended more towards developing their experience in the natural world, with a focus on hands-on and sensory inputs.

Without explicit connections being made between the field trip and classroom science, it was difficult to see any continuity between the experiences in terms of the subject matter. As noted by Dewey (1938/1997), the teacher plays a crucial role in leading the students into the subject matter related to an experience, and there was little evidence of this happening surrounding the field trip. However, there was continuity in the science content connections made between the pre-orientation lesson in the classroom preceding the field trip and the field trip.

On Science Teaching and Learning

Even though the teacher's interest in teaching science in general was not as high as it was for other subjects, Ms. Miller transferred her knowledge of different teaching strategies in other subjects into her science lessons to ensure student engagement in science. This transference was mentioned in Barnett and Hodson's (2001) analysis of good science teaching, in that teachers can and do transfer teaching pedagogies from one context to another as they move from being novice teachers to expert teachers of science.

The interviews were replete with Ms. Miller's comments about her understanding of her students' existing knowledge. She was particularly interested in presenting subject matter in different ways to ensure student interest, engagement and motivation. Thus, in this study, although the classroom teacher did not have deep understandings of the subjects of EE, ES, or nature study, she was quite supportive of the learning process of her students throughout the field trip process. She modeled engagement with the environment and plants and animals throughout the field trip, and actively engaged and supported students during their explorations. In addition, she worked to develop science lessons in the classroom that incorporated teaching strategies beyond the text and associated worksheets.

With Ms. Miller developing her expertise in the use of different teaching methods over time, it is possible that her comfort level with science teaching and content areas will grow. Floden (1997) argues that if the process of inquiry is incorporated in the classroom, the dynamics surrounding the teacher's content knowledge changes. With students interacting independently while they ask questions and solve problems together, the need for the teacher to have greater depth of knowledge is significantly reduced

(Floden, 1997; Crawford, 2000). A greater range of roles for the teacher becomes possible during inquiry-based lessons: such as fellow researcher, modeler, mentor, collaborator and learner (Crawford, 2000). Inquiry and project-based learning strategies were not evident during this particular field trip, but the potential for moving in this direction is a possibility that could be explored for future field trips, by either or both site and classroom educators.

The constraints on science time in the classroom due to local, state, and federal curriculum mandates was another factor that affected the connections or lack of connections with science content related to the field trip. With heavy emphasis on math and language arts evident in the daily classroom schedules that I observed, there literally were very few minutes to devote to science and social science, both topics that are relevant to EE and ES. In addition, the classroom teacher's understanding or lack of understanding of how, when and where she might make connections between the field trip and textbook topics was also affected by the ill-defined nature of EE/ES and overlap with the social sciences.

The problems faced by the classroom teacher related to the content of this particular field trip were not unusual. Tal (2001), for example, found that even experienced teachers were not comfortable with the science content needed during an outdoor field trip learning experience. In some studies, lack of content knowledge has been associated with teachers asking fewer open-ended questions and maintaining tighter control of the content discussed (Carlsen, 1991). In Howes' (2008) analysis, another factor that affects the quality of science content negatively in elementary classrooms in the US is the lack of time afforded to elementary teachers for planning and preparation.

Student learning process. During the interviews, the students shared their memories of the field trip in detail, often describing the plants and animals based on their observations of size, shape, color and characteristics. These descriptions provided evidence that students had benefited from the repetition or continuity of subject matter and the science process skill of making observations that were presented and modeled within the field trip. This high level of retention of knowledge contrasts with Knapp's (2000) study of the effect of a field trip. In that study, students did not retain content knowledge about the plants they had studied during the field trip, at two different time intervals (one month and eighteen month) after the field trip. In both this study and Knapp's study, students were very positive about their field trip experiences.

Scientific observations and reflection time. Although the results of the student interviews suggested that the students were fully engaged with their senses on the boardwalk and during the field trip, the importance of reflection time after an experience was also evident during the interviews. In this case study, the process of the interview provided the students with an opportunity to reflect on their field trip experience together, to discuss the field trip guided by the research questions, to write about the field trip, and to draw a picture based on their experience during the field trip. Dewey (1916/2007) explicates the relationship between reflection and an educative experience as:

> Thought or reflection, as we have already seen virtually if not explicitly, is the discernment of the relation between what we try to do and what happens in consequence. No experience having a meaning is possible without some element of thought. (p. 121)

Howes (2008) suggests that reflection is important to student meaning-making in her analysis of student science observation skills. She suggests that development of observation skills does not necessarily make the experience an educative one. Howes (2008) recommends that there be follow-up in terms of drawings, reflections and discussions to complete the experience of making observations.

The importance of a reflective thought process to one student's meaning-making process emerged during the second interview with James two months after the field trip. James, who I had observed to be normally very voluble during class, the field trip, and the interview, remained very quiet as he was drawing a picture of the forested area from the field trip. He was so quiet that he was not responsive to leading questions. As the interview time came to a close, I asked him about his drawing. At that point, he simply stated that his picture portrayed the concept of a "Character in Nature." At the time, James did not explain what he meant, other than saying it was like something they had done in science class.

I asked the teacher about the student's comment during the teacher interview immediately afterwards. She described how the students had been working through the concept of: "Character vs. Character," "Character vs. Society," etc. in language arts that week. Because of her description, I finally understood that during the entire interview time period James had been reflecting on his experience during the field trip in terms of his recent assignment in language arts class.

Ultimately, I think that this moment was very important for the student and for me. It really focused my attention on the importance of reflection time after the field trip experience, and time for drawing, talking and thinking about an experience for anyone to make sense of an experience.

So I believe that, in this case study, the interviews provided the students with an opportunity to converse with each other and with me. I use the word "converse" specifically to differentiate the way that we talked about things during the interview from a more instructional style, like that used in the classroom or during the field trip. The students were very responsive to all of the approaches. I think that the time spent talking together about the field trip provided them with an opportunity to reflect as a group and as an individual, as evidenced by this last example of the student who connected his language arts assignment, portraying himself as a "Character in Nature."

Thus, it was during the interviews in this study that the students had the opportunity to think and talk and reflect on their experiences with each other and with me. This evidence of the importance of reflection time raises the issue of ensuring that there is class time spent on reflections, talking, journaling, and drawing after field trips to the outdoors.

CHAPTER VII: CONCLUSIONS

This study of a particular field trip revealed situations and interactions among the participants' experiences in the classroom and the field trip that might be found surrounding *any* field trip. Even though time for science in the classroom had been reduced, the teacher made the decision to take her students on a field trip to an environmental science education center. This field trip was an opportunity for a new type of educative experience for her students that involved an experience in the outdoors and investigations of the environment. The students used different simple tools during the investigations and developed their ability to make observations about plants and animals. A pre-field trip class session with the site educators contributed to the experience by providing an introduction to the field trip and outdoor context that would reduce the novelty effect for students.

All of these elements contributed to the educative quality of the field trip. They were significant to the students' overall experience and important because the experience of a science field trip is often remembered more vividly than classroom science experiences (van Zee & Roberts, 2001). Sometimes connections and remembrances of field trips are unexpected, as happened during this particular field trip process. This study provided strong evidence that reflective moments before, during, and after the field trip assisted in student construction of new knowledge, with frequent references to old knowledge.

Summary

The design of this study focused on the learning process surrounding a field trip experience and included science lessons in the classroom before and after the field trip.

Because studies of field trips have rarely included the classroom context, authors of recent reviews of field trip literature have indicated that there is a need to develop understandings of the learning process over time in both the formal and informal contexts (Dillon et al., 2006; Falk & Dierking, 2000; Rickinson, 2006). This study was designed to address that gap through analysis of the experience of students and their teacher in the classroom before and after the field trip as well as in the outdoor environment.

In addition, the analysis of dialogue among participants and their interactions with the environment in each context is not often included in field trip studies. The analysis of dialogue in this study made it possible to see explicitly the ways in which the site educator modeled making observations and her interactions with students while describing the environment and plants and animals found during the field trip. Analysis of dialogue also revealed the different ways in which students responded during the field trip making their *own* observations during the field trip and later, during the interviews. The students did not hesitate as they asked questions of the site educator, their teacher and the chaperone. I attribute this student openness to interaction to a combination of the positive interactions at the field trip site, and also to the classroom environment, where the teacher in general welcomed student input.

Student engagement levels were also high during the interviews, as they reflected together on the field trip verbally, in writing, and in the process of collaboratively drawing pictures. The interview format and time spent in small group discussions supported the students' meaning-making processes related to the field trip by providing time for reflection. As students thought about their experiences, the beginnings of abstract ideas related to the concrete actions during the field trip were revealed. Thus, teachers should ensure that both individual and small group reflection time is available to students in preparation and as follow-up to a field trip.

During the interviews different ways in which the students' curiosity about the natural world had been stimulated by the field trip were revealed. Connections that students made to their home lives provided insight into their prior experiences and knowledge of the outdoors. The importance of the senses during an outdoor experience in a natural setting was also revealed in the interactions of the students with the environment.

Deweyan Characteristics

This study contributes to the research literature through the interpretation of the students' learning process with data from the classroom as well as the field trip, and through detailed analysis of interactions between and among participants and between participants and the environment in both contexts using a Deweyan lens of an educative experience. The classroom and field trip experiences were scrutinized for the following educative qualities: aspects of the active and passive components of learning, development of continuity, the interactive nature of the experiences and subject matter connections in the classroom and during the field trip.

Active and passive components of learning. Students responded actively to a variety of teaching strategies used by both the classroom teacher and the site educator. The site educator explicitly described and then modeled the science process skill of making observations throughout the field trip. The students were responsive and began to use descriptive words as they made observations about new plants and animals found during their explorations. During the interviews after the field trip, they discussed what was found during the field trip using descriptive terms, and remembered many details about the plants, animals and habitats from the field trip.

The importance of reflective and interactive discussions as follow-up to a field trip was revealed during the interviews. During this time, students were actively involved with each other in sharing and remembering what was important about the field trip. They individually made connections with their lives and with other concepts from school. The interviews provided opportunities for reinforcing and reconstructing the experience verbally, and through their writing and drawing. Some students reflected on the site educator's suggestion that they should go outside and look at things carefully at home, in the same way they had investigated the environment during the field trip.

The interviews and reflective journaling activities also reinforced the importance of social interaction, writing, and drawing to the process of developing abstract ideas from the concrete experience of the field trip for some students. During the interview process, the importance of sensory inputs in an outdoor natural setting was also made clear as students made sense of their field trip experiences by talking, writing and drawing about them.

Development of continuity. There were several sources of continuity within and surrounding the field trip experience. Within the field trip, the students' experiences were linked or continuous in nature due to the site educator's repetition of terminology, ongoing observations of plants and animals, and investigations with tools. Before the field trip, the pre-trip visit stimulated student interest and prepared them to experience something new and different. Several students also accessed the education center's website in preparation for the field trip. After the field trip, the students made connections with their home lives. They mentioned their prior experiences watching nature shows on television and playing in and exploring the outdoor environment around their homes. Although direct connections were not made with science lessons in the classroom, the classroom teacher's enthusiasm and willingness to try new things was consistent and included the field trip.

The study provides evidence of the detrimental effect of the No Child Left Behind Act on classroom time available to teach science, which contributed to the lack of connections made with classroom science. In addition to a reduction in time spent teaching science, the control of the scope and sequence of science subjects by the school and county also put constraints on the teacher's decision making process regarding choice of content.

Interactive nature of the experiences. The students' interactions with the site educator were consistently energetic and responsive. The students responded actively as they participated in a variety of activities that involved interactions with others and with the environment during the field trip.

For example, in response to the site educator's explicit descriptions and observations, the students began to use descriptive words as they made observations about new plants and animals found during their explorations. During the interviews after the field trip, they discussed what they had found during the field trip using descriptive terms, and remembered many details about the plants, animals and habitats from the field trip.

Interactions in the classroom were more constrained by the static nature of the classroom environment and limited sensory stimulation. However, the psychological comfort level maintained by the teacher in the classroom contributed to student willingness to participate in the classroom and during the field trip.

Subject matter connections. Connections with environmental science were not explicitly made between the field trip and the classroom, partly due to differences in educator expectations for the field trip. The classroom teacher had two expectations for her students during the field trip. She wanted her students to have an experience in the outdoors that they might never have had before. She also wanted them to participate actively in *hands-on* activities during the field trip. Although she never used the word *environment* during the interviews, her goals are implicit in the goals and approaches of EE. This contrasted with the site educator's stated goals of working with field trip participants in terms of ES. The site educator chose to work with the students to develop their observation skills, and included a mixture of EE, ES and nature study in the field trip design and implementation. As a result of these differences, elements that would have contributed to continuity between the subject matter of the field trip and the classroom were not part of the students' meaning-making process.

Limitations of the Study

Although the findings of this study were limited to these particular students, teacher, site educator, and field trip site, other environmental science and informal educators and teachers may find the results useful in developing understandings for the process of learning in their own settings in the US or internationally.

