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MECHANISMS INFLUENCING STUDENT UNDERSTANDING ON AN OUTDOOR GUIDED FIELD TRIP

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by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosphy

The University of Texas at Austin

December 2009

Dedication

This work is dedicated to our three children, Seamus, Leah and Rory who have been my inspiration in understanding children. May they all go continue to grow and explore the world around them.

Acknowledgements

I have many thanks to my committee members, Dick Richardson, Jim Barufaldi, Ed Emmer, Jill Marshall and Ed Theriot for their help and support. Many thanks to Sari Khayyal for all his help when I needed it.

I especially thank the third grade classes of Trinity Episcopal school and the teachers and parents who made it possible for this study to progress.

Thanks to all my friends and family who feigned interest in my work and who listened to me complain yet prodded me on to keep working. Gaye Al-Rashid, Ramzi Al-Rashid, Bonnie Butler, Perian Strang, Janie Black, and Flavia Gaskin. I also thank the people at Westcave preserve and McKinney Roughs for their assistance.

Most of all I thank my husband for all of his love and support throughout this process.

MECHANISMS INFLUENCING STUDENT UNDERSTANDING ON AN OUTDOOR GUIDED FIELD TRIP

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The University of Texas at Austin, 2009

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Field trips are a basic and important, yet often overlooked part of the student experience. They provide the opportunity to integrate real world knowledge with classroom learning and student previous personal experiences. Outdoor guided field trips leave students with an increased understanding, awareness and interest and in science. However, the benefits of this experience are ambiguous at best (Falk and Balling, 1982; Falk and Dierking, 1992; Kisiel, 2006

Students on an outdoor guided field trip to a local nature park experienced a significant increase in their understanding of the rock cycle. The changes in the pre-field trip test and the post-field trip test as well as their answers in interviews showed a profound change in the students' understanding and in their interest in the subject matter.

The use of the "student's voice" (Bamberger and Tal, 2008) was the motivation for data analysis. By using the students' voice, I was able to determine the mechanisms that might influence their understanding of a subject. The central concepts-emerging from the data were: the outdoor setting; the students' interest; the social interaction. From these central concepts, a conceptual model was developed.

The outdoor setting allows for the freedom to explore, touch, smell and movement. This, in turn, leads to an increased interest in subject matter. As the students are exploring, they are enjoying themselves and become more open to learning. Interest leads to a desire to learn (Dewey, 1975). In addition to allowing the freedom to explore and move, the outdoor setting creates the condition for social interaction. The students talk to each other as they walk**;** they have in-depth discourse regarding the subject matter -- with the teachers, each other and with the guides. The guides have an extremely important role in the students' learning. The more successful guides not only act as experts, but also adjust to the students' needs and act or speak accordingly.

The interconnections of these three concepts-- the outdoor setting, the students' interest, the social interaction - worked to provide the mechanisms by which the students increased their understanding of the rock cycle.

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INTRODUCTION

Introduction

With the passage of the No Child Left Inside Act (NCLI) of 2008, the importance of understanding outdoor education has never been more relevant to curriculum development and insight into children's cognition. When the No Child Left Behind Act (NCLB) was passed in 2001, a new method of assessment and accountability was adopted by schools. This measure of high stakes testing of specific subjects marginalized other subjects. This meant many teachers were forced to cover subjects, which are specifically related to the assessment tests, and in doing so, neglected other important subjects. Research has shown that traditional classroom science focuses on the memorization of terms and the repetition of recipe laboratory experiments, to the detriment of learning scientific ways of thinking for connecting students to everyday life (Gallagher, 1991; Wasley, Donmoyer and Maxwell, 1995). Science education is considered essential for today's students, and is frequently touted as in need of improvement (AAAS, 2006).

The National Science Education Standards (National Research Council [NRC], 1996) recommends students develop an understanding of science that enables them to use their knowledge in personal, social, and historical contexts. These scientific literacy standards state that, "everyone needs to use scientific information to make choices that arise every day. Everyone needs to be able to engage intelligently in public discourse and debate about important issues of science and technology. And everyone deserves to share in the excitement and personal fulfillment that can come from understanding and learning about the natural world" (NRC, 1996).

The National Science Education Standards realizes that the "classroom is a limited environment. The school science program must extend beyond the walls of the school to the resources of the community" (NRC, 1996, p. 45). Yet subjects such as outdoor education, rarely a top priority for teachers, even in a more amenable educational era, is predominantly given up to make room for the typical "drill and kill" of memorization topics. Teachers are reluctant to place much energy into organizing field trips, and principals have approved fewer field trips in order to allow teachers more classroom time to prepare for these high stake exams that act as evaluations of the entire school (Michie, 1995).

Outdoor education is not irrelevant in the overall education and well being of students. Currently, there is more than a greater understanding to be gained from an out-of-doors field trip or educational experience. There is research showing that outdoor education can enhance student academic performance (NCLI, 2008). Students become more engaged in outdoor education programs, and this in turn, may lead to more engagement in their overall schoolwork.

"*In the classroom, NCLB causes science teachers to bypass environmental science when it does not appear to relate directly to state tests. Beyond the classroom, teachers have to forego valuable, hands-on field investigations rather than take time away from test-related instruction*." (NCLI, 2008)

Outdoor education can be defined as: education in, or about the out of doors. An outdoor school field trip is when class time is spent in the outdoors. This may be an outdoor structured trip away from the school, or a visit to the school garden or schoolyard. The curriculum is being extended into direct learning experiences occurring in the outdoors. Research shows that field trips are an effective educational tool, yet they are often overlooked as such. Outdoor field trips are recommended in science education standards. The National Science Education Standards provide a vision for more inquiry, since it is central to science learning and critical for science programs to have access to the outside world (pg 221). While field trips are used as an educational tool, questions remain such as: What are the changes in student learning when participating in an outdoor field trip? Are students gaining the benefits intended from these outdoor field trips? And, what is happening to the students as a result of this "hands-on connection" or the program's direct experience intervention?

Research into the effectiveness of a field trip is mixed. A review of the research literature found that if field trips are undertaken under particular conditions they serve as useful educational tools (Falk and Balling, 1979; Disinger, 1987; Orion, 1993; Orion and Hofstein 1994). However, the potential for promoting student science learning and learning opportunities are not being maximized (Griffin and Symington, 1996).

Background and Significance

THE CULTURES OF SCIENCE EDUCATION

There are three major arenas where science education occurs: in the classroom, in laboratories, and out of the classroom. The out of the classroom arena may occur in a museum, aquaria, or out-of-doors. Since learning can take place in any locale, the literature has distinguished between the terms formal and informal settings. Formal consists of the traditional classroom, with specific curriculum and rules in place to lead to a successful completion of course (Hein, 1998). Informal is characterized as unstructured, non-sequential, exploratory, non-assessed, and social environment (Falk, 2001).

Formal science education culture depends on the experience of the student in regulated classroom environments. In the classroom the specific skills, habits and attitudes of students and teachers are reinforced within this academic structure. Although the NSES recommends otherwise; in the science classroom, science education depends on the transmission of a body of knowledge that emphasizes memorization of facts and terms over reasoning and understanding (Gallagher, 1991; Munby and Roberts, 1998).

Informal science education culture also has learning as the central goal (Falk and Dierking, 2000), however, the learning is achieved in a different manner. Rather than follow a strict guideline, there is more flexibility, and memorization is not required.

While there are great differences between the formal and informal cultures of teaching and learning, educators are starting to understand the advantages of informal and formal learning working together (Falk, 2001).

Recently many schools have recognized the importance of outdoor education by providing access to a "new" type of school yard. Many schools have school gardens or ponds or "wildlife" areas. Both the Educational Development Center and the Boston Schoolyard Funders' Collaborative (2000) state that school yards are emerging as one of the core missions of a school. In addition, "The school yard of the twenty-first century is a multi-use site that fosters recreational, academic, and social activities, and strives to weave its functionality into the fabric of school and community culture" (p. 6), (cited Cox-Peterson, 2006). It is the jump from taking this out-of-door learning away from the schoolyard and examining the learning occurring off-site that is of particular interest for this research project. There is a certain level of comfort in known outdoor locales. This level of comfort is pushed when the learning location is unfamiliar, for both the teachers and students. This lack of knowledge or understanding of what will happen on an outdoor field trip may even cause the teacher to hesitate to take his/ her students on these types of field trips, instead of continuing with the "safer" indoor, controlled environment, with worksheets specifically tailored for the field trip.

This is not to detract from or belittle the indoor learning environment, but rather, I suggest that for effective understanding of science, students must be exposed to multiple facets of not only science, but also field-based learning experiences that provide visual and physical opportunities for promoting learning from an interdisciplinary and participatory approach. However, the outdoor field trip is not something to be embarked upon without preparation. Work must be done to reduce the novelty of the location prior to the field trip. The purpose of the trip should fit into the curriculum in some way, preferably closer to the beginning of the teaching unit/ topic. And these field trips, like most, are more effective with a guide or docent to facilitate and enhance the field trip experience. This preparation work applies, whether it is for a two hour or a two day field trip.

Texas Assessment of Knowledge and Skills (TAKS) is the standardized test used in Texas public schools. Examination of student results on the Earth Science section of this test have shown an alarming trend. During the 2007-2008 school year, students in the third through fifth grades scored very low in this area of science (Ten Brink, 2009). While there has been some improvement across grades in the past five years, it is not considered to be a significant. Two thirds of all Earth Science TAKS are answered incorrectly. So one of the questions that this research project will attempt to answer is:

Can an outdoor field trip focused on geology, be a catalyst for better understanding of the Earth Science learning framework by third graders?

Reasons and Importance of Outdoor Education

Outdoor education provides an opportunity for children to learn about, as well as appreciate, their environment. Through outdoor education, children can learn to protect, understand, classify, observe, and explore the earth. It is a way for people to learn about natural resources in an informal setting (Lee, 1984).

SOCIETAL BENEFITS

The use of outdoor education to educate the public regarding the natural world and its resources is seen as important enough for the U.S. Federal government to have enacted the Wilderness Act of 1964. This act allowed for a dual mandate of wilderness area managers, which are to: 1) preserve the wilderness through management; and 2) to provide educational and recreational opportunities for the public. The wilderness managers found that using an educational strategy in teaching and informing visitors, versus a control strategy of rules and regulation, was more effective in regulating the behaviors of the visitors to the areas (Thorn et al, 1994).

ACADEMIC BENEFITS

Outdoor education can complement and enrich most school curricula. This is done through the hands-on and direct experience that comes with an outdoor experience. Teachers or guides do not have to limit the content to science, but rather should increase the spectrum to include as many different subject areas as possible (Lee, 1984).

Anderson, Lucas and Ginns (2003), found that a class visit to a museum can help the students understand and retain content; the transference into an out-of-doors setting is of great interest.

The Outdoor Field Trip and its Value to the Classroom

TEACHERS AND HIGH STAKES TESTING

An outdoor field trip has the same issues that will cause a teacher to balk at the task of taking a field trip to a museum. Teachers often find field trips to be supplemental rather than necessary, and, thus, may not make them a priority (Falk, Martin and Balling, 1978). In order for a field trip to be considered important, a field trip needs to have value to the teachers and principals (Orion, 1993). This may mean that some assessment needs to occur; field trips are not usually assessed in the same way as other school subjects.

Some studies have shown that teachers are more likely to hesitate to participate in an outdoor field trip, because they are often unfamiliar with the techniques used or the philosophy and organization of an outdoor field trip (Fido & Gayford, 1982; McKenzie, Utgard, & Lisowski, 1986). Teachers recognize the benefits of out-of-door field trips (Cox-Petersen, Marsh, Kisiel, & Melber, 2003; Griffin, 2004; Lucas, 2000); however, the fusion of classroom learning with the out-of-doors can be vexing (Kisiel, 2003).

As high stakes assessment and standards have been implemented across the United States, teachers find themselves increasingly required to justify, specifically, how out-of-door field trips help meet the stated standards (Schatz, 2004).

There is more to an out-of-doors field trip than simply taking the children outside. Teachers need to work towards providing their students firsthand experiences when possible, but out-of-doors education may utilize both natural and artificial environments (Knapp, 1996).

FIELD TRIP AS A TEACHING TOOL

While the field trip has been recognized as a teaching tool, there is not consensus as to its effectiveness and educational value in schools (Orion, 1993). Orion (1993), based on other studies, developed a model for the optimal implementation of a field trip. It is a process-oriented approach, focusing on the interaction between the students and their learning environment. During this process, the students will actively construct knowledge and information from the environment, unlike the passive acquisition of knowledge from a teacher that may occur in the classroom. This form of learning lies in the constructivist theory of learning, of active over passive, and the advantages provided by such application.

A field trip should be integrated into the classroom curriculum from the very beginning of the unit in order to facilitate and bolster the abstract concepts presented in the classroom. Even though a field trip needs to start near the beginning of the unit, the students need to be prepared for the field trip. This preparation will diminish the "novelty" of the field trip and increase learning. There should be some concrete activities planned by the teacher and the field trip facilitator to reduce this novelty. Orion and Hofstein (1994), found that there are at least three novelty factors that need to be addressed prior to a field trip. These factors include: the cognitive; geographical; and psychological novelties.

In a school setting, field trips have been assessed as a teaching tool for many years. According to the National Science Education Standards (1996), an outdoor field trip is a recommended teaching strategy in science education. And while there has been a push for including the outdoor field trip as an instructional tool for nearly a century, there is not a great deal of literature relating to the use of this tool in regard to children's learning.

OUTDOOR EDUCATION LOCATIONS AND THEIR ROLE IN EDUCATION

The locales for outdoor education can vary from a nature center, to a ranch, to a preserve. These differing place-based environments play an important role in outdoor education; they strive to increase the understanding of how humans impact the world around them and foster positive attitudes towards the environment. There is an attitude that may be brought back into the classroom as well as in how children view their everyday lives.

Two Specific Examples of Outdoor Education Sites

Westcave Preserve

The site for the pilot study is Westcave Preserve (WP). WP is located in the Texas Hill Country, it consists of thirty acres of ecological diversity. WP's grasslands are scattered with wildflower meadows, ash junipers, oaks, and cacti bordering a sheltered limestone canyon punctuated with rare plants and cypress trees. As the students walk down the trail along the creek bank they come upon the focal point of the trip, a forty-foot waterfall backed by caves, tumbling over fern-covered travertine columns into an emerald pool complete with fossils in the caves. WP has school programs that are designed to guide the students through the trails. The guide gives the children the opportunity to observe the plants, animals, and geology of the Edwards Plateau. Additionally, WP provides teacher resources including pre and post visit activities as well as other resources including Texas Essential Knowledge and Skills (TEKS) alignments and teacher workshops.

McKinney Roughs

McKinney Roughs nature park is an 1,100 acre park situated East of Austin in Bastrop County. This park is also unique in its geographic composition, lying as it does at the meeting points of multiple Texas geological regions. McKinney Roughs has an education program as well as summer camp designed for varying ages of school children. Their programs range form multi-day to a few hours and from water and wildlife conservation to land stewardship. These programs are also TEKS aligned.

Definition of an Outdoor Field Trip

An outdoor school field trip is when classtime is spent in the outdoors. This may be a structured trip away from the school, or a visit to the school garden or schoolyard. The curriculum is being extended into direct learning experiences occurring in the outdoors. It is a valuable learning tool to complement classroom science because it provides hands-on experience (Borun and Flexer, 1984).