Complementary Attributes of Informal/Nonformal and Formal Organizations

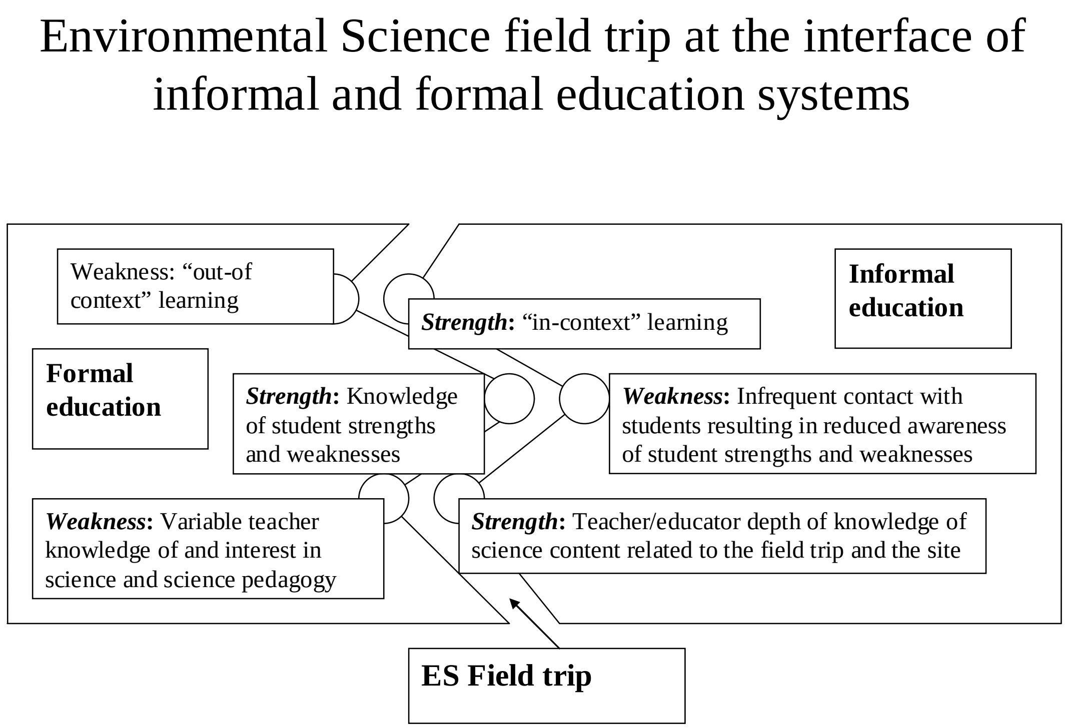
The learning processes for the students and their teacher were intricately entwined with the relationship between, and strengths and weaknesses of, the formal and informal educational systems that were the contexts for learning. In Figure 7.1, I present a representation of this relationship that is designed to illustrate the different ways in which the environmental center and school complemented each other.

The relationship between informal and formal institutions was central to this study. In the process of developing an understanding of the meaning-making process for the participants involved in the field trip, I began to visualize the field trip as the area of interface between the two institutions. As I became more familiar with different aspects of the institutions in terms of their strengths and weaknesses, the image became more detailed (see Figure 7.1).

From my perspective, both the teacher and the site educator had expertise and knowledge bases that were complementary to each other that supported the students' learning process in different ways during and surrounding this particular field trip.

In this case, the teacher in the study developed interesting teaching strategies for content with which she was not familiar and as a result, students experienced and practiced questioning and hypothesizing skills in the classroom. The students experienced environmental science content in more realistic ways because the site educators used *hands-on* and investigative teaching strategies in the outdoor context of the field trip. The site educator also targeted the science process skill of making observations and modeled using the senses of sight, hearing, touch and smell for the students throughout the field trip. This provided students with an in-context experience of skills that are frequently used by scientists.

Figure 7.1. Representation of Complementary Relationship between Informal and Formal Education Systems.



All of these practices supported the learning experience surrounding the field trip as an educative one, by arousing student and teacher curiosity during their experiences (Dewey, 1938/1997). The challenge for field trip planning and implementation is to develop relationships and educational experiences that attend to the different ways in which experiences can be connected to the *next* experiences (Dewey, 1938/1997; Wong et al., 2001).

Implications

This study has implications for several aspects of the planning and implementation of field trips. Coordination between the educators involved in the field trip planning process helped to ensure that the field trip experience met expectations and learning goals for all participants. Advance organization meetings, training sessions for teachers, and development of a plan of action to support discussion and reflection time for participants after the field trip would contribute to the overall meaning-making process related to field trip experiences.

In an ideal situation, development of long-term relationships between formal and informal settings would provide different opportunities to support development of students' and teachers' understanding of outdoor environments. One result of long term relationships might be development of teacher understanding of the subject matter and teaching strategies for in- and out- of context learning.

Current research literature on field trips is very focused on the particular type of context, such as a museum, science center or zoo, rather than the subject matter that is addressed during the field trip. Development of a number of studies in a particular subject area would contribute a depth of understanding of the ways in which particular contexts and subject focii contribute to the learning process.

Another contribution to the research literature is the focus of this study on the complexity of the subject matter of EE and ES and Nature Study. These subjects are unique and continued to evolve, even as this study progressed. New environmental problems emerged, and new terms like "Global Climate Change" recently became part of our everyday discussions about the environment. Explication of the differences among the subjects and the ways in which social science is also involved need to be more clearly explicated by professionals so that teachers and their students develop more rich understandings of the complexities involved.

The inconsistencies in science discipline terminology found among the standards from the national to local level contributes to potential confusion for teachers interested in working toward educating their students about the environment. This should be addressed in future versions of standards documents, with explicit recognition of the complexity of environmental science as a discipline area. This is also true for curriculum development at all levels, including textbooks.

There are aspects of this study that contribute beginning understandings of urban students' participation in an ES field trip including science lessons in the classroom. Although both educators were sensitive to the students' needs and learning processes, there was little explicit discussion about cultural differences among home and school environments, and the study of an outdoor environment. Further research on this gap in knowledge would contribute to understandings of the ways in which field trips support life-long learning for urban students.

This study provides an example of the effects of NCLB mandates on instructional time for science, with implications for future direction at all levels. Because the class time devoted to science was restricted to thirty minutes per week, it was difficult for the teacher to plan a complex or inquiry-based science lesson.

Professional development courses for teachers do not always include discussions of planning for field trips in general, although some school districts have requirements before field trips are approved. Because of the magnitude of current environmental problems, more attention has recently been directed towards the study of the environment utilizing resources that are available outside of the school context (NEEAC, 2005). In addition, there has been recent recognition of the importance of youth experiences in the outdoors (Louv, 2006). Thus, development of teacher education programs including these elements should be considered a high priority in the US.

Lesson Planning Framework

Rickinson (2006) suggests that research studies should be made more accessible to teachers, with discussion about results and new ideas related to the problems being addressed by research in EE, in particular. To that end, as a result of this study, I have developed a field trip planning framework that could be used by teachers of all grade levels to assist in their preparations to take students on an EE/ES field trip in an outdoor setting.

This framework (see Appendix F) specifies three factors that affect field trips: the *site's physical characteristics* (habitat type and associated plants and animals), the *influence of site staff* on instructional quality of educational field trips, and *development of relationships with research* at the site. The framework is designed to explore further ways the basic ecology of the site affects the field trip, the importance of understanding different pedagogical styles frequently employed by site educators, and ways to frame student field work in the larger context of scientific research.

It is my intention to use the three criteria in the planning framework for analyses of additional field trips. Miles and Huberman (1994) suggest that replication of a research study to multiple contexts is an effective way to develop a meaningful data set to answer research questions. Because more studies that focus on environmental science field trips are needed, accomplishing this research at multiple sites will enable a broader look at the effects of pedagogy, site characteristics and connections with research.

Some, but not all field trips to research centers include educational presentations about research at the site. This aspect of science field trips has not been extensively studied; that is, how on-going research at the site of a field trip affects the field trip experiences of students and teacher. More frequently there are reports and studies of teachers experiences doing field work with scientists which contrast with educational field trips for students that are designed and often led by site educators rather than scientists (Dresner, 2002; Shepardson, Harbor, Bell, Meyer, Leuenberger, Klagges, & Burgess, 2003; Tal, 2001).

Future Related Studies

Because this study involved only one particular instance of participation in a field trip, there are many questions that remain about the process of learning surrounding outdoor environmental science field trips for urban participants. Some of the questions include:

- In what ways does students' particular socio-cultural background affect their experience of the field trip?
- What do teachers participating in field trips learn and how do they use what they learn in facilitating their students' learning in future field trip experiences?
- In what ways do the views of middle and high school teachers differ from elementary school teachers surrounding environmental science field trips?
- In what similar and different ways might different physical contexts and habitats affect the student learning process?
- What are the long term effects of the field trip on participants' understanding of and future study of the environment?

In addition to research with a focus on environmental science field trips, further studies that develop a deeper understanding of urban youth interacting with each other and the outdoor environment that focus on development of science process skills are needed. That research could be used to develop new ideas for implementation of field trips to natural areas that ensure the educative quality of the experiences.

Another aspect of the dynamics of a field trip experience that are not often considered are the ways in which the different cultures of the school, the environmental site, and the home environments/cultural roots of the participants might affect the overall experience. Because environmental science education centers are frequently dominated by the paradigm of the "naturalist," characteristics of the context might be particularly foreign to urban African American students or anyone with limited access to natural spaces. Therefore, not only the social culture, but also the culture of the discipline should be considered as having the potential to affect learning experiences and processes.

In the following quote from *Experience and Education*, Dewey (1938/1997) suggests that the connection between nature and the human experience has great depth.

> These commonplaces prove that experience is *of* as well as *in* nature. It is not experience which is experienced, but nature—stones, plants, animals, diseases, health, temperature, electricity, and so on. Things interacting in certain ways *are* experience; they are what is experienced. Linked in certain other ways with another natural object—the human organism—they are *how* things are experienced as well. Experience thus reaches down into nature; it has depth. It also has breadth and to an indefinitely elastic extent. It stretches. (pp. 4a-4b)

Thus, explorations of the outdoor environment during field trips have great potential inherent in them as educative experiences. With careful consideration of ways to develop continuity within and surrounding the field trip, the potential educative nature of the experience will be enhanced. Thoughtful addition of time for reflection to active moments for participants provides potential for development of understanding beyond the superficial. Extra attention to the quality of interactions among participants and the environment also has the potential to enrich the experience. Finally, development of ways to facilitate participant exploration of the subject matter, whether it is environmental science, environmental education, or nature study beyond the field trip would contribute to the "elastic" potential to stretch participant knowledge more deeply into the subject matter.

Appendix A

Student Interview Protocol and Worksheet

Agenda for Interviews:

After a short introduction and welcome to the study, the students will be prompted to discuss the field trip with some general questions. Then students will be asked to answer the questions on the worksheet. After they are done working on each question, we will discuss their answers. Then students will be given some large sheets of drawing paper and markers and asked to make a drawing of their experiences during the field trip. These drawings will be a collaborative effort to depict some aspect of the field trip that was important to them.

Pilot Study Student interview questions and student worksheet

Thank the students for their willingness to participate in the research and talk with them for a few minutes about the interview process and the study that they are involved in. Questions to ask: What is research? Discuss the idea that the environment is very important right now and they will be making a contribution to the knowledge base through this study.

1) Have students make observations about their ***classroom, home and school outdoor*** experiences
2) Have students make observations about the field trip and activities
3) Have students compare their observations
4) Write a story about what they thought about the field trip
5) Ask them what they think about each part of the trip—what they liked, what they would change….

Student Worksheet Questions:

Name______________________________ School________________________

Date_______________________

Take a few minutes and write the words that come to your mind as you think about your field trip experience.

Tell a story about something that you thought was special or exciting on the trip….

What was your favorite experience on the trip?

Appendix B

Descriptions of Science Lessons in the Classroom and the Field Trip

The following descriptions of science lessons in the classroom and the field trip include sections from the transcripts of the observations. The descriptions are arranged in chronological order, with three classroom observations before and after the field trip on October 4, 2006.

Descriptions of the Science Lessons Before the Field Trip

The following summaries of the science lessons in the classroom before the field trip include the main subject area, teaching strategies, and student actions and responses during the lessons.

Summary description of classroom observation one. The first observation on September 20, 2006 was supposed to be a science class. As Ms. Miller started the lesson, she looked at me and said: "Oops, we are doing social studies today. Is that okay?" I replied that it was fine. The subject of the lesson was based on a chapter in the Social Studies textbook that explored the landscape in the eastern United States in terms of the topography of the Appalachian Mountains, the Piedmont Plateau and the Atlantic Coastal Plain. This class session involved teacher questioning of students and reading of the social science text out loud. Students were asked to come up to the map and locate the states surrounding Maryland, then Ms. Miller introduced land formations before getting out the social science texts. She read a few paragraphs about land formations in the US, and asked students to put their fingers on their noses when they heard the words *mountain, plain* or *plateau*. She then pointed out pictures of mountains, plains and a plateau in the textbook. Ms. Miller made no explicit content connections to the upcoming field trip.

Ms. Miller began the class with a map of the state and its surrounding states and asked students to locate and name those states. The students struggled with the names and locations of the states, even though Ms. Miller encouraged them to try to find the states. There was also some time spent on controlling student behaviors that were disruptive to the class work.

> TE: Ok, so West Virginia is about here. Be careful- Friday you have a test, and I am going to say: Where are all the other states. Where is this? Where is that? So you better pay attention. Ok, give me another state that borders Maryland. Who has a good memory? Someone said a state before, but I am looking for a quiet hands. Ok. (Student) what are you doing? (Student), hands to yourself. If you need to, you can go visit the principal……
>
> TE: Where do you think Pennsylvania is? I am wondering if anyone can remember Pennsylvania being where? Remember it is not inside Maryland, it is outside. Point to where it is. Point to it: Take a good guess. You said it. You said where it was. You have got to give her a chance. (Students talking in the background while the student is trying to locate Pennsylvania on the map.)
>
> TE: Ok take a seat. Let's get someone else up here. Point to Pennsylvania. It is not hard. Once you see it you will say it is not hard. (Students are very noisy…)

The students were trying to locate the states, but were not easily able to do so. During the class there was a lot of extra talking that Ms. Miller would periodically try to control. This also was the first time that tests on Friday were mentioned. Ms. Miller discussed going on a field trip as a reward for good behavior, but didn't point out on the map where the field trip was located next to a large river leading into the Chesapeake Bay. She waited patiently for long periods of time as the students looked for the states on the map.

Ms. Miller presented the idea of a coastal plain, the Piedmont Plateau and the Appalachian mountains in terms of *levels*, meaning height above sea level. At the end of her discussion points she asked the students to locate the features on the map.

TE: Ok. Region Three is the coastal plain. No, I said that down here is flat. I am going to show you a map in the book that will actually show you the different *levels*…so that leaves us with region two being what? Raise your hand if you remember what the last one is…(Comment to a student: Does that matter? Are you really worried about that?) What is the last one that we have? Raise your hand. (Students are very quiet.)

It starts with a P. (Student)?

ST: ummm

TE: You have to be sitting quietly. No…Give it another try (Student)?

St: Chesapeake?

TE: No, but that was a good try. Ok, (Student).

ST: Pacifico.

TE: I'll give you a hint. It is not Pacifico. (Student?) (Another student?)

TE: Piedmont Plateau. (The students then make a lot of noise talking and repeating it.)

Shortly after this exchange, the new social studies books were distributed and Ms. Miller read the first paragraph. She asked the students to put their finger on their nose if they heard the name of one of the three regions as she continued to read to them from the text. Their response to this direction was not uniform throughout the class, but several students did hear the words and followed the direction to put their finger on their nose.

TE: Okay do I have someone responsible enough in each row to pass out the social studies books? Ok, pay attention while I read the first paragraph. Land forms of the region. Here is how it goes. You are actually going to hear the words that we have up there. You can't jump ahead. If I say *plains*, *mountains*, or *plateau*…put your finger on your nose. Here I go. "The northeast region has the oldest mountain range in the country. (She looks around room to see who has their finger on their nose.)

Ms. Miller worked with the students in different ways to keep them engaged during this lesson starting with a projected map of the region, and moving to reading in the text and listening for particular words.

Summary description of classroom observation two. One week later, on September 27th, the subject for the science class time was solar systems. This class session was dominated by a combination of student questions and references to the science textbook. Ms. Miller basically went around the room and answered every single question and/or listened to what the students had to say about solar systems. The session ended with a kinesthetic demonstration of the movement of the earth and moon around the sun by three students. During the demonstration, key vocabulary words like *rotation* and *axis* were discussed. Ms. Miller made no explicit content connections to the upcoming field trip.

During this class session, Ms. Miller's tone of voice changed dramatically from a stern tone of voice when she was focusing on student behavior to a softer, friendlier tone of voice during instruction time periods.

Ms. Miller was supportive of student ideas during this session. She began the class asking the students to talk about what they knew about solar systems. She then went systematically around the room and gave every single child the opportunity to ask a question or make a comment about solar systems.

She mentioned early in the lesson that she "is finally beginning to understand this subject" and that she didn't "get" it in school herself. After the discussion (which lasted about twenty minutes) the science texts were distributed and students were asked to read some paragraphs that focused on the earth's rotation around the sun. Their reading of the text was quiet and halting. The following excerpt from the transcript illustrates the behavior management issues, tone of voice shifts, Ms. Miller's willingness to share her own learning process with her students and her support of student ideas.

> TE: Because right now this side of the room is having problems…because I have people that I can't trust right now. (the room went really quiet. She changes her tone of voice to *teaching* tone.)
>
> Ok . take one and pass it down…(Student) Turn around and grab a book. There you go. Alright….Here it is …alrighty (Student) Could you come join the middle group?

Ok, I need everyone to turn to page C 66—(loud book sounds) If you do something to the books you owe me a hundred bucks…(change of tone of voice again) Ok (student)…we might get to that in a few minutes I want to talk about something else…yes?

ST: Page?

JR:Yes? C-66 yep you got it . Ok good, This is not my favorite kind of science but I am learning to like it a little bit more.

ST: I like astronomy.

TE: Good! You can help us out with it...I need somebody to read that first little paragraph…Nice and loud. (Student)? Start under: How do the sun, earth and moon move?

ST: (Very quietly reading from the text. Her reading is a little halting but she gets most of the words.)

TE: (Interjects the correct words.) She reads about five sentences.

TE: Ok, stop there. Raise your hand if you think the earth moves around the sun. I didn't know that until I learned it in school. When you are playing outside, do you feel like we are going in a circle?

ST: I learned it in about first grade. At first I was like, Ma, why is the sun so far from us?

TE: hmmmm exactly. But guess what? It moves so slow that you can't even tell it moves like this…. how long that it takes to move around the sun?

With this question several students made guesses about how long it takes for the earth to move around the sun. The guesses ranged from twenty four hours to thirty five days to five hundred days, and the discussion ended with one student responding with the exact number of days in a year.

Ms. Miller asked a series of questions to stimulate discussion and student thoughts while simultaneously responding to students with their hands raised to ask their own questions or make comments throughout the lesson. The series of teacher questions included: How long does it take for the earth to move around the sun? Which side (direction) does the sun rise in? What planet could we not live on because it is too close to the sun?

The students made comments and asked questions throughout the class session. Student questions included: If somebody goes to the sun would they be fried? Are we on earth? How do the ice ages come? How do we make snow?

The final activity was a kinesthetic demonstration with three students portraying the sun (stationary), the earth moving around the sun and rotating on its axis and the moon moving around the earth. This was the first lesson using the brand new science textbooks. Ms. Miller was following the county "pacing" guide to teach astronomy as the first science subject of the year. The activity was suggested and described in the textbook.

Summary description of classroom observation three. During the third classroom observation on September 29th, the site education staff facilitated a thirty minute introductory discussion about the field trip with the students. Ms. Miller was in the back of room observing the session. Ms. Freeman (pseudonym for the lead site educator) began with a description of what students would do on the field trip, rules for the day, what to wear and to bring, lunchtime procedures and what could be found at the site's website. She then moved around the classroom with two salamanders in a container for students to observe firsthand.

After some introductory comments, a discussion about the animals that live at the sanctuary ensued. Ms. Freeman encouraged the students to visit the sanctuary's website to see a full listing of plants and animals and a description of the habitats found at the site. She presented one special *rule* was presented to the students:

> Site Educator (ED): There is another rule that I have to tell you about. There are a couple of words that you are not allowed to say when you are at the site. These are special words, like *yuck* or *gross* or *eeuwh* or *nasty*. You are not allowed to use those words because for all of the animals and plants and all the things that we find, we think there are some better words to describe things. There are usually some better adjectives to describe the plants and animals.

During this session, Ms. Freeman gave an interactive presentation to the students focusing on what they would be doing and seeing during the field trip the following week. She had brought several salamanders from the site to show to the students. She began by sharing with the students that she had been involved in a *special* activity the night before. She had been out until midnight watching and collecting marbled salamanders moving during a rainstorm.

ED: Something special happened last night. Some people are always disappointed when it rains. I actually was at the site last night until almost midnight.

Student (ST): Whoa !

ED: Because of the special thing that happened, I was able to bring in something for you to see. Now remember what words you are not allowed to use.

ST: Ooh!

ED: Last night, what was happening was that we had some nocturnal animals. Do you know what nocturnal means?

ST: Nocturnal means it is an animal that is awake at night and asleep during the day.

ED: Exactly! And it only comes out if it rains at night and they were coming out because it is time for them to lay eggs… and so inside this box…..I have two of them and one is a boy and one is a girl and stay where you are and I will come around. That is a good question…what is it? (Sounds of students in the background saying oh, oh! then an eeuwh…)

ED: What was that word? What else could you say instead of eeuwh?

ST: It's a lizard…(Talking sounds of students looking at the two salamanders.)

Teacher (TE): They are cool. They are neat…I personally wouldn't touch them. (Students talking in the background). They are real. She wouldn't bring toys. (student) You alright?

ED: Ok, they are trying to move but first, I don't want to get all of your papers wet. We woke them up and they don't like to be up during the day. Like if someone came and woke you up at night. You would be: "No, I don't want to." But these animals…Are you studying different types of animals?

TE: Not right now we are studying astronomy. Relax.

ED: This animal has wet slimy skin. The toes do not have claws. And when it is time for it to lay the eggs, they will be laid in water and they will be like jelly. This animal is a salamander, so who guessed salamander?

ST: …(talking loudly…)"Oootsie-wootsie" baby.

ED: Ok so this salamander is a type of amphibian if you think about a gegko and a lizard and a snake: they are reptiles and they would have scales, and lizards have claws and their eggs would be leathery. Ok.

Ms. Freeman asked the students which one was a female to stimulate their thinking and a discussion about how the male and female might be different.

ST: Do you know which one is a boy and which one is a girl?

ED: That is a fabulous question: Which one is a boy and which one is a girl? Where do you think this one was found, based on what is in the container? In the wetland or in the forest?

ST: The forest?

ED: Well, it was a trick question. It was found in a forest that has wetlands. Now I am going to pass it around and you decide which one is a boy and which one is a girl.

ST: It is that one. It is pregnant.(students talking loudly) That one is pregnant.

This class session closed as Ms. Freeman asked if there were any other questions. The word camouflage was also introduced and part of the discussion about which animals might be difficult to see. The session was designed to provide information useful for the students and to develop their curiosity about their upcoming field trip.

ED: Does anyone have another question?

ST: If you couldn't see it and you stepped on it…..

ED: Most of our animals are well camouflaged. You have to watch where you walk.

ST: If we find an animal, can we pick it up?

ED: You have to follow the rules for picking them up.

This class session was shorter than expected due to an assembly that had been added to Ms. Miller's agenda for the day on short notice, so Ms. Freeman finished the discussion quickly to allow the students to move to their next activity.

Summary Descriptions of the Field Trip Segments

The following descriptions include summaries of the teaching strategies, short sections of the transcript, and descriptions of student actions and responses during the field trip.

<u>The opening segment</u>. The group orientation for this field trip started at about 9:40 in the morning, right after the bus arrived at the site. The lead site educator asked the students to leave their bags of additional clothing outside of the building. Once inside the visitor center, they all sat in a circle for the opening discussion, which included a review of the site rules and a summary of what they would be doing that day. The lead site educator then asked the students to use the bathroom and meet with one of two naturalist/site educators leading the groups for the field trip.

During the opening circle, Ms. Freeman discussed what would be happening during the field trip. She mentioned what students could expect to see and what they would be doing. She also included behavioral expectations for the students. In discussing animals that might be found, Ms. Freeman mentioned snakes several times. The example below shows just the beginning of student questions, comments and observations throughout the trip. In addition, it typifies Ms. Freeman's discussion style in which she talks about important and interesting characteristics of the animals, plants and the ecology of the site. She pointed out interesting characteristics and facts about animals, using key science vocabulary words in response to student questions and to sightings made throughout the day.

> ED: We are going to explore the forest and the wetlands….our meadow….and if we are lucky sometimes snakes are out there.

The following excerpt from the opening circle illustrates some of the expectations for the trip:

> Educator (ED): We actually can touch a lot of things. But because most people are allergic to poison ivy and itch after touching it, we'll make sure

that you know what it looks like. What about another rule? Well---

regarding our animals…remember we are not a zoo, so if you see any animals, we probably won't be picking up most of the animals. Miss E. and I are going to give you the opportunity to touch some of the animals. And of course we are not going to hurt any of the animals. Even spiders and ants.

There was one rule regarding the words that students would possibly say while observing plants and animals at the site. Periodically throughout the day, the site educator would remind students that: "There are a few words that we are not allowed to use today: like *ick* and *yuck* and *gross* and *eeuwh*."

During these discussions, the students were very attentive, raised their hands to answer questions and appeared very enthusiastic. The opening circle discussion included the following further commentary on animals that might be seen:

ED: There are a lot of animals. Some of the animals you probably won't see because they are nocturnal. Does anyone know what nocturnal means?

Student (ST) reply: Animals that don't sleep at night.

ED: Animals that don't sleep at night. Foxes, deer, rabbits, beaver and rabbits, those are out during the night. We won't see those today. During the day we will be able to see birds, snakes, and spiders and if we are lucky snakes will be out. But the question is: Will we see them? Will you look for them? Are you going to stay quiet?

ST: What kinds of birds are here?

ED: We have tons and tons of birds.

ST: Will we see a banana snake?

ED: No

ST: How do you find snakes?

ED: That is a perfect question--how do you find snakes if they blend in because of camouflage? You have to be looking, you have to look really hard and you know what? I will let you know that we probably will not see a snake because they don't like it when groups come along, so they typically hide really well. But if we do, that will be great…I know that you have a lot of questions. How many of you would like to spend the day inside here or outside in the forest and the wetland? When we are outside we will be walking. Ms. Jones (pseudonym for the assistant educator) and I will always have to be the leaders. The leaders go first. Sometimes we will have to be in a line like when you are in school. But sometimes we won't be in a line.

At the end of the opening discussion, the students were divided into two different groups led by two site educators. They were asked to use the bathroom before the hike and then moved out onto the grassy lawn adjacent to the education building.

Segment two: The lawn. As the field trip started in the grassy lawn area outside of the education building, bird and cricket sounds were quite loud. The sounds of planes overhead were also periodically heard throughout the day and were quite loud in volume compared to the animal and human voices during the field trip. Clipboards with worksheets for the day were distributed to the chaperones at this time. The worksheets illustrated the habitats being explored during the field trip and were designed to become records of animal and plant sightings in each type of habitat visited. Students were asked to report their sightings to the chaperones who would then record their findings onto the worksheet.

During the first segment of the outdoor work, the students were given magnifying glasses and the suggestion to explore the grassy area. Within moments the students had found a beetle, a bug, a cricket and a caterpillar and were being careful to look closely at the ground and the grass. They all quickly bent over the grass in close proximity to each other. Within minutes they began to move around and explore larger spaces, with more distance between each individual student. The following interactions and findings occurred right after the students began to use their magnifiers. The students spoke excitedly and often on top of each other:

ST: Ooh! I found a bug!

ED: Awesome!

ST: I see a little one.

ED: Look at it and pass it around. This is a caterpillar.

ST: I found a beetle! (real loud)

ED: What area do you think we are in…a field a forest or a wetland?

ST: (loudly, together): a field

ED: Look at that…it is actually a beetle. If you look at it carefully, you know what? This one might be a caterpillar.

ST: I found an ant…I found a cricket.

ED: Does anyone else need to look at the caterpillar before we release him?

ST: Oh I found a beetle. Look at it! It is a little cricket.

Teacher (TE): That's a different looking cricket.

Segment three: The meadow walk. As the students walked from the lawn to the meadow area, they continued to look at things with their magnifiers. They found a walnut in its green shell, a green tree frog, a daddy long-legs, a mushroom, and a big spider. One student proposed that a hole in the ground was a snake hole, and the educator discussed the fact that snakes don't dig holes. She proposed that perhaps a squirrel was digging in the area and had buried a nut.