According to Disinger (1984), an outdoor field trip is defined as a teacher-led student excursion away from the physical classroom that is specifically held in the out-of-doors. He claims an outdoor field trip is beneficial because it does the following:

1. Helps students develop a conservation ethic;
2. Enriches classroom learning;

3. Is hands-on;
4. Improves science education; and
5. Enhances academic curriculum

In the past twenty-five years there has been an increase in the understanding and importance of an informal learning experience. These studies have exceedingly focused on examining the effectiveness of informal science centers such as: museums, zoos, aquariums, and the resultant learning in children (Adey and Shayer, 1990; Barab and Hay, 2001; Boyer and Roth, 2006; Dierking, 2002; Dierking and Falk, 1997; Falk, 2001, Flexor and Borun, 1984; Ramey-Gassert, 1997; Schauble et al). However, there is a gap in the literature and a useful answer may lie from conducting a closer examination of the learning that occurs in an out-of-doors natural setting; in particular, on a guided outdoor fieldtrip.

Statement of the Problem

The problem is to document the mechanisms by which children on an outdoor guided field trip negotiate their learning. Research shows that students are more disconnected from the outdoors than ever before (MacPherson, 2002). Children are fifty percent less likely currently to participate in outdoor, unstructured activities than they were fifteen years ago(MacPherson, 2002). By conducting science indoors, using pictures or models, the false appearance is created that science learning can only, or most successfully, occur within the four walls of a classroom, and set apart from the outdoors.

Orr (1999) states “Ironically, for all their worldly sophistication, our students are often starved for direct experience that connects them to soils, plants, water, forests, wildlife and a related body of skills” . Often there is a “biophobia”, the fear of nature, that acts as the barrier to learning about and connecting with the natural world (Cajete, 1999). The current trend in much classroom science education is the degradation of the environment. And by focusing student environmental education on disasters such as: effects of global warming, hole in the ozone layer, oil spills, destruction of rainforests and oceans, students may develop a fear of the natural world and its environmental problems, with the end result being a greater disconnection from the natural world (Orr, 1991).

Due to the paucity of outdoor experiential learning literature, we know we need to include outdoor field trips in the examination of informal learning. The knowledge gained and retained from this form of field trip may be lifelong. It is the facilitating factors that make the outdoor field trip method effective for the students that are most neglected. In order to address this problem I have conducted a study examining the guided outdoor fieldtrip. While museums and aquaria are indeed important components of informal learning, I believe that the outdoor learning environs should not be glossed over or incorporated into the more formal of the informal learning arenas but rather examined in their own right. Outdoor learning is at least as important to students' learning as the museum setting. In addition, they are situated in the authentic “real-world” and may have more applicability, and relevance, and interest to the students. According to Project 2061 (1993), one way to improve science education is to conduct it in an authentic setting.

Often the outdoor field trip is seen as a frustration to the teacher, since it can be difficult for the teacher and/ or guide to maintain control or attention of the students.

Worksheets, or other forms of "record keeping," are more difficult to contain than in indoor environments, such as a museum or aquarium. This is also the case in nature centers or zoos, where there is less chance for the destruction of worksheets than there may be when examining a creek. So the problem of how to connect the field trip to the classroom curriculum, while keeping the students properly focused, and engaged enough to ensure a fun and meaningful trip experience remains unanswered. Hence, the outdoor setting continues to be an under-utilized instructional environment for science education.

There are some resultant difficulties when looking at outside learning environs: there may or may not be the ability to have exhibits, and often the exhibits are not as tailored as those in indoor informal learning centers. This in itself can lead to difficulties when organizing a field trip for a class. If the teacher is not prepared he/ she may not be aware of what the students are going to do on the field trip, or how the intended learning is going to happen in such a potentially distracting environment. And of importance to the teacher and administration, how can what is seen in the field connect to the classroom? This question of classroom connection can be the difference in having a school principal allow the field trip to occur, particularly in this era of high-stakes testing in schools.

When asked why they do not use the outdoor environment, teachers often site concerns of management issues, lack of planning time and assistants, and issues with school bureaucracy, including funding and other restrictions (Dissinger, 1984; Hall & Wright, 1980). I believe that if an outdoor program is conducted with forethought, the information gleaned from experiential learning can be mapped onto the curriculum, and because of the very nature of this learning, it could have an increased impact on the students' retention.

In order to achieve the most from a field trip, indoor or outdoor, there are some basic tenets that should be followed. There should be: pre-trip instructions from teachers, active involvement by students during the field trip, and a follow-up by the teachers after the trip (Falk, Martin, & Balling, 1978; Mackenzie & White, 1982; Novak, 1986). In other words, the field trip must be built into the curriculum in some form or fashion. In a well designed field trip the outcome may integrate: science content and process skills with English and language arts, mathematics, art, history or social studies curriculum, depending on the nature/ purpose of the field trip.

Purpose of this Study

This dissertation intends to address fundamental questions regarding science learning in an outdoor setting, with the goal of improving the use of field trips as a teaching tool for teachers and students. This research project examines the interactions and interplay of: previous knowledge or experience; socializing (student to student, student to teacher, student to guide, guide to teacher); and language (scientific, colloquial or level) used during an outdoor guided field trip. Outdoor field trips have the potential to enhance constructive social relationships among students. The assessment of how time is spent on a field trip and how this affects the cognitive and psychological gains of the students is an area that needs to be further explored. This research has the potential to help create an effective learning environment for students on field trips as well as assist teachers, since it will be focused on the outdoor learning environment. Additionally, while this study focuses mainly on learning geology, the results may be applicable to other science subjects (biology, physics, ecology, geography, chemistry, meteorology, and astronomy).

Research Question

Information gathered through this research project will help determine how children, on an outdoor guided field trip, negotiate their learning and understanding of science and how it connects with learning ecological relationships.

The specific question guiding my research is as follows:

"Can I identify the mechanisms by which outdoor guided field trips might influence the understanding of the rock cycle?"

Particular attention will be paid to:

> The change in content understanding and the mechanisms that facilitate this ▯ pre to post visit,
>
> How scientific understanding is negotiated between students, teachers and guides,
>
> The cognitive levels of questions used by the guides to the student,
>
> The presentation of scientific terms and concepts to the students.

It is the cognitive rather than affective gains I am interested in observing. It is the cognitive gains that may provide the verification needed for proving that experiential learning during outdoor field trips can serve as an effective science education teaching tool.

Importance

Outdoor and environmental education is a portion of science education that must not be overlooked. Not only does outdoor education put the child into the realm of the real world; it is through this form of education that children will learn first hand their own importance in protecting their world. In the past fifty years there has been an increase in public awareness and understanding of the importance of environmental issues. Problems of population growth, species extinction, global warming, and the impact of the carbon footprint, are becoming mainstream everyday issues. Outdoor education is an essential tool for educating children about environmental issues and their personal connection to the natural world.

And field trips may be a way to integrate outdoor education into the curriculum. The problems with field trips range from putting on a field trip (for the teachers and administration) to the ability to legitimize the field trip as a part of the curriculum in this age of high stakes testing and NCLB.

It is the understanding of how field trips work and how they can be deemed important that was the instigator for this study. So I have developed a model to show the important parts of an outdoor guided field trip that promotes the learning and understanding of the rock cycle in third grade students.

LITERATURE REVIEW

This chapter will begin with a discussion of my theoretical framework of social constructivism. Next, I will review the relevant literature of informal learning and cognition. Finally, I will review the literature pertaining to outdoor field trips.

Social Constructivism

I have used the framework of social constructivism to analyze the question of learning when attending an out-of-doors, guided field trip. This theoretical lens is appropriate for evaluating children, in groups on field trips, as they communicate knowledge or interest, as well as collaborate to construct knowledge and develop understanding as a process of discussion. The nature of the interactions between the children and their guides or teachers will further the understanding of out-of-door learning. Informal learning on field trips is, fundamentally, a socio-cultural environment in which social interaction is an important component.

This study examined the students' relations to each other, the classroom teachers and fieldtrip guides, rather than their relation to culture as a whole. According to Lemke (2001), science education research is more traditionally examined in the classroom setting rather than between the classroom, school and home. There is little research looking at science education through the perspective of the student.

Sociocultural approaches to the study of learning suggest that it is thegroup, not the individual, upon which the focus should be placed (Falk and Dierking, 2000). A guided outdoor field trip consists of a community of practice, where the students participate and learn. The community consists of the students (learners), the teachers and the guides.

There are two widely accepted constructivist learning theories: 1) cognitive or internal constructivism, and, 2) social constructivism. At its basis, in the constructivist theory, knowledge construction is built upon what is already known. What we already know depends not only on previous experiences, but also on how we organize these experiences into existing knowledge structures.

Constructivism's central idea is that human knowledge is constructed block by block: learners build new knowledge upon the foundation of previous learning and knowledge. This view of learning sharply contrasts with the more traditional view in which learning is the passive transmission of information from one individual to another -- a view in which reception, not construction, is the goal. Using the traditional behaviorist form, teachers tend to utilize "drill and kill" practices with a thorough understanding of the material being of little real importance (Brown, 1992).

The name "constructivism" implies that learners are encouraged to construct their own knowledge framework rather than copying it from an outside source (a book or a teacher, for example). The knowledge construction process occurs in "real situations" not in de-contextualized, formal situations found in traditional textbooks, and this construction occurs in conjunction with others, not just through the individual (Brown and Campione, 1994; Collins, Brown, & Newman, 1989; Kanselaar, De Jong, Andriessen & Goodyear, 2001). There are many concepts found in constructivist learning, such as, for example, generative learning, situated learning or cognition, and cognitive apprenticeship. What is vital in the theories of constructivist learning is that we construct knowledge based on what we already know and that knowledge construction and learning is not a passive process. Rather, it is an active process of maintaining and creating perceptions of understanding.

A child learning to cook with his/ her father will gain more than simply the knowledge of peeling potatoes. The act in itself, while part of a larger goal of making dinner, also becomes a social issue with the child contributing to the family (Greenfield and Lave, 1982). Children are social beings, and this attribute should be utilized, when possible, for enhancing social learning experiences. The learning occurring in an informal setting often comes as a social experience, with family, friends, or other students (Semper, 1990). As Vygotsky (1978) claims, children learn higher order mental functions through the use of tools and symbols of society. Children learn to master these cultural tools through socialization. Children also learn well with others, and in particular, those with whom they have a shared history. This history can be as simple as being classmates. If they have some shared experiences, this will increase their social bonds; in turn, this will improve their experiences. If the students engage in participatory activities and experiences with their peers, learning will be enhanced (Cox-Peterson and Spencer, 2006). Students working together, as seen in informal science institutions, can navigate their way through their ZPD with the help of each other or a guide (Csikszentmihalyi, 1988, Semper, 1990).

Theories of Social - Constructivism

COGNITIVE THEORIES

Ann Brown's (1989) theory of Fostering Communities of Learners (FCL), -whereby students actively participate in class discussions and readings is intended to promote critical thinking skills among students. The development of different students at different rates is not a barrier; rather this understanding is a given. In addition, instruction and assessments are authentic and relevant and the students are made aware of them. They are also, if possible, responsible for some of their own evaluation (Campione, 1989).

The Cognition and Technology group at Vanderbilt (1990, 1992, and1993) developed Anchored Instruction -- a multimedia learning environment in which problems are presented that are anchored in a real world context. On these CD-ROMs, problems presented to a character named Jasper were in the context of case-based stories. Included within these stories is all the data necessary for solving the problem. Children then use the information provided, as well as outside resources, to solve authentic problems.

Problem-based learning (PBL) was initially developed as a tool for medical students in the 1970's (Barrow, 1985). In PBL students work in small collaborative groups, and they are presented with challenging, open-ended/complex/ genuine problems, and the role of the teacher is to serve as a guide or facilitator for finding a solution (Hmelo-Silver & Barrows, 2006). The students are presented with, or take responsibility for identifying, a problem and the group promotes active learning through participation and the feedback provided from the teacher and other students.This inquiry driven instructional approach provides active engagement as part of the learning process.

In Cognitive Apprenticeship the students focus on authentic tasks and the learner learns from a master. This is similar to trade apprenticeships where the apprentice learns from working under a master (Collins, Brown, & Newman, 1989). In cognitive apprenticeships, the master will model behaviors in a "real-world" context. By listening attentively as the master explains his/ her thoughts and behaviors, the apprentice learns to identify the relevant behaviors and develops a conceptual model of the process (Bandura, 1997). The master will guide or coach the apprentice at the level that is just beyond what the apprentice can do alone. The apprentice, through the guidance of the master, will become more skilled and eventually be able to perform the skill at the level of the master. For the learning to be truly effective, the learning must occur in context. Collins, Duguid, and Brown (1989) argue that cognitive apprenticeships are less effective when skills and concepts are taught independent of their real-world context and situation. The activity being taught is modeled in a real-world situation. This may be seen on an outdoor guided field trip although on a smaller scale as the classroom field trip is usually a one day event rather than an immersion.

SITUATED LEARNING

Lave and Wenger put forth the idea of situated learning. This theory postulates that learning occurs in a community of practice with people learning from observing each other. In situated learning, the learning takes place in the social realm. Learning is not seen as the simple acquisition of knowledge or models. Learning is attained by the learners participation within a framework and is a social process that occurs within the situation. The skills are learned within this social process and with the full participation of the learner in the community (Lave and Wenger, 1991). "Learning as increasing participation in communities of practice concerns the whole person acting in the world" (Lave and Wenger 1991: 49). In a socially situated learning opportunity, the desire to learn will begin to come from within. In the study of science, this ability to work in the realistic situation with interaction with experts is particularly important. Discourse is important in science and understanding and building upon terms, methods and concepts requires that conversations occur (Lemke, 2001).

INTERACTION RITUALS

Collins (2004) uses the term interaction rituals (IR) to describe relationships between individuals and a group . He suggests that successful rituals create symbols of group membership and pump up individuals with emotional energy (EE), while failed rituals drain emotional energy. The feeling of group membership increases interest in the particular activities. Thinking and learning occurs through the internalization of conversation within the varying activities or situation.

An individual needs to become excited about the group for successful IR to occur. Collins uses the example of a football game as a successful IR. The players are the symbols and people become invested in them and develop EE. These players are discussed in varying situations -- school, work, a bar – and, in doing so, successful IR's are developed. While classwork or even field trips are not as exciting as a football game [n.b. --that's debatable!], it is not unbelievable to expect that the language, ideas and concepts of science lead to EE of members of the group. Successful IR's can develop within a science classroom or on a field trip. The amount of time a student spends talking or thinking about science is related to whether they have been drawn into group membership and are emotionally invested. This, in turn, is built upon past IR in science situations.

According to Olitsky (2007), a successful IR can lead to and contribute to student interest in, not only science, but other experiences outside of the classroom. Olitsky notes the increased IR when a teacher was part of the group for even just a little discussion;

however, within a science classroom successful IR's can contribute to a classroom becoming a community of practice.

UNIFICATION OF THEORIES

The theories of sociocultural learning are many and, while somewhat varied, they all recognize the importance of interaction with other people. People are cultural beings with the need for socially grounded learning. This means that they interact with each other as both learners and teachers -- listening and learning by example (Lave and Wenger, 1991). A progression from imitation through instruction to collaborative learning in early childhood is seen as vital to cultural learning. Social processes mediate learning in several ways. As educators we can provide educational approaches that can guide children to become motivated, questioning and thoughtful learners. The ideas of group learning versus individual learning have waxed and waned throughout the decades. The current trend is moving away from individual desks to learning in small groups at a table. Group situations are commonly used in today's classrooms. The computer has helped to reverse a relative decline in group work, since students often work at computers in pairs or small groups. However, while the children are less isolated physically, they are still mandated to work as individuals and in comparative isolation (Light and Littleton, 1999). Becoming a part of a group and social structure is fundamentally a part of being a person; thus, learning within a group is not a great stretch. In the classroom, we too often have children learning independently: they are not allowed to confer with their peers and, if they are, it is often limited engagement. Hands must be raised to ask questions or make comments, possibly detracting from the spontaneity of the learning. Children in particular have the need to work with each other and with the adults surrounding them (Light and Littleton, 1999).

The Importance of the "Students' voice

While examining the data, I also paid attention to the "student voice". The student voice takes into account the opinions and views of the student. The student is the one person who does not have control over the location and time of the field trip. This theory of listening to the students' voice is one that is not often utilized and therefore there is not a great amount of research to be found.

According to Osborne and Collins (2001), listening to the student's opinions can have further implications in science curriculum and development. The aspects of the field trip that they find either positive or negative can be addressed as necessary. In identifying the aspects of science that are interesting or important to the student, the researchers, curriculum developers and teachers can attempt to make school science more interesting and attractive to the students. Research shows that there is a relationship between a student's interest and the effective learning of new knowledge (Dawson, 2000). If a student is interested in what they are learning they will be more likely to put forth the effort necessary to learn (Dawson, 2000).

The role of the student voice in research is yet to be determined, not all student comments or questions are relevant or substantial. For example, a question asking if cats and dogs were "enemies" does not have great bearing on future curricula. However, finding out from the participants themselves (in the case of this study - the students) how a field trip contributed to their understanding of science may provide illuminating answers. Questioning the participants may work to focus the development of future field trips and classroom science (Baram-Tsabari and Yarden, 2005).

Learning Out of the Classroom

In Lauren B. Resnick's 1987 presidential address to the American Educational Research Association (AERA), she presented four contrasts (listed below) between traditional and outside school learning:

1. Individual cognition in school versus shared cognition outside of school.
2. Pure mentation in school versus tool manipulation outside of school.
3. Symbol manipulation in school versus contextualized reasoning outside of school.
4. Generalized learning in school versus situation-specific competencies outside of school.

Resnick contended that school learning is different from the standpoint that "school is a special place and time for people-discontinuous in some important ways with daily life and work" (Resnick, 1987), whereas outside school learning is more adaptive and contextual.

In traditional education, science can appear to be a large vat of facts and information that are set in stone and should never be challenged; learning it is a process of memorization with little opportunity for involvement or creativity. Additionally, there is no connection of this information to the outside world. This is seen in science and math, according to Resnick (1987), where there is a tendency for school knowledge to be disconnected from real life. Children treat an arithmetic class as a setting in which to learn rules, but are discouraged from bringing in their informally acquired knowledge about numbers.

Investigating scientific or environmental topics in an authentic environment may increase students' memory and understanding of concepts. Studies have found that field trips, and other out-of-school learning experiences, provide an environment for increasing student cognition, higher order thinking, and long-term retention of information, as well as resulting in more positive attitudes toward science (Basile & Copley, 1997; Cronin-Jones, 2000; Howie, 1974;Knapp, 2000; Mackenzie & White, 1982; Nichols, 1989; Orion & Hofstein, 1994; Roth& Bowen, 1995; Winn et al., 2006). Taking the learning out of the classroom spans the breadth from learning in the out-of-doors to learning in a museum to learning at the grocery store to learning while on vacation.

Literature Related to Outdoor Education

Field trips have primarily been one-time events where little connection was made to what was happening in schools. And though this still occurs in outdoor education sites (as well as museums), most facilities have worked toward developing a more structured relationship with teachers and schools. This coordination will allow for a more long-term and meaningful understanding of the field trip .

In a survey by Inverness Research Associates (1995), two-thirds of informal science institutions were engaged in some kind of educational collaborative with schools and half of all institutions offered teacher workshops, provided classroom support and assistance with materials, and helped schools with curriculum development, including pre- and post- trip information. This study also found that the use of outdoor facility educational programs in general has grown substantially during the last 10 years.

A field trip to the outdoors or to an outdoor facility is often seen as a fun time, a time to get out of the classroom to escape from work. It may also be a time of great stress. Some people do not enjoy the outdoors and find it to be hot, cold, sticky, messy or boring. This fear factor is found in many children, particularly those in cities without much exposure to the out-of-doors (Simmons, 1994). In addition, teachers have the added stress of participating on a field trip where the children are not contained (Seever, 1991). There are other barriers teachers and administrators express concern about as well including: a fear and concern about health and safety; the teachers' lack of confidence in teaching outdoors; school curriculum requirements; shortage of time, resources, and support (Dillon et al., 2006).

OUTDOOR EDUCATION

The educational experience for students outside of the formal sector may be strikingly different to the experience within the classroom (Braund and Reiss, 2006). The problem lies in that many children are becoming less interested in science based on their classroom science experience (Goodrum, Hackling, & Rennie, 2001; Osborne, 2007; Osborne & Collins, 2001).

Outdoor education has been defined as an informal method of teaching and learning, which offers opportunities for school students (regardless of intellectual abilities), to learn about and appreciate their environment and acquire skills with which to enjoy a lifetime of creative, productive and healthful living (Lee, 1984). Outdoor education is a combination of: the relationships between humans and nature; attitudes regarding caring about the planet; and utilizing natural resources for survival and leisure (Ford, 1986).

Where Outdoor Education Lies in the Education Spectrum

INFORMAL EDUCATION

Informal science is one arena into which outdoor education may fall. Informal science education is looked upon as an antagonist to formal classroom education. I will define and discuss the use of informal science as it pertains to the study of science education and the field trip.

ENVIRONMENTAL EDUCATION

Environmental education is another realm into which an outdoor field trip may fall. Environmental education is an area of education that lies within the informal science arena. There are some differences between informal science, outdoor education and environmental education. Environmental education uses multiple teaching strategies and environments to teach (Kunin, 1993). An outdoor field trip is often used in teaching environmental education (Ham and Sewing, 1988).

Definition of Environmental Education

In environmental education, the total environment is addressed. This includes: population growth; pollution; resource use and misuse; technology; urban and rural planning. Outdoor education and the field trip may not encompass the entire environment. In 1985, the Belgrade Charter (A Comparative Survey of the Incorporation of Environmental Education into School Curricula) was developed. This charter defines the goal of environmental education as “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones” (A Comparative Survey of the Incorporation of Environmental Education into School Curricula, 1983 p.3).

The North American Association for Environmental Education (NAAEE) was conceived in 1971 as a way for disseminating information out to educators regarding environmental education.

“In meeting the goals of its target audiences, NAAEE promotes the analysis and understanding of environmental issues and questions as the basis for effective education, problem-solving, policy-making, and management. It does not take formal positions on political or technical matters, except those relating directly to education.

NAAEE members believe education must go beyond consciousness-raising about environmental issues. It must prepare people to think tog tether about the difficult decisions they have to make concerning environmental stewardship and to work together to improve and try to solve, environmental problems.” (Dissinger, 2001). The NAAEE constitution defines environmental education:

“Environmental education is a process which promotes the analysis and understanding of environmental issues and questions as the basis for effective education, problem-solving, policy-making, and management” (NAAEE website).

An out-of-doors field trip may or may not be focused on the environment. As a field trip is an extracurricular activity that allows for experiences that are unable to be produced in a classroom, it can be viewed as another instrument in furthering children's understanding of science and the environment. Therefore, I would label an outdoor field trip as an instructional tool used in outdoor education under the umbrella of informal science education.

Informal Science Education and Constructivism

In an informal science setting, children are intrinsically motivated to learn and gain personal significance. Interest has a profound effect on learning. The desire to learn can be augmented if curiosity is nurtured (Ramey-Gassert, 1997). If a child is interested in what they are doing they will have greater attention, persistence and curiosity (Dierking, 2002). Often formal schooling stifles the curiosity of the child, yet an informal science setting can invigorate this curiosity (Semper, 1990). Formal classroom learning often has no relevance to the child, or their lives outside of school; emotion is removed and the goal is to follow a set curriculum (Gerber, 2001).

According to Falk and Dierking (1992), learning has become synonymous with the words "education" and "school" where learning is viewed as "primarily the acquisition of new ideas, facts, or information, rather than the consolidation and slow, incremental growth of existing ideas and information" (p. 98).

Acquiring knowledge should not be about memorizing information, but rather an ongoing process of creation, and recreation. It is through the reflection and revision of one's improvement and learning that the child will assume agency of its knowledge (Baron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford and the Cognition and Technology Group at Vanderbilt, 1998). The learning will happen from the inside out (Friere, 1993 pg 86). This raises the question of how relevant is the particular aspect of science to the child's life. It is often difficult for one to learn (not memorize) if they do not see a purpose to their learning. Since learning can be fun, why do children seem to become less and less motivated to learn as they age? This could be due to the lack of relevance of the learning to the child and the decontextualization of information (Dewey, 1938). In school, teachers often present the information to the children in a very esoteric, unreal or decontextualized form, it has no true bearing on or meaning to the student and their life (Dewey, 1938, Resnick, 1987, Lave 1988). As Resnick (1987) points out, the learning that occurs in the school is very isolated and disconnected from the real-world. Conversely, the learning that occurs out of school is likely to be authentic and, thus, is all the more meaningful. Information is given as general information with the goal that the children will then be able to apply the information to a variety of situations (Lave, 1988). There is a view that knowledge "cannot be transmitted but must be constructed by the mental activity of learners" (Driver, Asoko, Leach, Mortimer and Scott, 1994, Rahm, Miller, Hartly and Moore, 2003). Science learning, if possible, should be brought into the realm of the child, socially, politically and culturally (Barton, 2001, Dewey, 1929, Driver, Asoko, Leach, Mortimer and Scott, 1994). As John Dewey in his pedagogical creed states, "I believe that education which does not occur through forms of life, or that are worth living for their own sake, is always a poor substitute for the genuine reality and tends to cramp and to deaden."

GOALS OF INFORMAL SCIENCE

One of the goals of informal science learning is to present the "big ideas" of science in context. If learning is part of an activity and is relevant to the child, the knowledge gained will be greater than that of an abstract conception (Brown, Collins and Duguid, 1989; Dierking, 2002; Driver, Asoko, Leach, Mortimer and Scott, 1994; Falk and Dierking 2002). The learning is more concrete in an authentic situation . When children are provided with real data, or a way to obtain data, and some information on data interpretation they will be practicing real science (Pennypacker, director hands on universe NSF website2004). Words and tools are not solely ideas; they are genuine and, therefore, more valid to the student. As a result, such learning will be more applicable over multiple situations (Brown, Collins and Duguid, 1989, Dierking, 2002, Falk and Dierking 2002).

LEARNING AND LOCATION AND ACQUIRING SCIENCE UNDERSTANDING

Authentic science is science that is similar to the everyday science practiced by true scientists (Rahm, Miller, Hartly and Moore, 2003; Roth, 1997). Teachers, however, are generally not scientists, so the difficulty lies in having non-practitioners demonstrate authentic science (Barab and Duffy, 2000; Barab and Hay, 2001; Cunningham and Helms, 1998). Science is not practiced in a single way, there is no "nature of science" (Millar, Driver, Leach and Scott, 1993, cited Driver, Asoko, Leach, Mortimer and Scott, 1994). Scientific knowledge is constructed through the practice of science: through experimentation in the real world and discussions with others (Collins, 1985, Hanson, 1958; cited Driver, Asoko, Leach, Mortimer and Scott, 1994).

An effective learning environment is one in which the children are engaged at the edge of their ZPD, and are able to interact with others to progress and master their interest (Vygotsky, 1978). However, not all interactions and the experiences they produce are identically useful. Some experiences may even be negative in one's education if the information is faulty (Dewey, 1938). If there is a skilled member of the group or even a guide, the child's experience will be more positive and have greater learning potential. According to Cox-Peterson and Spencer (2006), children participating in a planned out-of-doors activity will be “building background knowledge through science experiences, can enhance vocabulary, literacy, and the understanding of science concepts.”

When one learns an idea in the abstract, and then is allowed to explore it in the concrete, the knowledge becomes real and useful (Dewey, 1929, Vygotsky, 1978).

In an informal science setting the process of learning science is as important as the content. Without children being a part of the discovery learning process, the content alone may seem static and irrelevant. But process without content could just be play. They will be having fun but possibly not learning (Baron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford and the Cognition and Technology Group at Vanderbilt, 1998). When children are at play they are still learning, although the learning is not directed with a goal in mind (Bruner, 1973, Semper, 1990). Tal and Morag (2007) found that children in a museum learn best when information is presented in a manner that is counter to traditional lectures with limited chance for experiencing. This is where the question of *how* children learn in an informal or out-of-doors environment is paramount. In a situated learning environment, the gap between knowing and doing is bridged. A “hook” may be needed to stimulate interest in a subject, but once the ‘hook is set,” the stage is set to learn. Knowledge is transferred through activity (Brown, Collins and Duguid, 1989, Rahm, Miller, Hartly and Moore, 2003). As Lave’s (1988) idea of “just plain folks” (JPFs) notes, the features of how JPFs behave is similar to that of practitioner, but is very foreign when compared to how students behave. This suggests that learning the way in which practitioners practice is more useful for the learner. In addition, Miller and Gildea (1987) show that people use vocabulary differently in a situation of normal use than they do in the classroom. Similar to the immersion approach of living in a foreign country, as being the best way to learn to speak a language normally, so is doing science a way of learning to practice science as a professional. However, according to Bruner (1969), all of a child's learning does not need to be situated. Children do not need to reinvent all key knowledge themselves. This is where a guide of some type -- a parent, a teacher, a docent or another child -- enhances the learning process (Brown, 1992).

Role of a Guide or More Experienced Person

The role of a guide can be a difficult one, since content knowledge, as well as an innate sense of how to help the child is needed. How long does one let a child flounder? If they flounder too long they may lose interest (Brown, 1992). If they come to the wrong conclusion, what is the best way to correct them? At what point does scaffolding and helping the child either: 1) lead away from their own choice in learning; or 2) become a technique for giving them the correct answer? If the guides are didactic in their approach for the tour, it may be fun and interesting, but the levels of science learning may be low (Cox-Peterson, Marsh, Kisiel, Melber, 2003).

ZPD

The help of an adult, or a more experienced child, can help guide the child through his or her Zone of Proximal Development (ZPD), (Vygotsky, 1978). This guidance is what differentiates informal learning from play. Such guidance is in contrast to the usual role of a teacher in school where he/she gives assignments and the choice of the students is to do the assignment, or not to do it; depending upon their choice, their grade may suffer.

LEARNING SOCIALLY

Learning should be more of a group effort (Barab and Hay, 2001; Driver, Asoko, Leach, Mortimer and Scott, 1994; Rahm, Miller, Hartly and Moore, 2003; Ramey-Gassert, 1987; Rennie, Feher, Dierking and Falk, 2003). Knowledge is bound by the communities in which people live (Dierking, 2002). It is a shared process that exists over time. This is particularly evident when looking at how well people remember and respond to information presented as a story (Dierking, 2002).

Children are generally social and informal settings are often geared towards this behavior. A teacher who is prepared may facilitate the understanding and desire within their students (Mortensen and Smart, 2007).

PROBLEMS WITH GUIDES

Many of the visits to museums are guide directed. Problems arise when guides present information in a lecture form. This is not an uncommon occurrence; most visits to a museum tend to have guides who are lectureheavy (Cox-Peterson et al 2003). The lectures and visits do not have the learner in the forefront: rather than centering on the students and their questions, guides ask the students close-ended questions and do not allow discussions and exploration to unfold (Tal and Morag, 2007). Lectures may have overly complex scientific language which are not explained (Cox-Peterson, 2003; Tal and Morag, 2007). Both Cox-Peterson et al. (2003) and Tal and Morag (2007) found that questions were the primary form of communication between the guides and the students; many of these questions were of a lower cognitive level, and others were not expected to be answered.