The next piece of equipment that was given to each student was a small magnifier box. With these boxes in hand the students proceeded to walk along the edge of the forest in a field and found more spiders, grasshoppers, crickets, butterflies, ants, sumac trees, a hickory nut, and a fly. They tried to catch them, without injuring the animals as they closed the lid of the boxes. That was one of the "rules" for using the boxes. They were walking in a grassy area bounded by the forest on one side and a meadow, with tall grassy and shrubby plants on the other side. Several of the students spent some time carefully placing the boxes over the insects and looking at them through the magnified lid of the box. They all shared their insect finds with each other, following the model of the site educator.

The next gathering point for students was in the corner of the meadow, where there are benches that face into the forest. The students were given more equipment (a soup spoon for pairs of students to dig with) to investigate the soil in the area. The site educator asked students to discover eight different things about the soil and to ask their chaperone to write the words onto the clipboard chart. She suggested that the students investigate the soil in terms of color, how it felt, and how it looked.

ED: Wow! What did you say about your soil?   Yes..Look you have two colors! You have this dark color and you have this brown.

ST: I found a little acorn

ED: Now somebody mentioned…..umm

ST: Oh, look! Look! Look!

CH: I got one of them too…

ST: Ooh, look! Look! Look!

ED: Ooh, look! These guys have eight words. (going to the other group) How many do you have? Two? You guys are winning. (Ms. Miller immediately started to work more explicitly with the children on their word list.)

TE: So tell me about color.

ED: I am going to give you another minute or so to look at the soil. And we will start heading towards the forest.

ST: It feels so ….cold…

TE: Cold. Ok, we will write down cold.

The soil work wrapped up very quickly as the site educator requested that the bug magnifier boxes and soil equipment be turned in. She closed the discussions at this location with a closer look at hickory leaves and why leaves fall off of trees in the fall before moving on to the next area.

ED: Gentlemen….Now before we head into the forest, I just wanted to show you this leaf. This is…You need you to take a seat, please. Give me "five".

TE: On the bench

ED: This is a hickory leaf. Were you telling me what hickory is used for? This particular leaf.is from a hickory tree. Remember someone told me what it is used for.

ST: Yes, barbecue sauce.

ED: He said it is used in barbecue sauce. They take the wood and burn it to make the sauce. I am going to crush it a little bit and you should smell it. Does it smell good?

ST: It smells like barbecue sauce. It smells like mint.

ED: Like a spicy smell?

ST: It smells like insects…it smells like…

ST: Can you eat it?

ED: Some people think that smell is really good, so they add it to barbecue sauce. They burn the wood and add it to the sauce and you can use it for your grill. But the nuts, you can actually eat the nuts. Oh and this tree-- look at this one. One of them fell off…I can use this one. That one doesn't look very much like a star. It fell off, how come the leaves fell off the tree…?

ST: They got old.

ST: It is fall….

ED: These trees kind of stop growing for the year. In the fall the trees don't need to eat any more, so the leaves all fall off. (Loud cricket sounds in the background).

ST: They need water and soil.

ED: They need water. Do you all know plants need water? And they need the soil and the sun and they need air and the leaves on this tree..

ST: Ohhh…Ooh

ED: What color are the leaves usually?

ST: Green…

ED: What is the chemical? The chemical that they make is chlorophyll. So let's hear you suck up the water. Make a sound to suck up water… How do you soak up sunshine? And chlorophyll…How do you soak up sunlight? They (the trees) just stand here. Just like you are out on the beach or in the playground…

ST: They get sunburnt….

ED: Yes, but you know what the trees don't get sunburned and they take the sunlight and the air they breathe in and the water and then through photosynthesis. Have you ever heard that word? It is when the plants take water, sunlight and air and make sugar…

ST: Sugar?

ED: The sugar is in the leaves and it goes to the trunk and then into the root and that is what the trees eat.

ED: Yeh- you found the sparkly dirt? That is called mica, a new word for your soil list. So this tree doesn't need to make food anymore, so all of the green goes away.

ST: Ohh! Ohh!

Segment four: The forest. At the end of this discussion, everyone proceeded to walk to the forest along the grassy walkway between the meadow and the forest. At the beginning of the pathway into the forest, the site educator distributed the next "tool" that she called a "super sorter". She suggested that students collect twelve things as they walked into the forest, excluding animals and leaves taken from branches. During the work in the forest, students made periodic references to the soil, which the site educator responded to with enthusiasm and usually a comment or two on the soil attribute that was mentioned. In addition, the students saw where the marbled salamanders like the ones that the site educator had brought into their classroom were caught.

ED: Now, do you remember that in the classroom I brought the marbled salamander in?

ST: We found one.

ED: Let's get everybody back in the circle, with feet frozen like trees. This is where the marbled salamanders on a rainy night come out and is where they are going to be laying their eggs. That is a BBC camera position. BBC is a film company that makes movies about nature, and they are coming out here to make a film about marbled salamanders.

ST: Do other people come here?

ED: Yes, we have other schools come here and but we also have scientists too who come here to look for animals. How about what you have in your containers. Do you have anything that you are kind of curious about? Did you find anything like this? This is really cool 'cause it looks like a berry. This actually is where an insect lives….It is an insect home. And how about this thing? Do you know what this is? It is called a gum ball. Do you think it is something you would eat? It is called gum ball because it is from the sweet gum tree. Do you know why it is called the Sweet gum tree?

ST: No.

ED: Because it is filled with sap. What is sap?

ST: It is stuff that comes out of a tree...

ED: And if a bug gets in it, it would turn into a fossil of amber.

If you put a tap at the bottom of the tree you can get syrup that if you boiled it down you could get from a maple tree. It would be maple syrup... Are you the ones who rolled this log over? You need to roll it back. We don't have a whole lot of time left in the forest, because we definitely need to get to the wetland…(cool bird sound)….Did you hear that noise? That was a woodpecker.

ST: In the woods?

ED: It wasn't the sound of the woodpecker pecking on wood, but rather its song.

ST: What is this?

ED: That is another kind of mushroom.

ST: Oh. (They are all bending over to look at things and have spread out a bit.)

ED: Come up this way a little bit.

ST: I think that is a bird or a rattle snake…

CH: (laughs) A bird or a rattlesnake?

TE: A bird or a rattle snake is quite different.

CH: I think it was a bird…

Segment five: The wetlands. As the students moved from the forest to the wetland area, they periodically yelled out when they found things like feathers, seed pods, dragonflies, a six-lined race runner (lizard), a daddy long-legs and flowers. At about eleven o'clock they stepped out onto the deck overlooking the expanse of river and wetland. Almost immediately a white bird was spotted by the students and educator simultaneously. The bird was described and identified by the site educator as a snowy egret.

ED: Ok, see that daddy-long-legs?

ST: ooh!

ED: Ok, now while we are on the deck, please keep your feet on the deck and I know I don't need to mention this to fourth graders but please don't spit over the deck or throw anything off the deck.…

TE: (Student) Let's go, come on.

ST: ooh… whoa (student chatter in the background)

ST: This is like a….Can we go down on that bottom deck?

ED: That is where we are going to be heading now. (Student chatter)

ST: Are we going to step on the wetland?

CH: Yeh

ST: I see a big white bird.

ST: I see a snake down there. I see a turtle

ED: Ok look way out in the water and there is a fence in the water. There is a big white bird. It is related to the great blue heron. It is one of the egrets. It is a snowy egret. See where all the grayish blue water is….(pointing in the distance)

ED: Look ! There's one flying over the marsh. See it flying? Yes, honey?

ST: I have a question…it looks like a painting of the moon…

ED: Sure..yes, doesn't it look like a painting?

ST: Where I am supposed to be? (The students are wandering around the deck looking over the wetland.)

ED: See that white bird landed.

ST: Are we going down there?

ED: We are going to go down on that trail down there.

TE: We are going to walk down there guys

ST: Are we going to fall down?

ST: Are we going to jump?

TE: (reassuringly) I am not going to let you go.

As we walked in single file along the path down to the wetlands, the students were relatively quiet. The boardwalk was about four feet wide and was located five to ten feet away from the river bank. This segment of the field trip began with a discussion about characteristics of different types of wetlands.

ED: See the frog in the water there?

ST: There are two of them.

ED: To the left of the orange pole.

ST: Right there and right there. (pointing)

ED: Yes, they are brown frogs, but they are actually called green frogs. Ok, now I have been mentioning a lot that we are going to a wetland…So what is a wetland?

ST: Some place that has water?

ED: Are we in a wetland?

ST: Yes.

ED: Your teacher and chaperone have clipboards with a picture of different types of wetlands. I want you just to look at the plants and figure out which of these wetlands we are in and look at what kinds of plants that we see here. Which of these plants look most similar. You see that we have trees in this wetland? There is only one kind of wetland that has trees and it is called a swamp.

The discussion then moved to how deep that mud was next to the boardwalk. The site educator demonstrated the depth by pulling a pole which was approximately ten feet long up out of the mud. During this demonstration the students were actively involved in the process of guessing the depth of the mud and were amazed at how deep it was.

ED: Did I mention that rule about no passing on the boardwalk? I am going to break that rule. Now, in the swamp you can see that there is not a lot of water in the swamp. If I fell off, how deep do you think that I would go? (Student name)?

ST: A little bit-- like an inch?

ED: An inch? How far do you think I would go?

ST: Just to the tip of your boots.

ED: all the way down?

ST: I think you are going all the way, all the way, all the way down.

ED: Ok what did you think? Now what I am going to do is stand in the middle of the boardwalk… And I am allowed to step off the boardwalk . (She leans over and pulls out the pole from the mud very slowly. It is about tenft tall) how deep would I go? All the way!! How deep would I go?

ED: Some of our mud here is thirty feet deep.

TE: That is like five Mr. B's on top of each other. That is how deep..

Students are talking loudly…. Saying whoa!

As the group moved forward on the boardwalk, a discussion about beavers living in the area ensued with Ms. Freeman drawing attention to the worksheet pictures of a beaver in swamp habitat. She pointed out tree bark with teeth marks made by beavers cutting down trees.

ED: As we are walking on this trail we will be looking for some of the pictures on that sheet…and somebody noticed that the beaver is listed on that sheet. Beavers like to eat bark and leaves…the beavers are sleeping right now. They are in their lodges, but if you look at the bark you can see where it has been chewed on.

Then a student excitedly pointed out a snake.

ST: I see a snake! I see a snake!! (pretty loud) Oh- oh- oh- a snake, oh no.

ED: Do me a favor and if this group could move (the site educator moves back through the group to look at the snake.)

TE: Good job (Student name)!

ST: I found it!

CH: Good job!

ED: This is a black rat snake. It is our largest snake.

ST: What's that? (pointing in the vicinity of the snake.)

ED: They eat birds and rodents…rats, squirrels muskrats. And they can be like six feet tall.

CH: Who found that? Congratulations!!

TE: (Student name) found it. Good job (Student name)!

CH: Well done!

ED: Nice and it is climbing up a tree. That is often-times, our snakes are up in the tree.

ST: Would he bite?

ED: He might try and scare me away. You might try to scare them away, they tend not to bite. If somebody came real close, what they actually would do is…if you pick them up they would poop on you. Yes, it stinks and it is nasty.

ST: Where does it come out?

ED: Where it comes out is if you look at the tail where the body is kind of fat and then right where it starts to get thin is where the poop would come out.

ST: Where is the spider?

ED: Oh yeh, he is right here…and they try to be camouflaged. If you were walking and not paying attention would you walk right past it? Think about how many of us walked by and didn't see it. Because somebody up front was saying "Can we go now? can we go now?" That is why the slow pokes find everything. You guys, I already told you earlier we weren't going to see one.

ST: (Talking)…..

TE: I don't think I have ever been this close to a snake…

ST: Did anyone say ooh?

TE: No….

As the students moved down the boardwalk, they spoke quietly and made more observations. The site educator also continued to point out plants, animals and characteristics of the river.

ED: a little bird is flying in the plants if you look carefully you can see a little yellow on its tail. That's a good question (to a student). How much water does an otter need to swim? This river actually floods. How often do you think it floods? How much water do you think comes in? How often? This is the (River name). It floods two times a day causing tides. Are you learning about the solar system and things like that? Well, the moon makes the tides. We are at low tide here. Give me some evidence. Look around. Can you see how high the water got recently?

ST: uh…. if I look at the post holding up the boardwalk?

ED: How high do you think the water got? How much water?

CH: (Looking at the posts.)They are all dry. I am looking for moisture.

ST: (points at the high water mark on the post)

ED: Yep right there. See how high that water got? So now at high tide, where would the otter be?

ST: There are some bugs climbing up this thing.

ED: Yep

ST: Did the other group find a snake?

ED: I don't know we will have to ask them.

ST: No the other day…

ED: One person saw a snake yesterday. It was a ribbon snake. Now this is this still a swamp here? Where are the trees?

ST: Yes.

ED: Are these trees?

ST: ummm….

ED: This is the low marsh. Sometimes people call them yellow pond lilies, this is a marsh. This plant you can see goes all the way out there.

Two more snakes were spotted by a student at the end of the line. With this observation there was not quite as much excitement, but everyone took some time to look at the snakes.

ST: I see a snake….oh! Two snakes!

ED: this one is too far away to touch. This one is a queen snake. It is a very small snake

ST: ooh! cool!

ST: You are some snake finder! We are the snake finders. The other class didn't find any.

ED: Queen snakes. I am glad that we have a snake finder. Did you write that one down?

The students spent about forty-five minutes traversing the entire boardwalk. Additional discussion topics included otters and their habitats, muskrat footprints, and cattails. In the last part of the boardwalk, students were captivated with the little green tree frogs that were on the boardwalk and the cattail branches beside the boardwalk. They were allowed to touch the frogs briefly after wetting their finger tips. At the end of the boardwalk, the group followed a steep path through a forested area back to the education center on the upland plain.

While they were waiting for the other group to get back, they spent some time in the exhibit room in the education center.

Segment six: The animal cages, Submerged Aquatic Vegetation (SAV) tanks, and the exhibit room. The students spent about fifteen minutes looking into several large outdoor cage areas where sick and injured animals live. An injured turtle was spotted in the fenced area, although it was well camouflaged in its surroundings. They also spent some time discussing the plants and animal inhabiting the submerged aquatic vegetation tanks behind the education center. Sightings at the tank included frogs, tadpoles, water-striders and algae.