The afore-mentioned recent research points to the continued need to understand the importance of the structure of the field trip and how the children are learning.

Modes of meaning making

According to Rahm (2003), children in a museum have multiple ways in which they begin to make meaning from what they are experiencing. She found the combination of talk and action and their relation to each other were very telling of how the students were making meaning in the museum (Rahm, 2003). While there are studies of dialogue between students in museums, these are rarely seen. Guberman and VanDusen (2001) found that children do engage in scientific thinking with or without an adult guide. Knowledge is “talked into being”through the diverse voices, understandings, personal experiences and interpretations of student and teacher/ parent/guide (Green and Dixon, 1993; cited Rahm, 2003). However, there is more to social learning than simple dialogue as these previous studies make clear

Issues of personal relevance and willingness to visit a museum again are also important (Bamberger and Tal, 2008). Students who went to the museum for a field trip tended to learn more in the classroom post- field trip. Notably, the students who participated in the field trip felt that the ability to have interactions with their peers, teachers and guides was important to their learning (Bamberger and Tal, 2008).

However, each group examined may have different outcomes and from this there may be more modes of meaning making. The examination of many snapshots of how students make meaning will allow us to begin to build a movie of this process, and from this most effectively affect curriculum (Rahm, 2003).

Benefits of an Informal Learning Environment

LEARNING STYLES

The goal of both informal and formal education is to educate;- even if this arises from different assumptions and inherent qualities, the goal is the same. (Tressel, 2001; cited Rahm 2004). An informal science institution covers three of the four effective learning environments set down in the book entitled "*How People Learn*" (Bransford, 1999). Informal science institutions are:1) learner-centered; 2) knowledge-centered; and 3), community-centered. Bransfords's fourth learning environment is "assessment-centered; its applicability depends on the definition of "assessment." Formative self-assessment and reflection and revision would be two forms of assessment appropriate for an informal science program.

STUDENT UNDERSTANDING AND ROLE IN UNDERSTANDING SCIENCE

The benefit of informal science programs is immense. Through the use of a well planned field-trip, students can discover the big ideas of science by seeing science happening in front of their eyes. If children can understand the goals and understand what they are looking at, or for, they will be better equipped to direct their learning and, thus, be more likely to feel that the new knowledge was worthwhile -- not only to them, but also to their peers (Baron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford and the Cognition and Technology Group at Vanderbilt, 1998).

In addition, children who have participated in several informal learning experiences, before beginning formal school, are more likely to have higher schemata in formal learning environments than those who were not able to participate (Adey and

Shayer, 1990). Zuzovsky and Tamir (1989), also found that students with a background rich in informal learning, had a more developed schemata than students who did not. They found that students with the more enriched schemata continued to learn much about science through informal methods, while for those with the impoverished schemata, formal science played a larger role (Zuzovsky and Tamir, 1989). Children who participate in informal science regularly tend to have a great commitment to science and learning science (Tamir, 1990).

SOCIAL BENEFITS OF AN OUTDOOR FIELD TRIP

An outdoor field trip may close the gender gap (Jarvis and Pell, 2005). Exhibits may be designed to attract both sexes, and, if children are exposed at a young age, they may develop an interest in science and scientific principles. However, Crowley et al. (2002), found that parents are three times more likely to describe scientific principles to boys than to girls. Thus, these parents are inadvertently creating a gender gap in scientific knowledge in their children. However, in school groups, Jarvis and Pell (2005) found girls participating in a field trip to a science museum had a greater increase in interest in science than boys did; although boys had higher levels of interest throughout the study, the change was greater with the girls.

Informal science institutions have a history of realizing that the visiting children have different and unique abilities (Beer, 1987, Ferber, 1987). Effective informal science institutions are designed with this in mind; they provide a niche for children with many different learning styles and interests to explore (Wellington, 1990). Informal science institutions can actualize some key theories in learning education:they allow for the motivation to be driven by curiosity; accept multiple methods of learning; encourage exploration and play; and they take into account that different children have different experiences as well as allow children to see how "real" science is practiced (Ramey-Gassert, 1997, Semper, 1990).

Cognitive versus Affective Gains

In the review of the literature, I found the majority of the research on outdoor education has been on affective rather than cognitive gains. This may cause some dissonance within the field and teaching communities. Emphasizing the affective component of learning may be off-putting to teachers (McIntosh and Zeidler, 1988). But, as some studies show, the cognitive gains from the outdoor field trip alone may not be significant((Falk, Martin and Balling, 1978, Falk and Balling 1979, Falk and Dierking 1997). This is why a field trip must be integrated into the classroom. Most of the studies I found advocated the use of outdoor field trips as enrichment to the classroom but not as an essential part of education (Falk, Martin and Balling, 1978, Falk and Balling 1979, Falk and Dierking 1997). Falk and Balling (1979), found that field trips may not be the most efficient mechanism for cognitive learning but there are other benefits to the experience. However, Orion (1993), found children did make cognitive gains when on field trips. A productive field trip will help the children make the connections between the abstract concepts they are learning in class to the more concrete science found when going on a field trip (Prather, 1989). According to Dillon et al. (2006), students in an environmental education program scored higher in 72 percent of assessments, than students from a traditional school across a variety of subjects. And Eaton (2000), found outdoor learning environments were more effective at developing cognitive skills than classroom learning. The research points to both gains and no direct gains; however, there is no research I have found to indicate that participation in an outdoor learning program was not beneficial in some way.

This project will review the use of the outdoor field trip as it pertains to social constructivist learning of science, the use of the student voice, the cognitive gains made on a field trip, and the effect on student learning.

METHODOLOGY

In this section I will outline the methods and procedures used in developing this study. I will begin with the methodological issues, a description of the study site, and participants, data sources, procedures, and data analysis.

Summary of Methodology

I have situated this study in a socioconstructive paradigm in which I, the researcher, recognize the multiple realities and strengths of individual students, and the complexities found within them. I have applied the use of naturalistic inquiry, as described by Lincoln and Guba (1985), and grounded theory, as described by Corbin and Strauss (2008), as my research strategy. And I have examined the data using the "students' voice" (Bamberger and Tal, 2008). My participants included two third grade classes from a local independent school in Austin, Texas, who attended a field trip to McKinney Roughs, a local wilderness education area. Data consisted of interviews, observations and pre/post tests. These tests and interviews were coded and themes emerged from the data.

Description of Research Methodology

While this study was technically a mixed method study, I used grounded theory as the methodological theory for this research study. Grounded theory was developed by Glaser and Strauss in 1967, as a qualitative method of research. However, I will utilize the Corbin and Strauss (2008) coding paradigm model for determining the possible relations between categories and phenomena resulting from the open coding. When using the social constructivist theory as a theoretical background; grounded theory as the methodological approach is an instinctive, natural fit. As the school children learning on their field trip will have various actions and interactions occurring in their learning, so will the researcher in his/ her understanding of the phenomena taking place. Grounded theory allows for this fluidity in understanding context.

As a portion of the data collection, I developed with the teachers a test to determine if there was a change in content understanding prior to and after the field trip. These tests were graded using the rubric provided and a simple means and T-test was performed to determine if there was a change in content knowledge.

QUALITATIVE RESEARCH

Using qualitative methods, the researcher is able to delve further into understanding the phenomenon in question. The qualitative researcher is interested in the study of process and how meaningful relations are made. It is through the research and analysis that the qualitative researcher builds theories (Bogdan and Biklen, 1988 Lincoln and Guba, 1985, Patton 1990, Eisner, 1991). Strauss and Corbin (1998) assert that qualitative methods can be used to understand a phenomenon about which little is known; yet they can also be used to gain more understanding or perspectives on things about which much is already known. It is through qualitative research that one can achieve a deeper understanding of quantitative results. Also qualitative methods may be used to identify essential or particular variables initially, and these variables, once determined, can be tested quantitatively. In addition, qualitative observational research is naturalistic because it studies a group in its natural setting, rather than in an experimentally contrived laboratory setting. There are many methods of qualitative research; this study will be guided through the use of grounded theory.

Grounded Theory

Grounded theory is an approach to qualitative research. In grounded theory, the researcher does not begin with a set hypothesis or theory. Rather, the researcher will gather data, and from this data develop codes, concepts, and categories. From these categories a theory is developed (Corbin and Strauss, 2008). Grounded theory allows for the theory to be grounded in the data gathered. The theory is not coming from a priori theory, which was developed in a different context. Each interaction is unique in its context and reality. The researcher should aim to approach the situations without an a priori theory as this may not fit the problem being addressed (Lincoln and Guba, 1985). What is found in one context may not prevail or be accurate in another. Grounded theory, by its very nature is responsive to each individual context (Lincoln and Guba, 1985). Researchers in grounded theory need to work discreetly from the literature. By doing this they will use the data gathered and mined to develop constructs and theory (Corbin and Strauss, 2008). As Corbin and Strauss (2008) claim, "it is impossible to know prior to the investigation what salient problems or what relevant concepts will be derived from this set of data" (pg. 35-36). However, the researcher must be sensitive to the data, acknowledging his/her position in the research, in order to more fully understand the meanings of the data (Corbin and Strauss, 2008). It is through this sensitivity that the researcher will begin to find connections in the data and build theory (Corbin and Strauss, 2008).

This study will build a theory about how an outdoor field trip influences the learning and cognitive development of school children. As the researcher, I do not have any a priori theories to influence this research and theory development. Rather, I have made myself familiar with the literature to "enhance sensitivity to subtle nuances in the data" (Corbin and Strauss, 2008 pg 37). However, only the data I gather and analyze according to the guidelines of Corbin and Strauss (2008) will be used to build theory, rather than building on previous theories.

Description of the Site

McKinney Roughs nature park is an 1,100 acres park situated east of Austin in Bastrop County, Texas. This park is owned and managed by the Lower Colorado River Authority (LCRA). The LCRA was formed in 1935 to provide: water control, electricity, drinking water and public services for various communities in Texas and additionally to work as a partner in conservation, preservation, education of the land and water in LRCA parks and nature centers along the Colorado river.

McKinney Roughs is unique in its geographic location, because it contains three box canyons. Additionally, the park contains characteristics of four different ecological Texas regions: the Post Oak Savannah; the Blackland Prairie; the East Texas Piney Woods; and the Central Texas Plateau. In the park there are canyons, meadows, and a unique and diverse population of flora and fauna that can be discovered along the banks of the Colorado River. On site there is an exhibit building with aquaria and terrariums containing live animals native to the area. There is also a large aquarium containing various species of fish found in the Colorado River.

McKinney Roughs has an education program designed for varying ages of school children. Their programs range form multi-day to a few hours and from water and wildlife conservation to land stewardship. Additionally these outdoor programs are all TEKS aligned.

Description of Participants

All the school children in this study attend a local Episcopal independent school. This school, though located in the west section of the city in which the research is being conducted, is attended by students who live in many different locations of the city. While the majority of students live in upper middle class to affluent families, approximately 15% of the students are on scholarship, allowing for children of different backgrounds to attend the school. Additionally, approximately 15-20% of the students have some type of learning difference (e.g., Dyslexia and Attention-Deficit Hyperactivity Disorder).

In addition to the traditional classroom science, elementary students attend a "Classroom of the Earth;" a science class dedicated to the exploration and understanding of nature. For this study, third graders attended a "Rock On!" field trip to McKinney Roughs Park.

Procedure

PRE-FIELD TRIP

The science teacher as well as the classroom teachers were consulted pre-visit to determine their specific goals for the field trip and to design an enjoyable (to the students) assessment to give to the students post-visit. An eleven question multiple choice, short answer test was administered to the third grade students prior to the field trip. The questions for this test were pulled from released Texas Assessment of Knowledge and Skills (TAKS) and (NAEP) tests. This method was done to assess the levels of knowledge and understanding of geology pre-visit. This enabled me to assess cognitive development or understanding (Dori and Tal, 1998). A simple populations means and t-test were performed to determine a change in understanding observed for the students. Fifteen students were then interviewed about their answers to the test. This data was then transcribed and coded.

DURING THE FIELD TRIP

This field trip lasted for approximately one and a half hours. When the students first arrived at the site they had some free time to run around and explore the area. When the field trip officially began both classes were taken into a room where there was a brief (twenty minute) presentation about rock types. During this presentation, they students were shown different rock types and told briefly how these rocks were formed. On the outdoor portion the formation of the rocks was conveyed in greater detail. After the presentation, the classes went with their respective guides on an hour long hike onto the trails in McKinney Roughs. On the hike the students were able to move around, talk to each other and the guides and parents. When the guide would come across an interesting formation or at specific predetermined spots she or he would talk about what they were looking at. These included: two overlooks, areas of different geology, an area with volcanic rock from a long dormant nearby volcano, and just some areas that were "typical" of the region.

During the hike the students were able to ask questions freely of the guide. They were also able to explore the areas. They were able to talk to each other; there was a general flow of the students into and out of groups. At times there were groups of four or five and then these students would dissipate and reform as either different groups or smaller groups. The entire trip had the fluidity in both classes. It was only the girls I refer to as my negative cases that were not as fluid in their movements between groups. There were conversations within the groups about the rocks they were finding as well as general ecology statements between students.

I attended the field trip as an observer only, I did not participate in the field trip in any other way. The field trip was videotaped to more closely examine the interactions, language and other forms of communication between the students, teachers, and guides. The data from this videotape was analyzed by the researcher and a peer.

POST-FIELD TRIP

A post field trip test was given to the students with many of the same, or similar, questions found on the pre-test. This analysis technique was used for examining the level of improvement and understanding relative to the answers on the pretest. Additionally, I conducted short semi-structured interviews with fifteen of the school children who participated on the field trip. Questions were asked regarding both the field trip and their answers to the post-test. Each interview was audio-recorded with the permission of the participants and their parents. Interviews were transcribed verbatim and this transcription was used for analysis. The post test was administered either the day after the field trip or three days after, during the next science class. However, neither class had had time to talk about the field trip with their science teacher.

PROCESS

Analysis began with the initial interviews. According to Corbin and Strauss (2008), analysis is an ongoing process. It is a process of "generating, developing and verifying concepts - a process that builds over time and with the acquisition of data" (pg. 57). As concepts begin to emerge from the first pieces of data, it is important that the analysis begins immediately, as the results or patterns seen in these interviews will guide later interviews. According to Corbin and Strauss (2008), concepts will "give us a basis for discourse and arriving at shared understanding" (pg. 12). Theoretical sampling will allow for the growth of the concepts. Each of these units was further coded, by identifying and analyzing emerging patterns. Grounded theory methodology and analysis is not a linear process, rather it is a recursive process. As new data were generated, the new codes were compared with existing codes and categories and were renamed or regrouped as necessary. This process often occurs intermittently as the data are analyzed. This process cannot be done in an orderly fashion; it may be highly convoluted or chaotic going up at one moment then downwards. As Marshall and Rossman (1989), explain (as cited in Erlandson, et al., 1993):

> Data analysis is the process of bringing order, structure, and meaning to the mass of collective data. It is a messy, ambiguous, time-consuming, creative, and fascinating process. It does not proceed in a linear fashion; it is not neat. Qualitative data analysis is a search for general statements about relationships among categories of data; it builds grounded theory (pg.112).

ANALYSIS

Transcribed data was analyzed using the Corbin and Strauss (2008) grounded theory approach. Analysis in grounded theory is achieved through coding. Coding, according to Corbin and Strauss (2008), is "taking the raw data and raising it to a conceptual level" (pg. 66). Observations on the field trips were analyzed for group patterns, small group interactions, questioning, and lecture interactions. In particular, the structure and types of the field trip visit, and the cognitive levels of questions being asked by both students and guides will be of interest. How content is communicated to the students was also analyzed.

Open/axial Coding

Open, or axial coding, is a portion of the process of theory building in grounded theory. Open coding is the process of developing categories of concepts, and themes emerging from the data. It is a considered an open process in that the researcher engages in exploration of the data without making any prior assumptions about what might be discovered. According to Corbin and Straus (2008), in open coding the data guides the researcher. As the corpus of data is gathered, analyzed, and compared it should point the way to more insights, data, and directions for further data collection. In this way the coding is "open," not regimented. All the data is considered to allow for unlocking all the possibilities within the data. After breaking apart and conceptualizing the data, the researcher will begin to find concepts. Open coding is the technique of "breaking the data apart and delineating concepts to stand for blocks of raw data" (Corbin and Strauss, 2008, pg. 198). Once these blocks of data have been determined they are placed into concepts or categories (Corbin and Strauss, 2008). Coding data is not a linear process, nor is it a process of finding what the researcher is looking for in the data, but rather a process that allows data to lead the researcher. In this way concepts are developed, often through abstract thinking and "thinking outside of the box" (Wicker, 1985; cited Corbin and Strauss, 2008 pg. 160).

Axial coding is the continuation of open coding. In axial coding the concepts developed in the initial open coding are compared, and via inductive and deductive thinking, connections are formed. Axial coding is "the act of relating concepts/categories to each other" (Corbin and Strauss, 2008, pg. 198). When making connections between categories new relationships may form. Through analysis of the higher level concepts new structures or patterns will be developed and visualized. The researcher will focus on the coded themes developed during open coding to construct categories or themes, and thus develop the context and explain the process of the observed phenomenon.

Some of these concepts are of higher order and these may become categories. The lower level concepts will provide information for, or provide detail for, the higher level concepts (Corbin and Strauss, 2008). Through the data, categories are determined that may be relevant to the phenomena being observed. When the researcher begins to examine the concepts and develop connections between various or somewhat similar concepts, themes or categories should begin to emerge.

Finding a Core or Central Category

As a tool in the analysis process, I used the computer software program Inspiration to develop my coding and concept relationships. During analysis the categories were linked and grouped together in ways that allowed for the development of emergent themes (Appendix A). Through this the central or core category was developed - it is the core category that is the "concept to which all other concepts will be related to" (Corbin and Strauss, 2008 pg. 104). This phase of the methodological process identified the resulting emergent core concepts and served as the primary study findings.

The researcher will, through the coding and development of categories, begin to identify a central phenomenon. As data coding progresses, one category will begin to emerge with greater frequency. This category will be connected to many other emerging categories. This will become the central or core category. Once this core category has emerged data will be coded for the core category and the sub-categories connected to it. The core category epitomizes the main focus of the research. While the core category may emerge directly from the categories, the core category may also come from pulling parts of several sub-categories together in order to fully capture the story. This core category should: be abstract, appear frequently in the data, be logical, and consistent with the data, and should grow in depth and explanatory power as categories are related to it (Corbin and Strauss, 2008, pg. 105). The central category provides an idea or term, into which other categories can be incorporated into it without redundancy.

Development of a Paradigm

Causal conditions that influence the phenomenon were explored and described. Data are analyzed for context. In the case of this study the context is key to the question being asked. The students will be in a different context than their usual school environs and thus context analysis is significant. The context is "the structural conditions that shape the nature of the situations, circumstances or problems to which individuals respond" (Corbin and Strauss, 2008 p87). Context can be formulated at both the micro (close to the individual) or macro (more distant) levels.

Through the analysis of the data, the researcher should be looking in the data for answers to the questions of: why, when, and where. When answering these questions the researcher is better able to place the phenomenon into context. Process is the personal aspect, describing the emotions that occur in response to an event, and including how the people acted or reacted to changes or stimuli. People are affected by the world around them. This research is not conducted in a sterile laboratory, and therefore the process as well as the context must be taken into account. It is through this integration of context and process that a paradigm model is developed.

The paradigm model is an analytical tool used to identify the contextual components for linking them to the process. According to Corbin and Strauss (2008), the paradigm is "a perspective, a set of questions that can be applied to data to help the analyst draw out contextual factors and identify relationships between context and process" (pg. 89). It is through this paradigm that the researcher is able to determine and understand: the *conditions* (why, where, how, and what happens), the *interactions/ actions and emotions* (responses to events) and *consequences*.

Establishing Trustworthiness

The issue of trustworthiness is one of great importance. As qualitative research does not have the numbers associated with quantitative research, the job of the researcher is to assure the readers of the value of the findings. According to Lincoln and Guba (1985), in qualitative research there are four issues in trustworthiness that demand attention: Credibility; Transferability; Dependability; and Confirmability. Each of these has a quantitative match although the criteria are different. The criteria used in quantitative methods of research are: Internal validity; External validity; Reliability; and Objectivity.

Credibility is an assessment of the believability of the findings from the perspective of the study participants. This may include the use of member checking, triangulation, as well as prolonged engagement in the study. As there is no assumption of a single concrete reality, the viewpoints of the participants are the "truth." Credibility is analogous to internal validity; the impact of one variable upon another or causal relationships (Lincoln and Guba, 1985).

Transferability is the degree to which findings can be generalized to other settings or populations. While the onus of transferability is not on the researcher, it is up to the researcher to provide sufficient description to enable the reader to decide if transfer is appropriate. The researcher can enhance the description through the detailing of the research methods, contexts, and assumptions underlying the study. It is the reader in a qualitative study that will ultimately determine if the description is thorough. According to Erlandson et al. (1993), a well done description can allow the reader to view the situation as fully as possible. And it is through this that we are able to see where the research will take us in the future. This can be through either using the paradigm model as a guide for future situations in the same settings, or as a way of understanding situations in a similar setting (Erlandson et al. 1993). It is through presenting the information and the perspective of the participants in a way that allows the reader to enter into the research that the researcher can provide the information that will give the reader what is relevant to them (Cresswell, 1998, Lincoln and Guba, 1985).

Transferability is analogous to external validity to the extent that the findings can be generalized. According to Lincoln and Guba (1985), it is the position of the researcher "to provide the database that makes transferability judgments possible on the part of potential appliers" (pg. 316). I have made every attempt to set up the conditions for relevant transfer of the findings by providing rich descriptions of the contexts and findings, as well as all data available to this research study.

Dependability and credibility are linked as are validity and reliability. Reliability is contingent upon replication, the consistency of observing the same finding under similar circumstances. Replication may not occur in a naturalistic study. Within qualitative research, there may be no set 'reality." Realities may change as naturalistic design is not static. Therefore dependability pertains to the researcher accounting for the changing circumstances that are inherent in qualitative research. In actuality dependability may be even more enhanced when the research design is altered as new findings emerge.

Confirmability, according to Lincoln and Guba (1985), relates to the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest. And how these findings are shared or corroborated with other respondents enhances confirmability.

As dependability and confirmability are tied together, a data audit is suggested for both. This data audit is performed by outside members and is used to locate possible areas of bias. While it is difficult to certify the dependability and confirmability of a study without a thorough audit of the research process and product by an outside party, member checking, the reflexive journal and the "Researcher as Instrument" statement support claims of both dependability and confirmability (Rodwell and Byers, 1997; cited Levy, 2003).

In order to establish trustworthiness for this research project I utilized three methods proposed by Lincoln and Guba (1985). I utilized member checking, triangulation, and a reflexive journal. Member checking consists of restating or paraphrasing the information from a participant returning to the participants with this information to ensure that what was heard was correctly understood. This was performed during the interviews with the school children as well as the teachers.

Triangulation is the use of multiple data sources to produce understanding, for this study these sources will consist of interviews with the children, observations, and results of the non-stakes test. Triangulation will ensure both credibility and confirmability.

"A researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing and communication of conclusions" (Malterud, 2001, pg. 483-484).

As the perspective of the researcher shapes all research: qualitative, quantitative, and even laboratory science, this bias must be brought to the forefront in a naturalistic study. A reflexive journal is used by the researcher to record her feelings and thoughts about the research and the knowledge construction. Therefore the researcher has kept a journal in which to record feelings or thoughts. These may be of the research or the feelings of the researcher herself. The researcher will record methodological decisions and the reasoning for them as well as logistics of the study.

Reflections of what is occurring in regards to the researcher's own values and interests, serve to provide the opportunity for catharsis, for reflection and for speculation about growing insights The purpose of this is to ensure that the researcher remains aware and avoids personal bias (Lincoln and Guba, 1985). This activity, of keeping a reflexive journal, has greater implications which may not be obvious. This journal can be used to monitor progress, strengthen concentration, and to reflect on the research methods (i.e., the level of trustworthiness). According to Lincoln and Guba (1985), entries should be made on a daily basis in the daily schedule and personal diary, and as needed in the methodological log" (pg. 327). Appendix A contains portions of my reflexive journal and my goals as a researcher.

HOW I ESTABLISHED TRUSTWORTHINESS

As I am the research instrument for the study, I relied on my reflexive journal as my analysis aid (see Appendix B). Again the reflexive journal was a multimedia tool I used to record my thoughts, ideas, insights, questions, philosophical positions and my actions relative to the study (Lincoln and Guba, 1985). I sat down to write journal thoughts twice weekly initially and then this increased as the study progressed. Additionally, I carried a small digital voice recorder with me to record thoughts I had at other times. During the data generation phase of this research I tended to record both verbally and I also wrote more frequently as I began to comprehend and discern connections in the data. The journal serves as a place to record insights and decisions and as such supports the credibility, dependability, and conformability of the study (Erlandson et al., 1993; Lincoln and Guba, 1985).

Additionally I worked with peers in coding the interviews and video. I found an initial agreement of seventy-six percent but after discussion and review agreement was ninety percent.

FINDINGS

The purpose of this study was to determine the mechanism by which an outdoor guided field trip might influence the student's understanding of the rock cycle.

To review, the pretest and pre field trip interview explored what students understood about the rock cycle as well as the water cycle and some general ecology. After the field trip the students took a post test and were interviewed about their answers to the test as well as some questions regarding their understanding of the material and their feelings of their experience of the field trip itself.

In the following sections this will be explained in detail using the words of the schoolchildren to document the findings. This chapter will be divided into the concepts with each sub-concept imbedded within the model. There are several sections relating to the guides as this property was seen across multiple concepts as being important to the students' learning. The results from the teacher interviews and questionnaires are also included in this chapter.

Table 1 shows the number of times a code was used in an interview. Each time a particular word was used it was noted and put into the coding scheme.

Table 1 Number of times code used in interview.

	k	s	m	a	n	s	c	a	e	m	r	sm	rq	j	aa	f	k	fc	t		total
fun	5	4	3	5	4	3	3	4	3	4	5	5	4	2	4	5	4	3	4	fun	74
walk		1	1	2	1	1	1	3	4	2	5	3	4		5	4	3	2	3	walk	45
outside	3	2	1	2	3	1	2	2	1	2	2	3	4		4	4	3	4	2	outside	45
friend	3	1	1	3	1	1	2	2	4	3	2	3	2	3	3	4	2	2	2	friend	44
talk	2		1	3	1		1	1	4	4	3	4	3	3	3	4	2	2	3	talk	44
observation		2	2	5	4	1	1			2	2	2	4		3	1	4	3	2	observation	38
interesting	2	1	1	1	2	3			2	1	4	3	3		4	2	3	2	3	interesting	37
share	3			1			1	2	2	2	3	3	2		2	4	4	3	2	share	34
guide	2	1		2	3	1	1	1	2	1	4	2	1		2	2	2	2	1	guide	30

setting	1	1		1	2	1	1	1	1	2	1	1	4		2	2	3	2	3	setting	29
different		1	2	2		1	1		2	2	2	1	2		3	2	2		1	different	24
understanding	1	2				1	3		2	1	1	2	1		4		1	1	2	understanding	22
social				2			1	1	2	2	3	2	2	3	1	3				social	22
learning			2	1	3	2	1	2	1	2			1		2		2	1	1	learning	21
new info	3		2		1	3	1	1		1	1		2		2		1	1		new info	19
explore		3	1		2						2		2		2		2	3	2	explore	19
like field trip	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	like field trip	18
hands on		2		1			3	1	1		3	1	2		2	1				hands on	17
like guide	1			1	2				1	1	2	2	1	1	1	1	1	1	1	like guide	17
prefer outside		1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	prefer outside	17
enjoy learning	1		1	1		1	1	1		1		1	3		3	1	1			enjoy learning	16
new location	1		1	1		2		1	1			1	2	1	1	1	2			new location	15
not school			1			3	1			1	1	1	1	1		3		1	1	not school	15
new pple				2	2	2	2		1	1	2	1								new pple	13
help	1			1			2	2	1		1	3	1			1				help	13
comfortable	2					1	3	1	1	1	1			1	1	1				comfortable	13
how learning	1				1	1	2	1	1		1				1		1	2		how learning	12
misconception	1			1	1	1							1	5						misconception	10
pride				1		2		3		1		1					1			pride	9
recall guide			1	1	1	1				1	1			1		1				recall guide	8
talk to guide				1	2				1		1						1			talk to guide	6
why learning						1			1				2							why learning	4
prefer museum						1														prefer museum	1
no opinion on FT														1						no opinion on FT	1

Table 1

Cognition

A great majority of research in environmental or outdoor education has focused on the affective gains (Falk, Martin and Balling, 1978, Knapp, 2000). Children are more likely to take more care of their environment after experiencing outdoor education. In this study, while affective gains were noted, focused on the cognitive gains of the students after participation on their field trip.

ACTUAL COGNITIVE GAINS

Research supports the use of pre and post field trip curricular support by the teacher for the student (Falk, Martin and Balling, 1978). In this case, the field trips occurred near the end of the school year, the week after the Comprehensive Testing Program 4 (CTP4) assessment testing of the students. What this meant was that the science teacher did not have the students in her classroom for two weeks before the field trip. Therefore any pre-trip information had been covered at least two weeks prior to the field trip. However, based on the post-field trip test, the students had significant gains in their understanding and knowledge of geology from the trip (See Table 2 and 3).

Table 2. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs C's Class

Group	Pretest	Posttest
Mean	5.32	6.68
SD	1.63	2.33
SEM	0.38	0.54
N	19	19

The two-tailed P value equals 0.0201

Table 3. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs H's Class

Group	Pretest	Posttest
Mean	4.50	6.25
SD	1.50	2.15
SEM	0.34	0.48
N	20	20

The two-tailed P value is less than 0.0001

For the pre and post tests, published questions were utilized from National Association of Educational Progress (NAEP) and TAKS (See Appendix C). For the two third grade classes, questions were pulled from the fourth and eighth grade science NAEP and TAKS exams relating to earth science and the water cycle. NAEP and TAKS questions were used as these questions have undergone rigorous testing and therefore create a more valid test of knowledge and understanding. The tests were graded using the provided rubrics with correct, incorrect, partially correct and unanswered being provided.

The majority of the students were better able to answer questions regarding the rock and water cycles post field trip. This was evident in the written answers of the actual exam, but also during the interviews. For example, prior to the field trip none of the children had any idea what type of rock sandstone was and the majority had never heard of it. Post field trip eighty percent were able to answer what sandstone was, how it was formed, and the majority of the students in their interviews were able to give examples of sandstone.

Flora: Oh sandstone- over time the rivers carry down the rock and then they would go on top of the first layer and then there would be another kind and it would be pressure and it would get smaller and smaller.

Nourah: So when she held up the sand stone how did it look?

Flora: It didn't look like sand.