The field trip ended for this group with a quick visit to the exhibit room in the education center. Students wandered around freely and observed many objects and displays that were designed for hands-on learning activity. Topics covered in the exhibit room include a poster of turtles found at the site, an aquarium with live fish and turtles, a large mural that is used for identification of animals found at the site, descriptions of wetlands and estuaries presented in interactive formats, an interactive display about wetland plant communities, descriptions of research projects at the site, an historical account of human activity and artifacts found at the site, information about migrating animals, the effects of tides, the river's watershed and geology, effects of salinity on plants and animals, sediments in waterways, nutrients in waterways, a bird puzzle and an animal tracks and signs game.

Right before the students left, the other group of all girls returned to the education center. The male students immediately started asking if they had seen any snakes.

Male ST: Did you find snakes?

Female ST: no

ST: We did. We found three of them.

ED: That is right you have to remember that. There is one right here.

(Pointing to an informational poster.) That is a black rat snake like the one that we saw. We saw the queen snake and we saw the lizard. Remember in the parking lot?

ST: and we saw two snakes.

The field trip ended in the education center meeting room with everyone talking loudly all together about the day's adventures. Ms. Freeman thanked the students for coming to the site and mentioned that they would be coming back in the spring.

Descriptions of the Science Lessons After the Field Trip

The following summary descriptions of science lessons in the classroom after the field trip include the science topic addressed, teaching strategies and student activities and responses during the lessons.

Summary description of classroom observation four. On October 30^{th}, the topic of the science lesson was an introduction to microscopes, in terms of their parts and their function. During this class session, Ms. Miller introduced the students to a worksheet on microscope parts. She used a "call and response" technique to review the words as a whole class activity. Then students proceeded to work on their worksheets and there was a whole class discussion about the answers. Ms. Miller responded to a non-responsive student in the middle of the class and called the office for assistance. Ms. Miller made no explicit content connections to the field trip.

The lesson started off with teams of students getting ready to work on science. Ms. Miller mentioned that they were starting a new science unit, and that they would be exploring a new scientific "instrument" in the following excerpt:

TE: Alright this team is ready.

Ok it's a tie between the colts and the falcons. Good job!

Ok, so we are starting a new unit in science, talking about cells and living things and non living things and animals and ecosystems and all those different things

Ok, so part of being able to do this is being able to look at cells

And there is an instrument that is used to look at cells, because cells are so small they cannot be seen with the eyes. Think about it: something that is really teeny tiny.

So, what is an instrument that we can use to look at a cell? These instruments that make cells bigger for us to see: What is an instrument?

(Calls on a student)

ST: trumpet

TE: No, those are musical instruments. These are science instruments.

Ok, let's see… (calls on a student)?

ST: a microscope…

TE: Thumbs up if you agree with the student that it is a microscope.

Two thumbs up if you agree with the student.

TE: I agree with the student.

(Extra activity during this class: Early in the lesson Ms. Miller noticed that one student was very non-responsive. Because the lesson was just starting, she was able to pay individual attention to the student at his desk. She called for help from the office over the intercom, while asking the rest of the class to work on the worksheet individually. It was obvious that there is a system in place for this type of situation. The response from the office was swift, and she was able to get back to the whole class within about ten minutes.)

Ms. Miller also mentioned that there would be a quiz on the information that they were reviewing on Friday.

TE: Today we are going to go over the parts of the microscope and then on Friday--I am going to give you all week to study and then we will have a quiz on Friday. If you pass the microscope quiz you will be able to use the microscope the next week that we do science…

ST: (students' response is a soft yehhhhh)

TE: But you have to know the parts…'cause then you know what I can't trust you with the microscope. They are super, super expensive. I mean, you would have to work like the whole year to be able to afford a microscope. They are not like ten dollars or five and below. So that's why I have to make sure you know the parts of the microscope. But you might not remember the eyepiece. So when I say you need to look through the eyepiece, you need to know what to do…..Good good………. Alright we are going to start with the easiest, the piece that everyone knows. It's going to be letter "A". Letter A. So I want you to look up letter "A" and I want you to tell me which part you think letter "A" represents. Ok, (student) says he knows.

ST: Eyepiece

TE: If you agree with him, blink your eyes.

TE: Anyone know what the eyepiece is for? We are going to add an eyepiece just for looks. (Calls on a student)?

ST: You need it to look at stuff.

TE: Ok, good job. The eyepiece is there….That's the part that you look through.

Ms. Miller's shifts in tone of voice were less dramatic during this lesson. She made several personal references during this lesson plan, which also softened the tone of the work, creating a friendly atmosphere. She used call and response to emphasize some vocabulary words early in the lesson. At the end of the lesson, she complimented different teams of students on their readiness. She especially mentioned that being quiet while doing things was just as important as getting it done. It appeared to be a new management technique that she was trying out.

Summary description of classroom observation five. On October 31st, the science subject was living and nonliving things in preparation for the study of cells. Ms. Miller began this class with a quick review of the parts of a microscope and then proceeded to an interactive exercise with words on post it notes for each student. They were asked to place their word in a column on the board under either *human* or *pencil* on the board. After the students placed their words and justified their choice, Ms. Miller invited the whole group to decide on what the columns signified and re-organize the words based on their reasoning. Ms. Miller made no explicit content connections to the field trip.

As Ms. Miller moved around the room distributing post-it notes with words on them to each student, she described what their next task would be. They were to place the post-it notes in one of two columns on the board under either the word *human* or *pencil*.

TE: Ok, listen up. Everyone just got a yellow post-it on their desk. Ok? Do not call out what you have and quietly, read it inside your head.

TE: All you have to do is read it quietly. (changed tone of voice: I should not hear a voice! If you are talking I will take your post-it.) (The students then proceed to be quiet as they are reading the post-its.)

TE: Ok raise your hand if you are having trouble reading what's on the post-it. It is top secret. (Reference to a student asking for help: He is being honest. That is what counts.) Ok, here we go… (She is moving from student to student.) Ok, you know what you have to do.

This lesson had started off with Ms. Miller irritated about a playground mishap that occurred just before the class started. Throughout the lesson her tone of voice switched dramatically from irritated to nice, with the irritation related to student misbehaviors and the nice tone of voice occurring during her teaching.

TE: Ok, alright now, here's the thing. Everyone knows what you have. Now you have to decide which side of the board your post-it goes on (students chatter quietly in response) Ok, so here's what you have to think of. I already have my two post-its up here. My first post-it says human, my second one is a pencil. So you have to decide maybe whatever the item that is on your post-it has in common with the other ones. So one by one you are going to stand up and you are going to read (aloud) what you have on the post-it. And you are going to put it on one side. As you get going you can't say anything. We will have to see if that person gets it.

And then once we get that, we will decide what each of the categories is.

Initially she told students not to say anything about why they placed the post-it in a particular column, but early in the exercise, she changed her mind and asked students to share their reasoning.

JR: Ok where are you going to put a chair? Put it wherever you think it will go.

Just out of curiosity, why did you put it there?

ST: Because humans need it to sit on.

Ok, that's an idea. (Student) why did you put that there?

ST: Because humans and they both eat.

As the lesson progressed, the students made their decisions and shared why they put their word in one of the columns or the other. Ms. Miller did not say whether or not the placements were correct, and listened to the reasons very openly.

ST: Fish

JR: Ok, why did you put it there? I am not going to say if you are right or wrong. I just want to know.

ST: I already told you.

JR: You have to say it out loud. Say it quietly or you are going to lose your turn.

ST: (inaudible response)

JR: It's a real thing…ok (student), what do you have?

ST: Rock

JR: Where are you going to put the rock?

JR: Ok (student) what do you have?

ST: I have shirt…

TE: Read it out loud. You have shirt. Well decide where you are going to put it.

Afterwards once we figure it out. I am not going to say what is right or wrong. Why did you put shirt up there?

ST: Because human beings wear shirts.

TE: Ok that is a valid reason….OK (student) what do you have?

Everyone looked at the words and rearranged them at their desks. Then Ms. Miller asked them to tell her what they thought the column headings should be.

TE: Ok, let me read what we have. On this side we have a *human*, a *dog*, a *shirt*, *pants*, *chair*, *cell phone*, *dolphin*, *spider*, *horse*, and *butterfly*.

Over here: *pencil, rock, basketball*, *desk, gold medal, crayons, cereal*, and *jersey*. There are actually four misplaced. That was my fault. We have four that are in the wrong place. Anyone take a stab at the ones…..Take a guess.

After moving several of the words around with student input, Ms. Miller reread the list to the students to see if they agreed that the lists were looking better. There were still no headings for the list.

TE: Ok you want me to put it over here. Ok, tell me how this reads…On this side: *human, dog, fish, dolphin, butterfly, spider, horse*.

Check this side out…Ok, *pencil, rock, basketball, desk, gold medal, crayons*, *cereal*, *jersey*, *chair*, *cellphone*, *pants*. Alright, we are in agreeance. What do you think the two categories are? … I need titles for my categories now…(calls on student)?

ST: You mean like a title? Human and Non-human.

TE: Ok I like that, but I am looking for something a little more "sciency" or "scientificky". All of those science $100 words. Yes?

ST: I just want to say… (whistling in background)…. umm

TE: You will be ok…ok I have 4 --3

ST: It could be humans human beings and …………..(trying)

TE: Alright give me something else …. K?

ST: Living things and nonliving thing…

Ms. Miller praised the student who got the correct titles for the two columns and then moved pretty quickly to a description of the next few things that she wanted the students to do to extend the lesson focus on living and nonliving things.

TE: Alright, this is what I am going to have you do. I am going to pass out a yellow piece of paper and we are going to fold it in half like we did human resources and natural resources. And I am going to have you guys copy the list of words down, because tomorrow I am going to give you a magazine. Everyone gets their own magazine and you are going to make me a collage. I am going to ask you to find five living things and five non-living things. And glue them on to the paper. Ok, so that is tomorrow's project. So I need this to stay up here so you have examples so we remember. And then on Thursday, if we get time-no on then Friday if we get time after our microscope quiz ok? I am trying to give you directions about what is going on. Ok, so, Friday we are going to go over what is a living thing. I am going to give you a couple of days and I want you to come up with your own definition of what a living thing and a nonliving thing is.

After mentioning the microscope quiz on Friday several times, the science lesson ended. When she stopped by my desk Ms. Miller told me that she had designed the activity while she was out on the playground that day, just before the lesson was to begin.

Summary description of classroom observation six. On December 6th, the focus for science was a discussion of the structure and function of the different parts of a cell. The discussion centered on a worksheet that had been completed by students the prior day with a substitute teacher. The beginning of this lesson was delayed due to students need to find their worksheets. Initially Ms. Miller asked students for their descriptions of the parts of a cell based on the worksheet. Then she discussed functions of each part by comparing the cell parts to parts and people in the school. Students were given prescribed time periods to think about their answers, and were diligent in coming up with ideas during the discussion of functions. Ms. Miller made no explicit content connections to the field trip.

It took a very long time to get the lesson started, with students talking with each other while looking for their worksheets in their desks.

TE: alright those of you who were here, we are going to move on and get started…ok here we go….(tone of voice change to teaching tone)..Everyone's cell should look like so…(voice change back to commanding)…(student name) Not now!.

I need someone to tell me everything they know about a cell membrane, 'cause you are going to have a test on it on Friday… so you have to know your facts. You can't just tell me it is the thing that is colored this way…(Student name)?

ST: There are two cell membranes.

TE: There are two cell membranes? No I need a blank one. There are two cell membranes? Really

ST: (says) That is what the teacher said.

TE: Ok, look at your notes…(students are coughing and shuffling) Look at your assignment. Look in your science notes.

The lesson centers on a review of the structure of a cell, with the worksheet based on the terminology in the science text prominent in the discussion. Eventually Ms. Miller turned the students' attention to the functions of the cell structures by asking them to make analogies between the cell parts and parts of their own school and individuals working in the school.

TE: Ok what can you tell me about the cell wall? (talking to student: "chill, chill.")

ST: Stiff structure that protects and supports the…(student reading the words haltingly)

TE: Ok so this is the protector of the cell. It is that baggy little edging right here... of the cell wall, ok? It is like a cushion. Tell me about the nucleus.

What do you know about the nucleus? If I only see three people writing notes, then those three people get a homework pass. This is ridiculous. Ok, (student), tell me about the nucleus, in your own words, not in theirs.

ST: It's the largest thing.

TE: What does the nucleus do?

ST: (inaudible)

TE: It is the brain of the cell. This is the nucleus up there, it is like your brain. It controls everything that goes on. It tells you what to do. Yes, it is the largest part of the cell, (student)?

There was lots of chatter in this lesson while everyone searched for their worksheets and then discussed the answers on the worksheet as a class. Ms. Miller used counting backwards from five and directed students to finish tasks in minutes or seconds to keep them engaged and on-task during this lesson. She gave students specific lengths of time to write and think and then counted down to help them accomplish the tasks. There were occasional changes in tones of voice between teaching and managing student behaviors. The discussion continued with the introduction of the school analogy:

ST: Ummm the chlorophyll. (needs help with pronunciation…)

TE: You got it …Just chlorophyll…Alright you got it….We'll go back and look at that later…I'll try to look up here at what is drawn…it's ok people do make mistakes but what I really want to know what you understand about the cell. So we are going to compare the parts of the plant cell to our school. Pens and pencils are down…You are listening to my independent instructions..So you guys sit here and think about it. So if you have your notes out and your picture of your cell that is going to help us do it together…..Now if you talk, you do it on your own for a grade. But otherwise we can do it together. No need to talk…when you get this, just name and date. No need to talk...

Alright our first plant organelle is called the cell wall. Your job is to tell us….put it in your own words, do it now. You have 30 seconds. You can't write big 'cause you only have a little box…

15 seconds…students are quiet…Tapping, 5 seconds, 3-2-1 Ok, what did you write for functions within the plant?