Nourah: How did it look?

Flora: Kind of stripy from the different layers that were different colors.

This portion of the interview shows some content gain. She is able to explain how sandstone is formed. This is something that she was unable to do prior to the field trip. This particular student believed sandstone was another word for sand prior to the field trip. Therefore while the answer may seem ambiguous as to the size of the rocks being carried by the river she has answered the question completely enough to receive a "partially correct" based on the rubric. She understands that rock, of some size, is washed down into the lake and layers are formed and due to the pressure the new rock is formed. On her specific exam, she draws a picture of the pressure from the water pushing down on the newly formed layers.

The results were similar for volcanic rock. While the majority knew, prior to the field trip, that volcanic rock came from volcanoes, for the bulk of the students this was the extent of their knowledge. Post field trip they were able to answer in more detail about volcanic rock, how it was formed, and the different types of volcanic rock.

This was also the case when looking at the geographic history of Texas. When I interviewed Carly I asked her a specific question regarding how oyster reefs could be found in the middle of Texas. She was able to recall the reefs but she also understood the big picture of the reason why there would be oyster reefs in McKinney Roughs.

Nourah: Do you remember when we were looking out over the deck and he brought out some rocks and he [guide] brought out the fossilized reefs.

Carly: Yes

Nourah: Do you remember where they found it?

Carly: They said they found it on McKinney roughs

Nourah: How is that?

Carly: - Because part of Texas used to be all water so if you had a house in Austin it would be at the beach. So there used to be oysters there but now there's not.

This portion of the interview was coded with a look at the recall of the guide, what the guide said and how it relates to current geography. From this I put into categories of guide and understanding. This was not related to the test in anyway so it was not rated in any form of rubric.

I also found that students had learned more about ecology during on the trip. Several of them mentioned the fire that had burned many acres on the field trip. So fire ecology came into play a bit in some of their new knowledge.

"But another thing we learned is there was this path, kind of, and then it separated, one side that didn't have a fire and one that did. And the side with the fire was really green and the one that didn't have the fire was

really like dead plants and everything. And so I was really surprised to see that. I thought that it would be the opposite of that. But he said the fire let the new plants and stuff grow. But there were some dead burned trees on the side with the fire and just dead stuff on the other side."--Kari

This was also not included on the pre or post test, nor was a question asked regarding this subject. Kari spontaneously volunteered this information. This was an item she found interesting and wanted to share with me. I did not code this however, as a desire to share since she did not expressly tell me that. This was coded as "learned", "guide" "understanding" and "new knowledge".

I have provided longer examples from the interviews as well as pre and post test examples in Appendix D.

For some of the questions the students provided answers that were partially correct, however upon investigation in the interview they were able to answer more fully. If a student had received an "incorrect" on the pretest and a "partially correct" on the post test this was considered evidence of learning as they did have improvement in their understanding and content knowledge.

PERCEIVED COGNITION

I included the students' perceived cognition as a way to acknowledge that the students recognized that they learned. These codes were: "learned", "how learned" "why learned". From these codes I worked to fit them into the larger groups of codes looking at why the student said he or she learned. For example, if a student told me she learned a lot from the guide I was able to connect learning with the guide.

Leaving the school grounds was a considerable benefit for their learning. All of the children were excited to leave school for the day and there were many reasons for this attitude. These ranged from the excitement of leaving the school and not having the usual class work to emotional reasons. Again, if I was able to see that they learned because of the location, if it was more "fun" then I could connect "fun" "setting" and "learning". Again, this is seeing how the students are viewing their learning.

From the interviews, it becomes clear that they recognize they are learning and they see how the field trip bolstered their learning; they had more fun and this made learning more interesting. There was new information which they were able to tell me about it in some detail afterwards, they paid attention to the guides, and the location held their interest.

As Linda stated:

> *"I felt like - well I feel more calm than at school - because if I don't understand it I get to look- but at school if I don't understand it - lets say they were talking about a rock that is rare in Texas and I don't understand it – when I was on the field trip if I didn't understand it they would show me and then I would understand it."*

Linda was nervous about being in school and she seems to have high levels of anxiety that is reduced when on a field trip. She felt better able to understand what the guide was explaining because she was able to see rather then just hear about a rock. She has the desire to learn and thinks her best way to learn is visual. Her comfort level is increased and is better able to relax and learn. While her comments are not unique they are not common either, however, she recognizes what in the field trip is helping her to learn: “why learned”-“emotional” (calm), “understanding” “seeking help”(guide), and “how learning” (visual).

Question: Tell me what you liked about the field trip?

“*Well, I feel like I actually, like, now that I kind of see how they do it and stuff and how it kind of works, it makes me like understand it more. Like pictures and things about it help me understand it more than like just doing it, like talking about it and not really getting to see it much.”*- Erin

“Well because you actually got to feel and look more closely at them which in science you don’t get to look at 10 maybe just at 4. But on the field trip on all the trails and all the ones they showed us we got to see about 20 or 50.”- Kate

“Yes I also when she was talking I got to look and feel I didn’t have to just imagine it. Because I would know because I would be looking and feeling it.”- Kathy

“I like to feel things so I can know, like, how to identify what they are”-- Carly

Erin also recognizes her need to see how "*they do it and stuff.*" She wants to learn using visual aids as well as doing or listening. The actual hands-on portion of the field trip was relevant to the students. They were able to touch and smell and even surreptitiously taste the rocks. There were many examples which provided multiple opportunities for them to get their hands on the rocks. When Erin was asked about a preference for an indoor science museum or outdoor field trips she responded with the following comment:

> *"I still think I would go McKinney Roughs, because I think I would do more things and it'd be more fun than going to a museum and just looking at things. And at McKinney Roughs, you can actually touch the rocks and actually see. Like, you can touch what you see, and you see more things and stuff."*

These students were telling me how they think they learn more effectively, and that is through: comfort, hands-on experiences, visual stimuli, multiple examples, opportunity to ask questions and learning from an expert.

In an interview with Kara she communicated how the field trip helped her learn and she expressed that seeing the new rocks and multiple samples of the rocks as well as hearing about them supported her in her learning.

> *Nourah: So she talked a lot about different types of rock - do you think the field trip helped you understand the different TYPEs of rocks better?*
>
> *Kara: Yes, because she talked about all these kinds that we didn't see in science and she showed them to us too.*

Nourah: Had you talked about sedimentary rock in Mrs. G.'s class?

Kara: Yes.

Nourah: But did you not get to see a lot of different kinds of sedimentary rock?

Kara: No, we only saw about two and on the field trip we saw shale and limestone and sandstone and even more.

Or as Rock eloquently phrased it : "*Probably I would like to take field trips more at school, because even though we're kind of still learning, it's just kind of a funner[sic] way to learn"*

Karen felt the best part of the field trip was: "*Probably that you get to have fun at the same time as you get to learn things about what that field trip is about."*
And this statement is backed up by Carly in her interview:

Nourah: What is your favorite part about being on any field trip?

Carly: *When we get to learn a lot and do fun stuff*

Nourah: What is the worst part about being on any field trip

Carly: when you have to listen to them talk and you can't understand what they are saying.

All these students feel as though they are learning more from the field trip than they do in the classroom. While this may or may not be the actual situation, they perceive it as so and participating on the field trip was a "funnier" way to learn than sitting in the classroom or staying on school grounds.

Interest

High interest levels were expressed by all the children interviewed. The students stated that because they were interested, they were more motivated to learn. There were multiple reasons which fostered their prolonged interest and desire to learn. The perception and reinforcement of the field trip as being "fun," was seen over and over again. Having fun while learning stimulated the students' interest in the subject matter of the field trip. The trip was characterized as being "pretty cool." As the students participated in the field trip, many of them became engrossed in seeking information relating to the environment and the history of the land, and in turn, their levels of interest were intensified.

> *"Probably that you get to have fun at the same time as you get to learn things about what that field trip is about"*—Kari

> *"Well, I thought that was actually kind of interesting. It was pretty cool. And I thought it was real interesting, because the – just looking around and seeing what it would be like if you were like someone else that was like in an Indian tribe or something."*—Leslie

Leslie's comments on her observations of the area show that she engaged her imagination in ways that would connect her with the land. She knows of "Indian tribes" having lived on the land. This portion would be coded with "interest", and "observation" and I also in further coding put this in as a way in which the guide made a difference in their understanding even though this was not stated specifically by the student.

The guides showed the students an old oak tree that had likely been tied down by a member of the Comanche tribe to point to something of importance (way to river, path to village). It is these small yet relevant points that enthralled the students and engaged their curiosity. And with the curiosity comes the interest and desire to learn.

NOVELTY

The students enjoyed the novelty of leaving the school grounds. They had their reasons for this which will be examined more closely in the Setting section. Several of the students expressed the point that meeting new people was a valuable part of the field trip. The main code for novelty was "new" and this was then divided into "new location" "new information" and "new people".

> *"I guess that there are like there are new people we get to meet and new things. Instead of like what we've been talking about at school.* — Carly
>
> *"Oh. Meeting all the new people and looking at things I don't have at home."* —Erin

"I like to go talk to new people and see all the new things."—Jordan

"I like going on field trips better, because I get to see more things that I haven't seen before and stuff."—Karen

"*Because you get to learn new things when you go there*."—Sean

All of these students are expressing an interest in the "new" whether it is new people of new things or learning new information.

In an interview with Rock about why he enjoys field trips he expressed his preference for being out of the classroom and this novelty was one of the elements that stimulated his interest. He preferred the novelty of the entire trip and this element of surprise and the change of scenery that is attendant with traveling to a new place.

"Well, first of all, we don't have to have school and we don't have to have homework. But what I like about them is like you really don't really know what to expect. Like when we had the GPS's, I didn't expect that. I thought we were just going to go on a hike and come back and that'd be it, but it just seemed sort of different, because like we learned about rocks and we learned about the GPS and all of that stuff"

New Location

Research has shown that by reducing the novelty of a field trip the students will gain more than they would have without some preparation (Falk, Martin and Balling, 1978).

In this study the teachers did not have time to prepare the students for the field trip. The students had no idea about the physical aspects of the location. When asked what they were expecting the answers varied, with the majority of them saying that it did not look like what they were expecting.

Interviewer: And when you went there, before you went there, what did you imagine it would look like?

Rock: Probably a little more like – a little less like houses, buildings, and stuff. I was thinking that it would be more hiking, but it turned out pretty well.

Or:

Interviewer: Did it look like what you thought it was going to look like?

Erin: Well, not exactly.

Interviewer: How not? What did you think it was going to look like?

Erin: I just thought, I didn't know that it was going to be a hiking place. I thought it was just going to be this big wilderness place.

Or:

"*Thought it would be kind of a canyon - kind of like the grand canyon but smaller."*—Dex

However, even though it did not fit their preconceived ideas of the location, this was not a great distraction to the students. They were informed prior to the field trip that they would be needing shoes for walking and they were going to learn about the rock cycle. This was the extent of their knowledge prior to the field trip. Possibly, the fact that these students have been exposed to many different locations in their life, could have led them to be less overwhelmed than other students from a different school would have been, this is an avenue for further exploration.

New Information

The students still felt comfortable and were not significantly distracted from the field trip by the novelty of the location. The students were told that they were going to study rocks and to dress for hiking. Other than that there was little if any preparation both academically and mentally for the field trip. This did not seem to affect their learning negatively, rather they preferred the novelty of the new environment and that they were learning information in a place other than their usual classroom.

"I think I like it more, just because it's more interesting to me than seeing like a musical or something"—Levi

"Umm, well we get to learn a lot of stuff that we probably wouldn't learn at school"—Celia

"Probably that you get to have fun at the same time as you get to learn things about what that field trip is about" —Kari

"It was really fun, because like we were learning about rocks at our science class, but, I mean, they kind of, when they went there, they kind of took it a step forward, and they were kind of saying, "This is where it comes from. This is what it's named. This is what happened." And like in class we did learn some of that stuff, but not all of it."—Rock

"*Because, I mean, I don't want to brag, but I'm pretty good at my science class. And, I mean, most of that stuff I didn't know whatsoever, like I didn't know about the basalt, I didn't know about the sandstone. I knew where… I knew about some of them, but most of them I didn't. They were absolutely new to me. Some of the rocks I've never even heard of."* —Rock

"Because you get to learn new things when you go there. A lot. I didn't know. I didn't know there was such a thing as sedimentary, igneous, and metamorphic rock."—Eliza

"Well, it's just kind of like interesting because there are different things that you haven't seen outside and you can just find interesting things. And

in the classroom, like, it's fun, but you don't have new things in the classroom."—Tania

"It was really fun, because we got to see all those different rocks, and then we found a lot of different rocks, like the volcanic rocks and the other rocks and sandstone and all that. And then we also got to see out there, like, all the different plants I also saw and stuff. It feels different than at home, because we don't have all that stuff and I don't usually get to see that. So it's more fun to do that." —Erin

Eliza was not only interested in the material but her pride in learning new information was evident in both her voice and her words when she said: "*Well, I learned a lot about like how to identify a volcanic rock, and it felt really interestin*g."

Pride in learning new information was experienced by many of the school children. The ability to go teach someone else what they had learned, led to an aura of importance within their own social structure and in their own understanding.

Allie: I felt like I knew a lot more than like my sister and my mom and my dad, and so I felt…

Nourah: You could go home and tell everybody about it?

Allie: Yeah.

Nourah: How does THAT make you feel?

Allie: Good.

All of these students expressed that they learned "new things" during the field trip. This information was not trivial. They took in new, in depth, complicated information, that became fun and exciting. Even for the student who is "*pretty good at my science class"* this was new material. There were more rocks to see, more than what they had at home. They talked about how they enjoyed the learning rather than just learning. This enjoyment of the learning is not insignificant to the students. That there is new fun material to learn increases their interest in learning. They feel pride in learning information that their family and other friends may not have. As Rock says, they are going beyond the classroom science and putting it into a realistic perspective.

The relationship between interest and learning is seen in the following tables. In Table4 I have provided a matrix of interest scores compared to the test scores. The levels of interest were determined by the coding score.

Low scores 0-19, Medium scores 20-29, High score >30

Codes related to interest	k	s	m	a	n	s	c	a	e	m	r	s m	r q	j	a a	f	k	f c	t
fun	5	4	3	5	4	3	3	4	3	4	5	5	4	2	4	5	4	3	4
walk		1	1	2	1	1	1	3	4	2	5	3	4		5	4	3	2	3
outside	3	4	1	2	3	1	2	2	1	2	2	3	4		4	4	3	4	2
friend	3	1	2	3	1	1	2	2	4	3	2	3	2	3	3	4	2	2	2
talk	2		1	3	1		1	1	4	4	3	4	3	3	3	4	2	2	3
interesting	2	1	1	1	2	3			2	1	4	3	3		4	2	3	2	3
guide	2	2		2	3	1	1	1	2	1	4	2	1		2	2	2	2	1
setting	1	1		1	2	1	1	1	1	2	1	1	4		2	2	3	2	3
different		2	2	2		1	1		2	2	2	1	2		3	2	2		1
learning			2	1	3	2	1	2	1	2			1		2		2	1	1
new info	3	1	3		1	3	1	1		1	1		2		2		1	1	
explore		3	1		2						2		2		2		2	3	2
like guide	1			1	2				1	1	2	2	1	1	1	1	1	1	1
enjoy learning	1		2	1		1	1	1		1		1	3		3	1	1		
new location	1	1	1	1		2		1	1			1	2	1	1	1	2		
new pple				2	2	2	2		1	1	2	1							
pride				1		2		3		1		1					1		
talk to				1	2				1		1						1		

guide																			
Interest	24	21	20	29	29	24	17	22	28	28	36	31	38	10	41	32	35	25	26
level	med	med	med	med	med	med	low	med	med	med	high	high	high	low	high	high	high	med	med
change in	80-65	95-80	100-85	80-75	85-75	85-75	70-60	75-60	80-75	75-65	85-70	85-75	90-80	55-50	95-85	75-65	80-65	70-60	65-60
test score	15%	15%	15%	5%	10%	10%	10%	15%	15%	10%	15%	10%	10%	5%	10%	10%	15%	10%	5%

Table 4 (Interest-Exam Score Matrix)

The relationship between the scores and interest in the field trip is further looked at in Tables 8-10. Students with the highest interest levels have the greatest change. This is regardless of their initial score. In other words, overall initially high scoring students did not necessarily have greater interest. Nor did they score more points on the post test. What is seen is that there is a greatest change in scores in the students who scored in the highest interest group, although there are fewer of them than of the medium scoring group. And of particular note, is the average of the high interest level group's post test score, was higher than that of the medium interest score. The students with the higher interest levels had an increase in score change on average of 2.25 over the students with the medium levels of interest and a change of 4.2 over the students of the lowest interest levels. The students in the medium interest levels had a change of 1.9 over the students in the low interest group.

The students in the high interest group had an average high score that was 7.9 points higher than the average for the medium group. And 22.5 points higher than the low interest group. And the medium interest group is 14.4 points higher than the low interest group.

The low interest group however, is small and therefore is not useful statistically but is an interesting comparison between the high and the medium interest level groups.

Low interest level	% change	high score	low score
	5	55	50
	10	70	60
average	7.5	62.5	55

Table 5 Low interest levels/score change

Medium interest level	10	70	60
	5	65	60
	10	75	65
	5	80	75
	10	85	60
	10	85	75
	5	80	75
	15	100	85
	15	95	80
	15	80	65
average	9.4231	77.115	66.538

Table 6. Medium interest levels/score change

High interest	15	80	65

level			
	10	75	65
	10	95	85
	10	90	80
	10	85	75
	15	85	70
average	11.667	85	73.333

Table 7. High interest levels/score change

Social Interactions With Others

GROUP SYNERGY

The social aspect of the outdoor guided field trip is important to the students. There was talking, laughing, holding hands, communal sitting (because they were tired from hiking), listening, asking questions, exploring and stimulating interest.

The students particularly enjoyed the freedom to ask questions as they arose and to be able to share insights with their friends. The codes associated with this included "friends", "together", "share" . These codes were usually associated with "fun". The students thought it was "fun" to be with their friends for multiple reasons.

> *"…And just really to have fun again with friends, like I did with my hiking partner, Carly. We really just had fun together doing the same things and really having fun just walking."*—Rory

"I liked that we got to be outside for the whole time and just like got to be with friends and everything like that." —Kara

"I learned how we can really work together to really learn how to make way points. And on the hike, after the hike, while we did it, we did mapping, our way points, and I thought that was pretty fun and a good experience."—Landon

"Yeah, I had fun. It was really fun like being with my friends. And like they would point stuff out and I would say, "Yeah, look at that," so we could just like share different things that we saw there."—Kelly

These quotations are excellent examples of how important the ability to socialize was for gleaning additional information. They shared their interests with one another, by showing each other interesting aspects of different rocks. They had fun being outside and walking around. They assisted each other on the hike as well as during the lab time. They learned how to, or at least practiced "really work[ing] together."

The students were learning through their interaction with each other as well as by listening to the guide and learning from him or her. During the hike they were picking up the rocks and showing them to each other. A group of four boys were examining a rock one had found, attempting to determine if it was petrified rock or sedimentary rock. After about five minutes of discussion and asking parents, who did not know the answer, they ran to the guide to ask and were told it was not petrified wood, much to their disappointment. It was the interaction of the guide with the school children that began to catch my attention.

Interactions With the Guides

The students quickly developed an interest in their guides because they injected real-world situational know-how into their lesson plans. The students felt comfortable asking the guides questions and talking with them.

The Guides and Their Presentation of Materials

Each of the classes had their own guide. One of the guides, Nadia, was knowledgeable but very fact oriented. The other guide, Erik, was equally, if not more knowledgeable in content. The two styles, between the guides, were very different from each other. Following are descriptions of the two guides presenting the same outdoor guided field trip.

Nadia

Nadia was rather formal in her interactions with the students. While she answered all the questions asked of her, she spoke very quickly, giving brief accurate answers. As the children walked through the woods and on the path, Nadia clipped along at a brisk pace. She spoke some as she walked which predicated that the students had to keep up with her to hear what she was saying. It was difficult for me to hear her during the hike and several times I considered giving up on the pace, as four or five of the children appeared to as well.

The field trip began with a lecture inside a room and moved to the outdoors to examine the geology and ecology of McKinney Roughs. The first stop was at an overlook. Here she pulled some different types of rock from the bag she was carrying. She pulled out a rather large piece of petrified wood and explained how petrified wood was made. As this stop was the first one after the indoor lecture about half of the students were a bit restless and paid little attention to what she was saying. Others, three girls in particular, were focused more on taking pictures of the rock as well as touching it and feeling how smooth and cool it felt. She then pulled out a piece of fossilized oyster reef that had been found near the river in the park. Again, many of the students were more interested in enjoying the beautiful view and talking about things other than what she was discussing. When Nadia was telling the students about how rocks were formed as well as how it was possible that there might have been an oyster reef in the middle of central Texas, her voice pattern was, if not bored then, rather flat. Her language was age appropriate and the students who were listening seemed to understand based on the questions they asked her. However, as I was not able to determine from each student understanding at the moment this was a subjective belief and as such noted in my journal. From my point of view she eventually became a bit overwhelmed with the noise of the children. They were beginning to crowd around her to ask her questions that were not actually relevant to the field trip and quite a few of the girls were fighting over the rocks to take pictures of them. Some of the students were asking question about the bag she was carrying and what it had in it. While others asked her how there could be oyster reefs in central Texas.

N*ahdia- so if you look out over there you can see where the river runs through there and all along the cliff there are these oyster reefs. Why do you think there are reefs there?*

Side conversation*:*

Marty: because of the river?

Sean- because it used to be the ocean?

M: it did?

S: yes I think so. Ms Nahdia didn't this used to be the ocean? Umm when the dinosaurs were here?

N- yes! This area was all a shallow sea and if you lived in Austin you would have a beach house. So there was all these oyster reefs out there.

From the overlook location she began the hike. She led them down a crushed granite path into the live oak-juniper woods. As the group walked down the granite path she had them pay particular attention to the crushed granite that lay between the cedar borders.

"This was all brought in to make the path, these rocks aren't from here. They were brought in to make the path. But if you look at the granite you can see the sparkles in it."

She stopped at different spots to show the children different geological features. At each of these stops she would show the children the types of rocks found in that particular area; some areas had more limestone and others more flint.

As the walk continued the group came up on a cedar fence that was leaning over on its side, the children hopped over this to enter the "restricted" area. This area was the only part of the park with lava from Pilot's Knob, a now dormant volcano about twelve miles to the northwest of McKinney Roughs. Scattered on the ground between the cedar trees were pieces of volcanic rock. Volcanic rock is not commonly found in central Texas. Nadia allowed the students to pick up a piece of volcanic rock and to speculate how it arrived there. After a few minutes of guessing she told them of the dormant volcano. The students were told that they were not allowed to keep any volcanic rock but that they were each encouraged to pick up any other type of rock they chose that was smaller than a quarter dollar coin in size and that they could keep that rock. While on the hike she pointed out a few of the different trees found on the property. When one of the students asked her about what type of tree one tree was she was unable to answer definitively:

"It is either a blackjack oak or a post oak."

Her overall content knowledge for ecological subjects other than geology was not strong. She was unable to identify several plant species or to explain, with any confidence, the differences between varying plants or how the particular species were important to the area. However, her understanding of geology was strong.

The students who had Nadia as their guide conveyed to me in the interviews that they "*really liked*" her. They thought she was "*very smart*" *"she knew A LOT about rocks,"* that *"I think she's an expert in rocks.* All of the children interviewed from that class enjoyed Nadia as their guide. Although some of them commented that they thought

she was *"kind of like a teacher*" and "*talked a lot.*" Even so, they said: *"she let us ask questions,"* and *"if I didn't know something she might know and I could ask her."*
Or as Eliza stated:

> *"And they made it… We did go then there for a long time, and they really – she really explained it, because that girl, Nadia, really – that's the name of the guide – that she really explained it because she really knows about rocks. That's most of her study. It seems to me that she really knows."*

The students see their guide as someone who is an expert in the field of geology. There was a sense of awe when she was speaking of this that is not readily transparent in the quote. And although she may at times have appeared to be a bit like a teacher, she was a person the children were comfortable to listen to and ask questions of.

Erik

Erik was an extremely laid back guide. He began by taking the students to the patio and having them look for fossil imprints in the patio stones. Initially he asked them questions about sandstone and how it could even have fossils in it.

> *"If sandstone needs water to form, what else does it need?"*

"Pressure!" was shouted by several students.

"Pressure yes, and when animals die in the sea where might they go"

"Sink into the sand at the bottom"

"Into the sand at the bottom."

From this beginning he began to show them the layers in the patio stone and explained in depth about the moon and tides and sediment all leading to the formation of sandstone and fossils to be found in the sandstone. They then went for "*an Easter egg hunt for fossils."*

They began to find fossils and talk about and show them to each other. This led to a few arguments of what type of fossil it was:

Remington: Look at the fish fossil I found!

Landon: That is not a fish fossil.

Remington: It is. Look. See the top fin and the other bones?

After a minute of examination

Landon: Ok fine! It is a fish.

As the students and Erik were having this discussion and the students were all squatting down - Erik was leaning against a post watching and listening. He answered questions as he heard them. Erik explained how an imprint fossil as well as other fossil types were formed. There was a fossil imprint of some algae and the filaments were visible. He explained again about how sediment and fossils can be related. He then showed them a "new fossil." This was where a leaf had fallen into the cement as it was drying. This then sparked a discussion about the use of the term fossil and how they were formed.

Erik picked up a piece of petrified wood and explained how the piece of wood, slowly over time, was replaced with minerals and became a rock.

> *"This is actually the state rock. Petrified Palm Wood. Palm like the palm of you hand. So if you need to remember the state rock just clap your hands and remember your palm "oh yah Palm Wood"."*

Erik then took them on a hike into the woods to the location where the ground was sandy. He had them bend down and feel the sand they were standing on and asked them where it might have come from.

> *"Crushed up rock"*
>
> *"Crushed up rock, what if I told you this was from the Rocky Mountains and you are all standing on part of the Rocky Mountains."*

He then explained about how geology can affect the trees and plants that grow in an area and the resulting ecosystem. He used the pine trees found in the park as an example of a tree that usually would not be able to grow in such a dry area but due to the unique ecosystem of the park, and some of the surrounding areas there was a forest of pine trees in an area usually populated with juniper-oak savannah and some Blackland prairies. He spoke in detail, showing examples of the relationship between geology and the ecosystem.

At the restricted part of the park, where volcanic rock was found, he painted a picture for them of life when the volcano may have erupted.

> *"Imagine being with the dinosaurs, we were at the edge of the water and the shore. There are all kinds of dinosaurs around swimming ones and land ones. The geology was different and there were different types of plants all around. Then a volcano erupts- what do you think the dinosaurs would feel?"*

He was answered with a cacophony of children's voices giving opinions. He then told them to look around for the volcanic rock.

> *"I found some!"*
> *"It smells like soap"*
> *"Oooh*"

The ability to find the rock in question and then be able to actually touch it made the experience much more relevant. They put their senses into their exploration of the rocks. Not just touching and feeling "real natural volcano rock" but also to be able to smell and find more. During this time of exploration and discovery he explains to them how the rock was formed from the volcano. He uses some language that is difficult to understand but quickly responds to blank looks with explanations of the meaning.

As they begin the walk back to the overlook he too stops on the granite path and explains to the students that the granite was brought in for the path specifically. He then shows them how they can get sparkly stuff on their fingers when holding granite.

> *"Granite is an igneous rock and it has four minerals in it: quartz, mica, feldspar and horneblende. You can see the crystals since it forms very slowly*"

A rock survey is then conducted, each child is to pick up any rock and he will identify it and they will join a group of others with the same type of rock. The students look around trying to find the most interesting rock, something different. Three groups are formed: flint, quartz, and sandstone.

> *"Flint, flint, flint, sandstone, flint, OH! You have flint. Flint, flint, this is flint…"*

At the end of this demonstration, all but three of the children are in the flint group. From this the children conclude that in that area flint is the most common type of rock. Erik does point out that if they were to head one hundred feet towards the river there would be different rocks, more limestone and other sandstone and less flint. And that is was due to time constraints that he was unable to take them there to see the difference. Erik also explains that at McKinney Roughs all the rock they will find, with the exception of the lava rock, is sedimentary.

> *"And we split up into groups, like Miss C was sandstone, Miss H was flint, and Miss M. was quartz. And a lot of more people learned that flint was more of a variety at McKinney Roughs, sandstone was a little bit, and there was only one quartz in that area that we found, but it was like a little circle area. We also… Just they really, really helped us understand how it meant to be outside, and how it meant to be there, and what it was about, and how the rock cycle works, and how, what rocks are made of."* —Rory

In looking at Rory's comments she recalls from this experience the majority of rock type found in that particular location being flint. She recognizes her learning as well as the learning of her friends. The guide also evoked an epiphany from her relating to the contextual relevance of the environment, when she is explained about being outside and what that means to her for grasping the concepts. She was very excited to talk about getting connected with the setting. His manner of description has pulled the students in and furthered their understanding of rock types.

DID THE GUIDE MAKE A DIFFERENCE IN THE LEARNING?

Both of these guides gave information and facts to the students. Erik's manner of presentation had fewer children drifting off mentally and physically to explore other interests. He held their attention, told stories, had them imagine, used demonstrations, and provided hands on learning opportunities. His attitude was casual, knowledgeable, and he seemed to be having fun as well. Nadia also had many facts to impart, but was slightly less relaxed and did not seem as comfortable around children. The children in her group had more of a tendency to go off topic in their personal discussions and to be less interested in listening to her and more interested in walking, talking to each other, and taking pictures. They were interested in the rocks and also asked questions relating to the environment, and when she stopped, to show them something they stopped and listened. Nadia had the tendency to keep talking either over the children or for too long.

During my interviews, I asked a question about how limestone sometimes had little fossils in it, the students who had Erik as their guide had very different answers than those who had Nadia. The following is an excerpt from a student who had been with Erik.

> *Interviewer: You know sometimes when you look at limestone you'll see fossils, shell fossils in it?*
>
> *Russell: Yeah.*
>
> *Interviewer: How can that be? How could there be shell fossils in that rock?*
>
> *Russell: I think that now that you mention it, I think I remember why. It could probably be like the ones from the ground were a lot of animal bodies clung together, and then over time once it comes out of the water or if it just stays in the water, over time, the fossils will – or the animals bodies will turn into fossils and engrave into the limestone, and then that'll probably be the reason.*

Russell is remembering what he had learned from Erik. During the "Easter egg hunt" for fossils Erik explained how it was that the fossils were found in the rock. This is in stark contrast to the students from Nadia's group who did not have a ready answer.