ST: (inaudible)

TE: Ok, it protects and supports the cell, think about it. Who in our school is our protector?…not all at once--but who walks around the whole perimeter or our school and supports and protects us?

ST: Ms. Frederick?

TE: Nope.

ST: Ms.Wakefield?

TE: Yes! She keeps us safe. She makes sure the doors are locked she makes sure no one is here without at pass. Ok, once you copy her name you have thirty seconds. Ok, look at the mitochondria.

Although this session began with direct instruction based on a worksheet with a picture of cell parts to be labeled, Ms. Miller added a section devoted to student development of an analogy. In preparation for teaching, she had decided that an alternative strategy was needed to ensure student engagement in the study of cell parts.

She engaged her students by asking them to compare the people and places in their own school to the parts of a cell. As she proceeded to work with her students developing the analogy, she indicated a discrete, 30 second time limit for student thinking about specific parts of the analogy. Students willingly shared their ideas and as the lesson progressed became more adept at figuring out school counterparts to cell parts.

Appendix C
Summary Matrix of the Interactive Nature of the Experiences, Tables 1-8

Table C.1. Descriptions of the Physical Contexts (first three observation dates)

Date and Contexts: **General classroom description** Although the classroom itself is static, Ms. Miller moves the student desks into different configurations every month. The wall decorations in the classroom stay approximately the same, with a daily schedule and additions to the math word wall at the back of the room. Ms. Miller does not hang up student work very much. She uses mostly prefabricated decorations in the room.	September 20, 2006 Social Science class **Topic:** Regional mapping and land characteristics **Brief Description:** This class session involves teacher questions of students and reading of the social science text out loud. Students were asked to come up to the map and locate the states surrounding Maryland. Ms. Miller then introduced land formations before getting out the social science texts. She read a few paragraphs about land formations in the US, and then made sure that students looked at pictures of mountains, plains and a plateau in the textbook.	September 27, 2006 Science class **Topic:** Solar System **Brief Description:** This class session is dominated by a combination of student questions and references to the science textbook. Ms. Miller went around the room and answered every single question and/or listened to what the students had to say about the solar system. The session ended with a kinesthetic demonstration of the movement of the earth and moon around the sun by three students. During the demonstration key vocabulary words such as *rotation* and *axis* were discussed.	September 29, 2006 Science class **Topic:** Intro to the field trip **Brief Description:** This session was led by Ms. Freeman, and is an introduction to the field trip. Ms. Miller was in back of room observing the session. The educator began with a description of what students would do on the field trip, rules for the day, what to wear and bring to the site, lunchtime procedures and the site's website. She then moved around the classroom with two salamanders in a container for students to observe firsthand.

Table C.2. Descriptions of the Physical Contexts (last four observation dates)

October 4, 2006 Field Trip **Topic:** The environment **Brief Description:** The field trip consisted of a hike through a grassy area, a meadow, a forest, back across the grassy area to a deck overlooking the wetland, the boardwalk over the wetland, and a small forested area before returning to the education center. Ms. Freeman was usually in the front of the line or small groups of students guiding them forward to different areas. Sometimes the students moved randomly as they searched for insects or other items of interest on the ground. On the wetland boardwalk, the group moved in single file, with Ms. Freeman in the front and Ms. Miller at the end of the line.	October 30, 2006 Science class **Topic:** Microscope parts **Brief Description:** During this class session, Ms. Miller introduced the students to a worksheet on microscope parts. She used call and response to review the words, then students filled out the worksheet and there was a whole class discussion about the answers. Ms. Miller responded to a non-responsive student in the middle of the class and called the office for assistance.	October 31, 2006 Science class **Topic:** Living and non-living things **Brief Description:** This lesson began with a quick review of microscope parts and then proceeded to an interactive exercise with words on post it notes for each student. They had to place their word in a column on the board under either *human* or *pencil.* After the students placed their words and justified their choice, Ms. Miller invited the whole group to decide on what the columns signified and re-organize the words based on their reasoning.	December 6, 2006 Science class **Topic:** Cell parts and functions **Brief Description:** The beginning of this lesson was delayed due to students need to find their worksheets. Initially Ms. Miller asked students for their descriptions of the parts of a cell based on the worksheet. Then she discussed functions of each part by comparing the cell parts to parts and people in the school. Students were given prescribed time periods to think about their answers, and were diligent in coming up with ideas during the discussion of functions.

Table C.3. Sensory Quality of the Contexts in Terms of Discernable Sensory Inputs (first three observations)

General comments on the sensory inputs including the visual, auditory and tactile characteristics of the classroom and field trip experiences.	September 20, 2006 Social Science class **Visual:** For this class student desks were in a big U configuration facing the blackboard and projection screen. A map of the region was projected onto the screen. Students also read along and looked at pictures in the textbook. **Auditory:** Teacher questions and student responses. *Student voice:* During this session there was an alternation from student chatter to quiet while working with the text. *Teacher voice* Ms. Miller's tone of voice alternated strongly between an irritable tone and a teaching friendly tone. *Background sounds:* Sounds of students moving around and using the pencil sharpener, rustling the pages in the texts. **Tactile:** Students passed out	September 27, 2006 Science class **Topic:** Solar System **Visual:** The desks were in the same big U configuration. Some colorful pictures in the text were referenced periodically. The final activity in class was a kinesthetic model of the solar system, with three students playing the roles of the sun, the moon and the earth. They portrayed the earth's rotation around the sun visually and kinesthetically with help from Ms. Miller. After class Ms. Miller was picking up papers and cleaning up…she stated that she likes her classroom to be neat. **Auditory:** Teacher questions and student responses. *Student voice:* Lots of student questions and comments varying in volumes level; some excited	September 29, 2006 Science class **Visual:** The student desks were in the same big U configuration. Marbled salamanders in a plastic container were shown to all students. *Student voice:* Student questions and responses throughout this session varied in volume and portrayed their curiosity and interest in the field trip; excited during the observation of salamanders *Teacher voice:* teaching, friendly tone of voice throughout. *Background sounds:* Some student chatter and increased volume while they were looking at the salamanders. **Tactile:** Students didn't get to touch the salamanders, but watched Ms. Freeman wet her hands before she picked them up.

	and got to use brand new textbooks.	chatter throughout; laughter during the kinesthetic demo *Teacher voice:* Teacher alternated between teaching tone and tough management tone. *Background sounds:* Loud book sounds **Tactile:** Students looking through books for correct pages	

Table C.4. Sensory Quality of the Contexts in Terms of Discernable Sensory Inputs (last four observation dates)

October 4, 2006 Field Trip **Topic:** The environment **Visual:** The series of settings were rich in colors (shades of green, brown, black) and textures (leaves, rocks, soil, water, grass, trees, plants, etc.). The education center meeting room had dark colored walls, a high ceiling, and a large stone fireplace at one end of the room. **Auditory:** Teacher questions, comments and directions to students and chaperones; student and chaperone responses, questions, discussions with each other and the	October 30, 2006 Science class **Topic:** Microscope **Visual:** The student desks were grouped in threes with two facing the group of three. There were four "team" groupings with names of football teams, the Chargers, the Falcons, the Colts, and the Redskins. **Auditory:** *Student voice:* Throughout this class there were periods of student loud chatter and movement	October 31, 2006 Science class **Topic:** Living and non-living things **Visual:** The student desks were still in the team of five configuration. The post-its and columns of words on the board added a visual aspect to the lesson. **Auditory:** Teacher questions and student responses throughout; student movement to the board with their post-its. *Student voice:* There was some background chatter during this lesson, but in general the	December 6, 2006 Science class **Topic:** Cell parts and functions **Visual:** Basically the same desk formation. **Auditory:** Teacher questions and student responses; student movement, humming, buzzing of the pencil sharpener. *Student voice:* Students were pretty noisy as this lesson got started, with humming, talking and singing in the background. Their conversational points during the

chaperones. *Student voice:* Students were very talkative and enthusiastic throughout the field trip. They asked a lot of questions during the discussions that varied in volume and clarity based on the individual confidence levels. *Teacher voice:* Ms. Miller supported student work with enthusiasm in her voice. There were occasional interactions in which she supported student work quietly. *Background sounds:* Included a variety of animal sounds, such as bird calls, insect noises (whirring, buzzing, clicking), the sounds of leaves being crunched underfoot in the forest, sounds of fish and frogs moving in the water of the wetland. Also very loud airplane sound periodically overhead. **Tactile:** There were many opportunities for students to touch plants and animals and leaves and soil and water throughout the trip.	interspersed with quiet work on the worksheet. During the opening work Ms. Miller employed call and response, creating an opportunity for students to call out, rhythmically, together. *Teacher voice* The shifts between management/stern tones of voice and helpful, teaching tones were not as dramatic as for other lessons. **Tactile:** Students worked with pencil and paper to fill out the worksheet.	students worked quietly as they placed their words on the board. Some of their answers were very quiet and tentative. *Teacher voice:* The lesson started off with some irritable teacher talk about what had just happened on the playground, but rapidly changed to a normal, friendly, teaching tone of voice. **Tactile:** The students placed their post-its onto the board.	discussion about cell functions compared to school functions were sometimes quiet and tentative sounding. Occasional laughter punctuated the discussion too. *Teacher voice:* Ms. Miller mainly worked with friendly tones of voice throughout this lesson. **Tactile**: Students mainly worked with their worksheets, filling them out with pencils..

Table C.5. Nature of Interactions (first three observation dates)

Date and Contexts: **Nature of the interactions and conversational characteristics** in terms of inquiry, conversation, instruction and debate (Burbules & Bruce, 2001)	September 20, 2006 Social Science class **Nature of Interactions:** *Teacher and students*: This session had characteristics of ***instruction*.** Ms. Miller was at the front of the room, leading a question and answer session about states and then regions of the US using a social studies text and an overhead projector with a map of the mid-Atlantic region to stimulate student responses.	September 27, 2006 Science class **Topic:** Solar System **Nature of Interactions:** *Teacher and students*: This session was more like a ***conversation***, with an open-ended discussion about the solar system and development of understanding of student questions prior knowledge about solar systems.	September 29, 2006 Science class **Nature of Interactions:** *Teacher and students*: This session had the characteristics of ***instruction*** in that the students were led through a series of descriptions and understandings about the field trip in advance of their experience. It ended with a brief ***inquiry based*** discussion based on several questions about the salamanders that were brought to the classroom.

Table C.6. Nature of Interactions (last four observation dates)

October 4, 2006 Field Trip **Topic:** The environment **Nature of Interactions:** *Site educator and students:* Throughout the field trip there were elements of ***instruction*** and ***inquiry*** in the interactions between Ms. Freeman and the students and chaperones. Ms. Freeman modeled making observations throughout the field trip. *Ms. Miller* maintained several roles during the	October 30, 2006 Science class **Topic:** Microscope **Nature of Interactions:** *Teacher and students*: This class session involved Ms. Miller leading the students to the correct answers on the microscope worksheet through an	October 31, 2006 Science class **Topic:** Living and non-living things **Nature of Interactions:** *Teacher and students*: This class involved an ***inquiry*** process as the students worked to solve the problem of where each word fit into the column scheme. There was also an element of ***debate*** as students	December 6, 2006 Science class **Topic:** Cell parts and functions **Nature of Interactions:** *Teacher and students*: This class session used elements of ***inquiry*** and ***instruction*** as the students worked to solve the problem of drawing an analogy between the functions of cell parts and their

field trip, including assisting student understanding of discussion points and completing activities, working with the students to fill out the worksheets as requested by Ms. Freeman, and managing student behavior as necessary.	***instructional*** process.	justified their reasoning.	school.

Table C.7. Construction of Knowledge (first three observation dates)

Elements of Construction of knowledge Quality of the questions asked by teachers and students, open or close-ended (Kisiel, 2005) and references to prior knowledge and experiences as they make "sense" of their experiences (Miller & Boud, 1996)	September 20, 2006 Social Science class **Quality of questions:** Most of the questions asked by Ms. Miller of the students were close-ended. **Examples of teacher questions:** Who can tell me: Who remembers one of the surrounding states of Maryland? Who remembers there were four of them? Do you remember where West Virginia was? Where do you think Pennsylvania is? **References to prior knowledge:** Ms. Miller referenced their prior work on the subject. There were no student questions.	September 27, 2006 Science class **Topic:** Solar System **Quality of questions:** This class included both open and close-ended questions on the part of Ms. Miller working with the students. Ms. Miller asked students to discuss anything they wanted to about solar systems. The end of the class session involved specific knowledge about how the earth moves around the sun. The series of teacher questions included: How long does it take for the earth to move around the sun? Which side (direction) does the	September 29, 2006 Science class **Quality of questions:** This class involved a number of questions from the students to the educators about the field trip. **Examples of student questions:** Do jaguar's live there? What is a wetland? Does that have water? Will we get to catch some frogs? That is a lot to remember! Do we need our bookbags? Do we have to bring lunch? Where do we eat? Do you know which one is a boy and which one is a girl? (salamanders) Do you have a website? **References to**

		sun rise in? What planet could we not live on because it is too close to the sun? **Student questions**: If somebody goes to the sun would they be fried? Are we on earth? What is under this part? How do the ice ages come? **References to prior knowledge:** One student referenced her experience with a phone call to her home county of El Salvador and another referenced a TV show and technology.	**prior knowledge:** The student questions were based on their prior experiences on field trips and common sense questions.

Table C.8. Construction of Knowledge (last four observation dates)

October 4, 2006 Field Trip **Topic:** The environment **Quality of questions:** Most of the questions asked by Ms. Freeman were designed to stimulate student thoughts about the environment. **Examples of site educator questions:** What area do you think we are in…a field a forest or a wetland? But what is it? Does it smell like a lemon? Does it smell like a pear?	October 30, 2006 Science class **Topic:** Microscope **Quality of questions:** The questions asked by Ms. Miller in this session were close-ended, targeting the parts of a microscope. **Examples of teacher questions:** So what is an instrument that	October 31, 2006 Science class **Topic:** Living and non-living things **Quality of questions:** Ms. Miller's over-arching question for this session stimulated the students problem-solving capacities due to its open-ended quality. At the end of the lesson, the students answered the question themselves. **The**	December 6, 2006 Science class **Topic:** Cell parts and functions **Quality of questions:** This class session consisted of a mixture of close- and open-ended teacher questions. **Example of questions:** What would the nucleus do? What does it contain; the green color? Your job is to tell

How come the leaves fell off the tree? Do you know why it is called the Sweet gum tree? What is sap? How much water would there be at high tide? Give me some evidence look around can you see how high the water got recently? **Student questions**: were wide ranging and showed their curiosity throughout the field trip. Example student questions: What kind of birds? Is there a banana snake? How do you find snakes? Did the other group find a snake? **References to prior knowledge:** There were periodic participant references to prior knowledge. For example Ms. Miller identified a green tree frog early in the field trip, accessing her prior year's field trip experience. A student sighted a spider in the meadow and immediately called it a tarantula, accessing her prior knowledge of spider names.	we can use to look at a cell? Anyone know what the eyepiece is for? What is the arm used for? Which one is the body tube? **References to prior knowledge:** None	**question was**: What are the categories of the two columns of words on the board? **References to prior knowledge:** As students justified their choice of column for their own word, they accessed their prior knowledge of the items in the list.	us what is the function, in your own words? Think about it: Who is the protector of our schools? Who is it that walks around the perimeter of the school and protects and supports us…Who is it? **References to prior knowledge:** Students accessed their own knowledge of their school as they compared parts and functions of the school to the functions of cell parts.

Appendix D

Student Interview Transcripts

On October 13th, three girls (two Hispanic and one African American Becky, Marianna, and Afia) (and a boy (African American James) were interviewed. On October 17th, two boys and two girls (all African American, Lynda and Nyah, Ade, and Niles) were interviewed. On December 6th, Nyah and James were interviewed as a follow-up to the October interviews.

During all of the interviews, the students were very curious about the equipment and what we would be talking about. They actively engaged with each other in conversation and mostly stayed on task throughout. There were several times when the groups' attention was diverted, but they responded readily to my direction. During the second interview, Ade pretended to be a radio announcer picking up the recording device on the table and speaking in a deep voice into it with "announcements" related to our work together. This added both a creative and playful element to the interview. Periodically the students disagreed, but we were able to quickly resolve the issues through discussion. In general, the interview sessions were noisy due to students talking excitedly on top of each other.

I began each interview with an introduction and brief description of the research study. After thanking the students for participating in the study, we discussed what we would be doing for about an hour. I showed students the video and audio equipment and then asked them to answer the first question on the interview worksheet (see Appendix A). The first question was a word list, which I hoped would give students an opportunity to freely think about the field trip. The second question asked students to write a story about something that was very interesting about the field trip. In the third question I asked the students to relate their favorite thing about the field trip.

The students were pretty quiet while answering the questions. After they had written down their answers, I asked each student to share their answers with each other. Students read the questions carefully with varying levels of confidence before giving their answers. Several students listed the same words for the first question. During both interviews, we spelled words together out loud.

October 13th Interviews

The students expressed enthusiasm for the field trip experience and discussed a variety of topics. They made several connections to other outdoor experiences in their lives. They cooperatively drew pictures that represented their memories of the field trip

Student enthusiasm for the field trip experience. As this interview got started, there were a series of quick comments made by students about the field trip experience:

ST: It was fun!

ST: Yeh, I liked it!

ST: I want to go again.

ST: I can hardly wait to go again in the spring!

ST: We were in the girls group. We picked up worms, and spiders.

They were very enthusiastic about the experience and expressed interest in the spring field trip.

Opening Discussion. I asked the students to define research, especially because they were involved in this research study. Their responses showed their understanding of research quite clearly:

ST: Research means when you find out something. And you research it.

ST: And you study it

ST: Or find information. Find it from the text.

Their definition was possibly limited to looking up information about a subject in books rather than the process of designing and implementing an experiment or study and gathering data.

I then asked the students to answer the questions on the worksheets. As the students began to write, they were talking about the field trip and related experiences from their lives. They discussed insects, the meadow, butterflies, water striders, and one student told a story about ants on the television show "Fear Factor" as they were writing. The following series of comments was typical during the interviews, wherein the students wandered through different thoughts together:

ST: I want to see a snake.

ST: Do you think we might see foxes in the spring? (Students talking on top of each other.)

ST: I want to go in the summer.

ST: Do you all got cicadas?

ST: What's a cicada?

PP: Do you know what a cicada is?

ST: It is those things that stay in a tree. It is those things that fly around you and I had one on my hand.

ST: I love those bugs.

One student proceeded to make mosquito noises and we had a brief discussion about foxes. Becky talked about bringing her family to see the site. As the students read their word lists aloud, sometimes other students interjected comments about the words. The discussions were brief during this part of the interview. The second question asked for student stories about something interesting during the field trip. Most students wrote one to three sentences, making both their written and verbal stories relatively short in length. The following excerpt is an example of one student's story and the comments of other students that it elicited:

> ST: (reading out loud) I liked going in the exhibit room and when we got to touch the turtle. (reading and speaking slowly.)
>
> ST: It looks like mud…umm the marsh.
>
> ST: I want to put the turtle in the water marsh.
>
> ST: I saw a turtle.
>
> ST: We got to touch it.
>
> ST: That was, oh my god….it had long claws.
>
> ST: It couldn't see us.
>
> ST: How come you all didn't see it?
>
> ST: How did it get in the tank?
>
> ST: I know it was a painted turtle, wasn't it?

In this short interaction, the students expressed their interest in the turtle in the tank, which some students had touched.

<u>Outdoor experiences</u>. The second question was a paragraph description of what each student considered to be the most interesting part of the field trip.

These paragraphs were quite short and were read very quickly by the students. If there was not much discussion, we moved on to the next person. I then asked the students to verbally compare their experience during the field trip to any outdoor experiences that they might have at home. They talked about riding their bikes, playing football, and going into the woods. Again, the descriptions were very short:

> ST: Outside, when I am outside, I just play with my dog in the back yard and then I bicycle. And then if my two friends are there I go knock on their door. And I don't like going outside by myself alone, because it is really boring. It's really boring.

Another student described playing outside with their friends:

> ST: It was like on August 1st and we were playing outside. We met some friends and it is almost like a girls' club. But when I started to play with them and I saw her mom she said that my daughter is sick, so I can't play with her and that made me feel bad.

Another student talked about what he did during recess:

> ST: Well, at recess --I just sit there-- I don't do anything. I don't play, but when I see bugs, I think of (the field trip site). I just sit there and think all day. That's why I was daydreaming…instead of listening to what my teacher is saying.

This was a very frank description of just sitting and thinking, that contrasted with the other activity-oriented descriptions.

The last question on the worksheet asked the students to describe their favorite thing about the field trip. Their answers ranged from picking up worms to "Seeing the tree frog because I had never seen a real frog" to seeing the green tree frogs and going on to the deck. One student mentioned three habitats:

> ST: When we went to the wetlands, the forest and the fields cause we saw all kinds of animals, wet frogs, and insects.

The verbalization of what they had written didn't create much extra discussion among this group of students.

Picture drawing. The final activity during the interviews was collaborative picture drawing related to the field trip. Both groups decided to split the large sheet of paper in half. Both groups worked on their drawings across the table from each other.

Both drawings (See Figures D.1 and D.2) depicted particular aspects of the site and show the students' interest in a mixture of plants, trees with holes, and animals. Drawing D.1 depicts the elevated observation deck with three people on it, three trees (one with a big nest hole in it) a green frog, clouds, an osprey flying, the sun and the moon. Drawing D.2 depicts a large building, clouds, a butterfly, two trees with holes in them, a smiling fish, and water. The student did not discuss the field trip together as they drew the pictures. These two students tended to draw things independently of each other's opinion about what should be drawn.

Figure D.1. Student Drawing 1, Oct. 13 Interview.

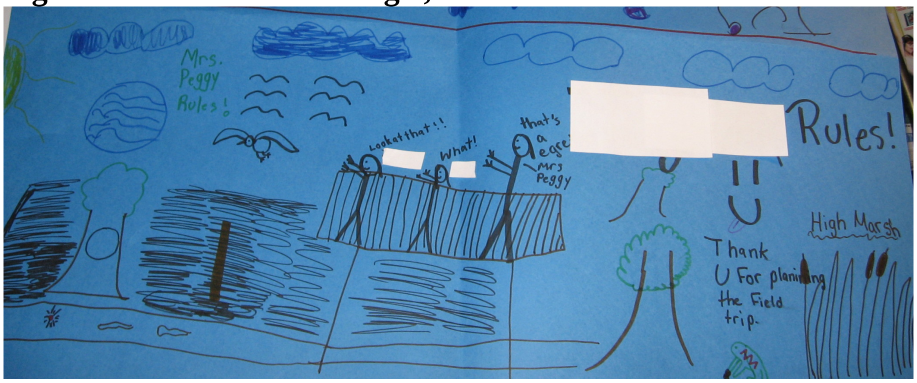
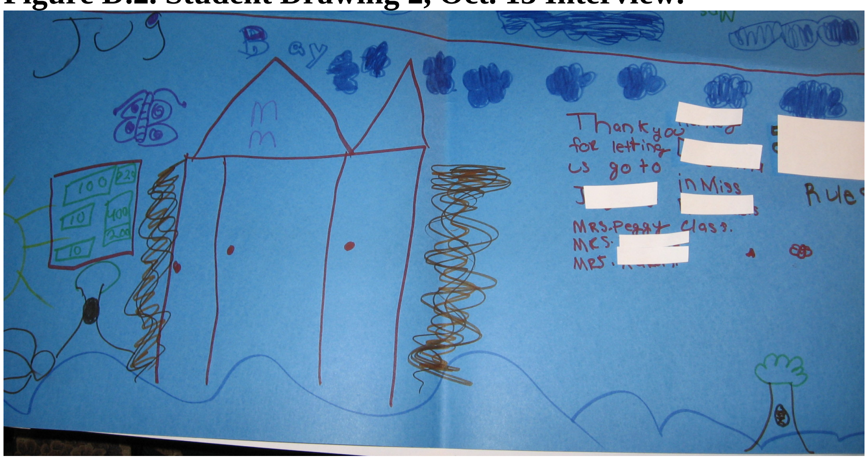


Figure D.2. Student Drawing 2, Oct. 13 Interview.



<u>October 17th Interviews</u>

These students also expressed enthusiasm for the field trip and discussed things they had found. They made connections to other outdoor experiences but not to learning science at school. This interview ended with a vigorous discussion of snakes.

<u>**Student enthusiasm for the field trip experience**</u>. The four students opened this interview with a discussion about what they had seen during the field trip:

ST: And we wrote down what we liked. And me and my friend saw thirty-two tree frogs!

PP: You counted them?

ST: Yeh, we did.

ST: And the boys, we saw two snakes and a bunch of tree frogs.

ST: And we saw the, umm, the beaver house (Students talking really loud on top of each other.)

ST: And we saw the wood that the beaver ate.

The students talked a little bit while they were working on listing the words from the field trip. One student said:

ST: Ooh! We saw that puffy mushroom. You put your finger on it, and it went Poof! and sprayed all that stuff into the air.

Another student said that they had wanted to take one of the little green tree frogs home. The following short discussion about beavers included sighting a beaver and a detailed debate about the shape of a beaver house:

ST: They said they got to see a beaver and it was brown and it was chewing on wood and when they came, it ran.

PP: So is it possible that they saw a beaver?

ST: Yes.

ST: Actually, No, ‘cause the lady said that the beaver was coming at night.

ST: That’s because beavers got to build dams.

PP: What did the dams look like?

ST: It looks like a hut so it is built around like a cylinder.

ST: No a cylinder and the bottom of a cylinder.

ST: No, it has a cone at the top and it looks like a circle down bottom.

PP: Maybe you could draw it on a piece of paper.

ST: (Student drawing) It looks like this…

ST: I said a cone and a cylinder at the bottom.

ST: No, that is what the house looked like that you saw.

The students were quite interested in the beaver homes and dams, and had retained a high level of detail about where beavers live. The two students who had differing ideas about the shape of beaver houses were willing to talk about it and work it out as they talked.

Student descriptions of things found. As the students worked through the list of questions on the worksheet, one student remembered touching something that was green and sticky:

ST: It is this green thing it is this thing that is green and when you open it, it is …sticky?

PP: Does anyone remember what that was?

ST: It was like this. It was black outside of it and it was green and sticky inside of it.

PP: Was it at the marsh?

ST: No. I forgot it was at the low or high marsh and she picked it off from the tall flower and then she opened it and I stuck my nail into it and held it on my palm.

ST: And it would stick on you without falling.

PP: Do you think it was a cattail? Was it a brown cattail, did she use the word Velcro?

ST: No it was a green thing…

ST: Alright in the middle of it would stick onto you like always.

ST: It was real sticky-- it was like glue.

We never figured out exactly what the green and sticky thing had been, but the discussion mirrored the intention of the site educators that participants should be able to describe things, and not be focused on identification and naming things. In this conversation, the students worked on communicating what it looked like and felt like, using many descriptive words. Because the girls and boys had hiked around the site different groups, they had probably found slightly different things during their hike through the different habitats.

One student remembered great detail about a blue heron discussion during the field trip:

> ST: I remember, 'cause they said look out and see these big white birds and then we saw them flying.
>
> ST: All I remember is they said when they get close to you, you should be careful.
>
> PP: Was it an osprey?
>
> ST: It was like one of those birds that flew around the low marsh like where it leads to the Bay and we saw it fly all around it….
>
> PP: Was it a goose?
>
> ST: No, it wasn't a goose.
>
> ST: It was a big white bird.
>
> PP: Was it a heron?
>
> ST: Yeh, it was a heron.

ST: And we asked Ms. Diane. where it was going and she said it was going to the Bay river and that was when we asked her how long does it take to get to the Bay river, she said it would take ten hours, but for the low marsh and the high marsh to rise it takes about six hours….

This student was making connections between habitats and a bird's movement, including length of flight times and details about the difference between the tides in the low and high marshes.

Remembering other outdoor experiences. Several students had stories about frogs in their backyards. One student talked about how her grandmother collects frogs:

ST: No, my grandma does…And at night time at my grandma's house she collects frogs and she got this big box like this and it got a like skinny board between them so they can't eat each other.

PP: Ok what does she do with them?

ST: She got a top over the frog so it can't jump out…And she put, like she catch little fishes like that for the turtles and she gives worms and ants and bugs to the turtles. And she found two camouflaged frogs.

PP: Let's have (Student) tell us what that big word means…

ST: Camouflage means when they are hiding you can't see them that good 'cause they change the color that camouflage them...

PP: Do you know how to spell that word?

ST: I am going to spell it.

ST: I am the news reporter and I am taking news. These people have told their stories.

ST: Not me!

ST: Big high news reporter…

In this story, the students correctly used the word "camouflage" as she talked about her grandmother's animals. Another student defined it and then we spelled it together. By the end of the interview, Lynda spelled it correctly on the board without assistance. Ade picked up the recorder and played "news reporter" at the end of this discussion.

Connections with science. Toward the end of the interview, we talked about classroom connections between science and the field trip. The students mentioned that in class they had been focusing on the solar system, but did not really make other scientific connections explicitly in response to the question.

Snake discussion. The interview ended with Ade and Niles drawing together and the two girls, Lynda and Nyah working on collaborative drawings. The two boys immediately decided to draw snakes on a tree limb. This excerpt shows the details of their negotiations about what and how to draw the snakes:

ST: (sounds of drawing)….and then you can design your snake, I am still designing mine. Mine has teeth like yours. 'Cause snakes don't got no arrows….I want this snake to look mean…Don't you want the snake to look cool?….(student singing)….You draw yours….That don't look right…I want my tongue to be a little bit wider. It is pink. If our picture was a little bit bigger…Why are you drawing the snake that color?

The snake was black.

ST: The queen snake was grey….and don't use pink, 'cause it looks like grey…no that is ugly…ok I am not using pink….This snake look cool. I found this one.

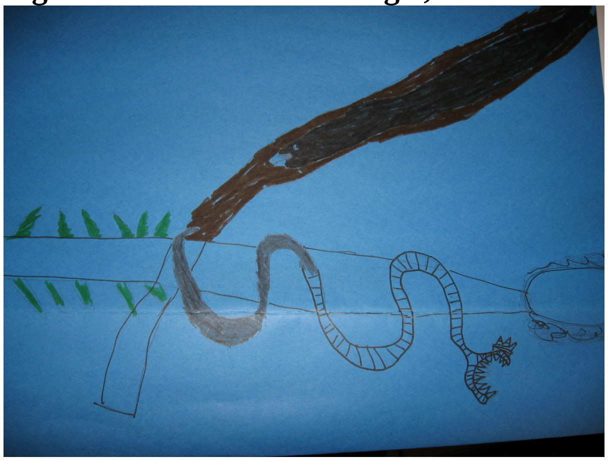
ST: It is just a queen snake. Mine is going to be the queen snake, the cool snake that is black white and grey.

ST: It does. A coral snake has lines on it.

ST: That isn't a coral snake it is a queen snake….You know it was grey… I don't want brown at the bottom of my snake..yeh I really put grey on my snake…Your snake is far away from mine…I should have put my snake right there….

The two boys had found the snakes during the field trip and were very engaged as they made a drawing of two snakes in a tree. Ade accessed his prior knowledge of snakes as he got creative with the colors. The two boys stated their opinions clearly about what the snakes should look like and then negotiated drawing together in very close quarters. The end result was a detailed picture of two snakes, one with a crown on its head and very large spiky teeth (See Figure D.3)

Figure D.3. Student Drawing 1, Oct. 17 Interview.



December 6th Interviews

I decided to individually interview Nyah and James on December 6th. These interviews were not part of the research design. After I finished my science lesson observation on that day, Ms. Miller and I agreed that I should interview Nyah to finish up the process that had been interrupted on October 17th, when she abruptly left the room. To balance the interview process, I decided to also interview James. I decided to share some pictures from the field trip with the two students. We then talked about the field trip together as the students made individual drawings related to the field trip.

To extend the discussions, I asked the following questions: In what ways do you like learning science in school? What do you want to be when you grow up? How do you relate what you are learning in science in school (structure and function of cells) to your experience during the field trip?

Even though it was two months after the field trip, Nyah remembered many details about the various habitats. She talked a lot about finding things. James was very quiet during the interview. He proceeded to draw a picture very similar to Nyah's, but with a personal addition that he described as a "Character in Nature."

Field trip habitats. The students both started drawing individual pictures at the beginning of their interviews. The female student remembered and discussed habitat details early in the interview even before we looked at the slide show, with no prompting:

NY: We went to the wetlands first. We went to the high marsh and then we went to the low marsh and then, hold on, there was five things, right….we went to the high marsh, the low marsh, the wetlands…We went to the woods and there was one more thing that we did…

PP: Did you go to the meadow?

NY: Oh yeh we went to the meadow.

PP: was that last for you?

NY: Yeh, the high marsh was the first thing for us.

PP: Ok. So what are you going to draw a picture of?

NY: When we was in the woods and we found this mushroom…that when you pushed down on it some stuff came out of it…

This student described catching insects using descriptive words:

NY …yep! I caught a black thing that had a hundred legs on it and it was brown. I caught a spider and a worm and I caught one of these green things.

PP: A grasshopper?

NY: No. I think it was a preying mantis. It was sitting on the tree and I caught it.

Finding things. Nyah also talked about a leaf that she had found in the forest and described one leaf as being very pointy and large in response to my question about leaf shapes that she remembered:

NY: (thoughtful tone of voice)…We had to pick up different kind of leaves and see if we could describe it…

PP: Do you remember any of the leaves?

NY: I picked up like a straight pointy one..like that (draws a picture)

PP: Oh that is really pointy! Like that (I drew a leaf) kind of?

NY: Yes but pointier…. yeh, like that…

PP: And it was pretty big? It was like that big? How long….show me.

NY: No- that finger to that finger.

PP: So that was pretty long…I am going to say seven inches…

Nyah also mentioned her experience rolling logs to find what was living underneath, which was encouraged by the site educator. She remembered finding a grasshopper, worms and a little brown salamander under the log.

Character in Nature. When James joined us, I decided it would be okay for the other student to stay with us. He immediately started drawing a picture that at first resembled the other student's picture. Even though I showed him the same pictures of the field trip that I had shown the other student, he did not talk at length about the field trip. Until…….James said that the picture he was drawing was one of "Character in Nature":

PP: Can you relate what you are studying now to the field trip?

JA: “Character in Nature.” Because you all had a lot of grass and flowers and trees. Because it was us, and we were the *character*. And we had the trees and grass and flowers and that was the *nature*.

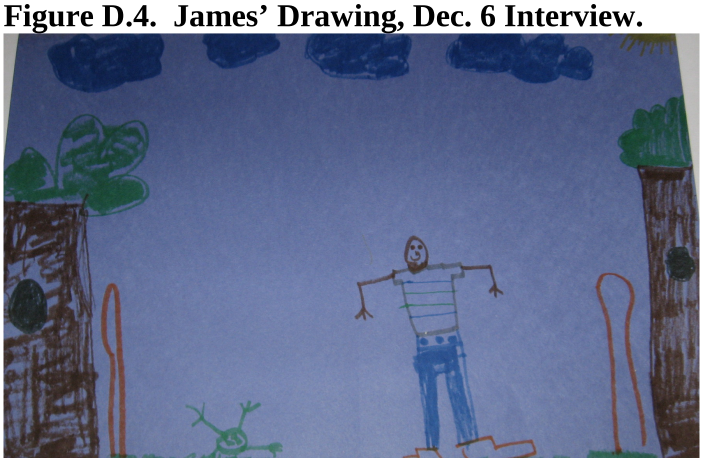
PP: So where did you get that from?

JA: From science.

In the middle of his pictures of trees, he had drawn a picture of himself and pointed to it while he was describing a “Character in Nature.” He had been very quiet during the interview in general, so we kept talking a little while longer and then ended the interview.

At the time, I did not realize the importance of what had just occurred. During the teacher interview right after this student interview, I mentioned James’ reference to “Character in Nature.” Ms. Miller responded by describing her work with students the day before during language arts, on the concept of “Character vs. Nature.”

Figure D.4. James’ Drawing, Dec. 6 Interview.



James’ picture showed trees and a human in between, see Figure D.4. In contrast, Nyah’s drawing illustrates her favorites: the puffy mushroom and the log to roll over in between the two trees, see Figure D.5.

Figure D.5. Nyah's Drawing, Dec. 6 Interview.

After both interviews, I realized that although James had not been very talkative during the interview, his thought process had been very much related to the field trip. He had made a connection between thinking about characters in nature and his experience during the field trip. His drawing represented his meaning-making process that connected his experience in nature with the concept of a character or person in nature.

Appendix E

Narrative Summary on "Camouflage and Snakes"

Snakes were of interest to the students from the beginning of the field trip experience, but Ms. Freeman, in describing camouflage and noting that it would be hard to find snakes, stimulated a higher level of curiosity in the field trip participants.

She first used the term *camouflage* during the pre-trip orientation and then used it to describe the common attributes of plants and animals that make it difficult to see animals in their natural surroundings. She mentioned early in the pre-trip presentation that the animals at the site might be difficult to find due to their camouflage characteristics and thus effectively presented students with a challenge that they might not see any snakes.

During the pre-trip discussion, the students seemed familiar with the concept of camouflage, and defined it correctly in response to her questions. Several students wondered if they would be seeing snakes. Ms. Freeman indicated that they might or might not, and mentioned their camouflage colors as the reason that they blend so well into the background.

> ST: How do you find snakes?
>
> ED: That is a perfect question--how do you find snakes if they blend in because of camouflage? You have to be looking, you have to look really hard and you know what? I will let you know that we probably will not see a snake because they don't like it when groups come along, so they typically hide really well. But if we do, that will be great…(Field trip, October 4, 2006)

During the opening segment of the field trip in the education center, Ms. Freeman discussed both nocturnal and camouflaged animals with the students. She made several more statements about snake sightings in response to students asking again if they would see any snakes. She said emphatically that they would not, suggesting that the animals at the site tended to run away from the noisy groups visiting the site. She also mentioned that they would be difficult to see, but that maybe someone at the end of the line might find some snakes. These comments only made the students more determined to spot a snake.

Because snakes are not everyone's favorite animal, and many people are afraid of snakes, it was not surprising that one student became apprehensive almost as soon as the group stepped outside. Ms. Miller reassured him that there was not a snake nearby. This was just one example of the close attention she paid to student fears. These fears were not unusual. During the post-trip interview Ms. Freeman mentioned that frequently students who have recently immigrated to the US are more fearful of snakes, and with good reason. Poisonous snakes are still found in many countries outside of the US and in South and Central America in particular, which are the origins of many immigrant families in this area.

Periodically during the course of the field trip, students made observations that were based on their prior experiences or knowledge of animals, and snakes in particular, showing their high level of engagement and interest in interacting with Ms. Freeman. During the hunt for insects, one student spotted a hole in the ground and labeled it a snake hole. Ms. Freeman immediately pointed out that the hole was too big, that it looked like a site where squirrels might have buried some nuts, and encouraged the students to look for evidence.

The vegetation in the wetland area along the boardwalk was quite different than the forest, and because students were walking in a single file, interactions were limited to one or two people and the environment. The opportunity to look carefully at the vegetation was not lost on the students at the back of the line. They spotted a black rat snake on a tree branch with much excitement! There were many congratulations and Ms. Freeman mentioned that everyone at the front of the line had walked by the snake.

Because the teacher was at the end of the line and right in front of me, I was the only person who heard her say very quietly: “I think this is the closest that I have ever been to a snake.” This comment provided evidence of her assertion during the first interview that she was not an outdoors person.

A student asked if the snake could be caught and Ms. Freeman replied that it could, but she would not recommend catching that kind of snake. She proceeded to very calmly explain that it would “poop” on your hands and it would smell awful, and showed the students (again in response to a question) where the excrement would come out of the snake. This down-to-earth discussion was presented as a scientist discussing anatomical functions, and provided students with another way to think about what is involved when handling wild animals.

This interaction provided a great example of Ms. Freeman’s descriptive technique during the field trip and yet another repetition of camouflage. She stated that it takes a careful eye to find camouflaged animals and this was the basis of her compliments to the students who had found the snake.

About fifteen minutes later, the same students spotted one snake and then another right next to it curled up in two small tree branches. Another round of congratulations went to the "snake finders" at the back of the line. The snakes were then described by Ms. Freeman as the smallest snakes found on the site, or queen snakes, providing another example of her depth of knowledge about animals at the site.

The students in our group were curious about whether the other group had found a snake, and one student asked the girls right away if their group had seen any snakes. He quite happily reported that our group had seen three. The girls reported that they had not seen any snakes, but had spent a lot of time rolling logs and looking for salamanders in the moist ground underneath the logs.

Appendix F

Field Trip Preparation Framework and Worksheet

Wetlands and Rivers as the context of field trips: A framework to assist a teacher's decision-making process, NSTA Presentation
Peggy L. Preusch, March 29, 2007
St. Louis, MO

Context
Location and habitat types
Maps of the area indicate:
Are there any descriptions of the habitat types available?
What is the level of detail? Will you need more information on the habitats?
Is there information available in terms of the study of the sciences like Geology?
Geography? Ecology? History?
Which particular plants and animals can be found at the site?
What effect will season have on what the students will see and do?

Pedagogy
Who will teach? Will there be an "expert" available to answer questions? How important are printed materials and signage to the overall experience?
Will the students be working in small groups? Or all together in large groups "walking and observing and doing things and talking"?
How frequently and for how long will students be involved in "hands-on" activities?
Will they be involved in an inquiry process or investigation at the site?
Who will be the "expert" at the site?

Scientific research
What is your interest level in research at the site?
Will the students be able to connect with research in any way?
Is there on-going research at the site?
Are there scientists working at the site? Or are they located elsewhere?
Is there any information available about the research at the site?
How will it be presented to students?
Will the students be actively involved in gathering data?
Are there any obvious connections to research available for your students?

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