The students who had had Nadia as their guide had some of the following answers:

> Alice: *Limestone, it is like –it's like it really is like – it's like stone like – what's it called?*
>
> *Interviewer: That's okay. Just take a second and take a breath and tell me about what you remember about the limestone. Remember she handed it out and it was white?*
>
> Alice: *Uh-huh.*
>
> *I: And do you remember what else she said about it?*
>
> Alice: *Yeah, it's chalky and it is kind of like – it's like you can crush it kind of and it kind of can go into little grains[?] and stuff, and it's not always like big and stuff. It can be small and stuff.*
>
> *Interviewer: Okay. And do you remember what kind of rock limestone is?*
>
> Alice: *I think it's…*

I: Let me ask you this first. Sometimes when I look at a limestone in a building, I will see a shell fossil in the middle of that limestone.

Alice*: Yeah.*

Interviewer: How could that shell fossil get into the limestone?

Alice*: I think it's because of… (Trails off no answer for 20-30 seconds)*

Interviewer: Where do shells live?

Alice*: They live in the sea. And so, oh, yeah. I think it's because limestone, it's in the sea. It comes down to the bottom of the sea, and then the shells form in it, and they like…*

Alice is trying to formulate a way shells could be found in the limestone, but this was not prior knowledge and she was not given the same experience as the students in Erik's group. However, with a bit of prompting and guided questions she was able to come to a semblance of the correct answer. I think she felt a bit nervous during the interview and might have been able to fully answer the question at another time. Karen is in the same situation, struggling to answer the question:

Interviewer: So what I was wondering is, how do shell fossils get in limestone?

Karen: Maybe because they…um… Maybe because just like the sandstone, how it mixes together, maybe they, like, the shells from the ocean are there and then the limestone is there as well and it…I don't know.

While Karen had most of the pieces of the puzzle in front of her, she was unable to assemble them. She remembered about it being a sandstone and something to do with the water. But how it actually works was not forthcoming and she gave up.

While one guide was stronger in material presentation and relationship to the children, both groups had significant increase in their pre and post test scores. However, the students with Erik, the guide who appeared to be more at home outside, were better able to tell me in interviews why certain phenomena, such as fossils in limestone or burns being good for the environment, may happen.

Since they only had one or the other guide they were not able to compare the two but positive comments were made by students from both groups regarding their guide and the way that the information was presented. The presentation of the material by the guides was also noticed by the students. There was the presentation of the material that pulled the students toward their guide, they felt comfortable and were able to learn the material presented.

"How they really explained it, and how they used human beings to really act out the part, and where, and they actually really explained it a couple of times just to really let you get it, and sort of in a fun way."—Rory.

"Umm, well I loved talking to our guide"—Philip

"But the McKinney roughs - you got to - know – they talked slow and asked if we had questions."—Eliza

The guide and his or her manner of explaining the information to the students made an impact on all of the students interviewed. Rory has specific examples of what helped her and that she thought it was fun. The multiple iterations of the information in different ways helped them to "*let you get it*". The students felt comfortable enough to talk to their guide and ask questions and they had high levels of enjoyment. So while there may have been some differences in the final outcome of knowledge, both groups learned from their guides and were happy learning from their guide.

Setting

Student's Preference

When interviewing the children they expressed an overwhelming preference to be outside. All the students were expressing a preference to being out of school on a field trip, but of more interest was the desire, that if they were going to be out of school that: it would be outdoors; that they would be able to touch things; and that they would be able to "*go to interesting places.*"

Reasons for Preference

As seen in Appendix C, the coding shows evidence that of the students' preferences. Being in the outdoors was considered "more fun" than an indoor field trip. They were able to explore and examine the outdoors, which many of them did not have the opportunity to do on a regular basis, for a variety of reasons. The majority of the students live in the city and there is not the opportunity to explore nature on a regular basis. Other students have parents who work full time, and are unable to take the time to, or do not have the interest, to participate in family outdoor time. However, even students who spend a significant amount of time in the out of doors, (playing, hunting, fishing, etc.) showed a preference for being in the outdoors.

The students had many reasons for preferring the outdoors, from having the ability to explore, to being able to "move around" or get some "exercise hiking." There was the potential of seeing real animals and there was also more to observe as they were walking around. The outdoors was considered "fun" and they preferred being outside over inside for any fieldtrip. And being on an outdoor field trip was different from the other field trips they had taken during the school year and this novelty added to their interest and excitement.

As Flora says:

> *It was really fun, because we got to see all those different rocks, and then we found a lot of different rocks, like the volcanic rocks and the other*

rocks and sandstone and all that. And then we also got to see out there, like, all the different plants I also saw and stuff. It feels different than at home, because we don't have all that stuff and I don't usually get to see that. So it's more fun to do that.

Flora is telling us that not only is it fun to be outdoors, but she also was doing something different and interesting. She particularly notes the variety of rocks and plants seen on the field trip. This trip is different than being in her own yard and this difference has made the trip more fun for her. And when further questioned about her field trip preferences, she comments that while field trips to museums are "*good*" she much prefers the outdoor field trip:

> *"Because, I like nature and hiking, we got to touch a lot of things and learned about plants and rocks*."

The ability to touch and feel the rocks was important to Flora. This is seen in many of the conversations with the students. This freedom to touch objects and learn in this manner. In observation, many of the students touched the rocks for long periods and several students, both male and female, would smell the rocks and one boy even went so far as to lick the rock. Having this opportunity to touch, hold, smell and even taste, made the field trip one in which the students experienced realism and attention to detail, which made it fun and the students learned more. These students had taken a field trip earlier in the year to the Austin Lyric Opera and therefore had the opportunity to be able to compare both the indoor and outdoor field trips. Additionally one was in science (which many of the students claimed to "*not be very good at")* while the other was in arts and culture. I was somewhat surprised when some of the more artistic children claimed to have enjoyed the science field trip more than the art field trip.

Interviewer: So, if you had to choose between the two, which kind would you rather go on, like the opera kind or…?

Rory: McKinney Roughs.

Interviewer: What about, say, an art museum or McKinney Roughs?

Rory: Art museum or McKinney Roughs? I really think McKinney Roughs still.

Interviewer: Can you tell me why you'd rather do that?

Rory: Because really they both have the same thing, but McKinney Roughs have one more thing. You can have fun, you can run around, you can walk, and there's already pieces of art all around you – trees, plants, flowers, and everything that you see around you.
And art museums are just basically pieces of art that you can still see in different forms and in different materials, but you have – you usually don't have – at McKinney Roughs, you can be more loud, you can have more walking experience, and you can really have more fun.

Interviewer: And can you touch things in an art museum?

Rory: No, I would say not.

Rory is also stating her preference for the outdoors. It is the freedom attributed to being in the outdoors rather than a museum that is attractive. I believe her comparison of art in a museum to art being everywhere outdoors shows her acknowledgment of the beauty and wonder that is available outside. This comment showed me how a direct experience with the outdoors was aesthetically important. The walking outside the physical freedom to be experienced with being outdoors, experiencing nature, and being able to interact socially were all important factors for her.

Contribution of Outdoor Setting

While simply the act of being outside may not have contributed directly to their cognitive gains, it did create an environment where learning was more likely to occur in a natural manner. By being outside they were provided with opportunities for learning and exploration that they may not have had at school. While a portion of the field trip was lecture type, they also were able to touch all the different types of rocks. The rock was more than simply a rock, it was something to explore and examine closely. This behavior of their examination more closely mimics the manner in which children will behave on their own in the outdoors (Falk and Dierking, 1992).

Interviewer - Tell me what makes a field trip interesting

Marty - What I think makes a field trip boring- is if it's a field trip where you just go look at stuff- kind of boring just to look at stuff. Not walk around.

Sean - I like to have a field trip where I'm doing things and I don't like operas and I like walking around and going to interesting places.

Interviewer - what if you were going to go to an art museum- would you like to go to an art museum?

Marty - I would sort of like that because I like art.

S- I don't know -kind of- no.

Interviewer - What about if you had a choice between an art museum and an outdoor field trip.

Marty and Sean - Outdoor field trip!

Even though Marty is happy to take a field trip to an art museum where he is able to walk around, he still prefers to be on a field trip outside. Both the boys discuss their desire to walk around, to be "doing things" and "going to interesting places." It was interesting that rather than answer my question directly, Marty took the lead and answered what made the trip "boring" and Sean flipped it around to answer what he did prefer. Marty quote of "*what I think makes a field trip boring"* says that not all field trips are interesting. That some are "boring." However, a field trip with the freedom to move around and be doing things, is what makes a field trip more interesting to the students. Interest in the field trip and in the content of the field trip will lead to further learning (Falk and Dierking, 1992). Based on the pretests there was limited interest in the study of rocks. The students had little knowledge of the rocks, but attending the field trip where they not only had fun but were also able to learn about the rock types stimulated their interest in the subject matter.

When I was interviewing Frances about her preferences she also had her reasons for preferring to be out of school:

> *Interviewer - do you like to take all kinds of field trips?*
>
> Frances - *yes*
>
> *Interviewer - what makes them interesting to you?*
>
> Frances - *that you get to go somewhere else-and it is not like staying at your desk you get to and learning about it- you actually get to do stuff really into it too.*

Unlike Marty, Frances does enjoy all types of field trips. She likes the novelty and variety of leaving the classroom. That when you are on a field trip - *"you actually get to do stuff really into it too.*" The ability to touch and feel is important to her, and in her opinion, this is a more interesting way to learn information than simply staying at the desk and learning from the teacher. Getting off the campus and out into the field is important to Frances and to how she learns information, science or other subjects.

Karen had the same kind of answer for her desire to go on field trips away from the school and outside.

"Well, it's just kind of like interesting because there are different things that you haven't seen outside and you can just find interesting things. And in the classroom, like, it's fun, but you don't have new things in the classroom".

The variety and interest make a field trip fun and thus create more of an impact. There is new information to learn and different "things" than in the everyday classroom.

Classroom Teachers

The two classroom teachers had differing opinions on many aspects of outdoor guided field trips. The difference was interesting especially in consideration of the strengths of the teachers. One of the teachers, Mrs. H., is more science/math oriented while the other teacher, Mrs. C., is a language arts specialist. Mrs. H. has been a classroom teacher for 28 years. Mrs. C. has been a classroom teacher for 30 years. Both teachers answered an online interview with follow up.

Both teachers were in agreement that an outdoor guided field trip was not only useful but is also a positive contributor to the overall education of the student. An outdoor guided field trip has the potential to capitalize on the student's natural curiosity. That students could further their understanding of multiple disciplines, not simply science, but also in social aspects of cooperative learning and working with other adults. Mrs. H. also believes if the students work on note taking and write a reflection piece after the trip the class can work to develop conclusions when comparing the individual reflections and coming together as a group for some conclusions. In having this sort of after trip experience, the children are building cohesiveness; they are learning about each other, but also how to navigate through group discussions as well as working on writing skills.

Both Misses. C. and H. felt outdoor science field trips have the potential to help with the curriculum in science and possibly other subjects as well. They believe that if conducted properly, the learning that occurs on a field trip can be related to the classroom. Although the way that learning occurs is very different in the classroom as compared to the field trip. On the field trip there are hands on learning experiences, there are activities and experiences that are "real" and hold more interest and importance to the students. The preponderance of the children remembered the activities and the physical aspects of the field trip and that facilitated their understanding of the concepts learned.

The most important part of the field trip, to both teachers, was for the students to increase their subject matter knowledge, to develop new skills, and for the students to learn how to work together.

DIFFERENCES BETWEEN THE TEACHERS

The two teachers had differing opinions on the importance of the children having fun on the field trip. To Mrs. H. this was one of the reasons that the children learned on the field trip. She believes that it is important for students to have fun and be with their friends. Mrs. C. did not see that having fun was of great importance or that being with friends could stimulate interest. Mrs. H. also saw that attending a subject matter field trip can help the students care more about the subject while Mrs. C. saw that as depending on the individual student, if the student had an interest in the subject matter then an outdoors field trip could lead them towards more interest in the subject. Mrs. C. also does not feel that the knowledge that they are going to be tested on after the field trip affects their learning on the field trip. Mrs. H believes that it may, although, this is not as great a motivator as having fun on the field trip.

The last greatest difference between the teachers was the amount of time used on a field trip. Mrs. H was not as adamant that little classroom time be utilized, but Mrs. C. felt the field trip should not interfere with other classes if possible. And to reach this end, she felt that field trips should be taken to locations near the school thus reducing the amount of total time out of the classroom.

DIFFERENCES BETWEEN TEACHERS AND STUDENTS

While both teachers felt it was important for the students to have some time learning out of the classroom, they did not think that "getting out of the classroom" was important to the students. The students thought being out of the classroom was one of the most important parts of the field trip. Being out of the classroom opens up the options of learning to the students. They have new things to see and touch, new people to meet and the students interviewed felt this was the best part of any field trip.

Mrs. C did not see having fun as an important part of a field trip. The children, however, did see having fun as being important. The field trip they had taken earlier in the year to the Opera, many of the students saw as "boring," "not interesting," and not only did they not have fun they were frustrated and even angry about having gone on this field trip. For the students, the realism of being outdoors allowed them the opportunity to have fun which helped maintain their interest in the subject matter.

TEACHERS AND THE ROLE OF THE GUIDE

Neither of the teachers felt that the type of guide was important. They both believed that the students do better and pay better attention to a guide they are familiar with than one they are not familiar with. But the education of the guide is important to the teachers and they firmly believe the guide should know how to speak to and manage groups of children. When asked, the teachers did not think that the students remembered the guide or the way that the guide presented. However, the students did not only remember their guide, they also remembered the way the guide presented, specific comments the guides had made.

I have seen on this research project that the students do listen to the guide, regardless of whether they have had previous experience with the person or not, and the presentation style of the guide does captures their attention. Additionally, the majority of these students have expressed a preference to be out of school on a field trip, but of more interest is the desire that if they are going to be out of school that: they are in the outdoors; that they are able to touch things; that they are able to "*go to interesting places*".

Negative Cases

While the majoritiy of students learned on the field trip there were four girls who opted not to fully participate in the educational experience. These students had a variety of reasons for not taking advantage of the learning opportunity, which ranged from the long bus ride to the heat. Additionally, these students preferred to take a field trip to an art museum rather than to an outside location. This was evident in their pre and post test results and the lack of change between them.

When watching the video I noted that the students who did not enjoy or learn on the trip were those who lagged behind, were off to the side talking, singing, and exhibiting other behavior not relevant to the trip. Questions consisted of "*Are we almost back?*" "*When is lunch?*" and "*What is for lunch*?" Student conversations revolved around pop culture and were not science or trip related.

During the interviews these students did not answer with complete sentences, for many of the questions, or they responded with "*I don't know,*" *"I don't really like science,"* and *"I'm not really good with science."*

When describing sedimentary rock and how it forms Elaine said, *"Sedimentox are kinda well the reason I put that down you see in the picture - it looks like its able to…"* and she circled the correct answer on the post-test but was unable to give any sort of explanation and did not know how to pronounce the type of rock correctly.

Her friend, Julia, when asked about volcanic rock, had the following answer, "*Lava is kind of like fire and spurts out of volcanoes that everyone knows - and I'm not* *really a volcano person*." I was unable to coax more answers out of her on this subject. Finishing with the comment, "I'm not really a volcano person" reflected her disconnected personae on this subject matter during the field trip.

The interviews with these girls were very difficult and short. All three girls were not interested in talking about the field trip. They did not enjoy the trip and accordingly they did not learn from the trip. They were not interested in paying attention to the guide, to participating in any meaningful manner, and thus they did not actually benefit from this field trip. I did not find any boys who did not enjoy the field trip, and the majority of the girls enjoyed the field trip as well.

Additionally, there were some students who did enjoy the field trip but still did not perform well on the post test and were unable to give complete explanations for their answers on the exam. Moreover, I found that these students all had the same guide on the hike. However, I do not claim that there is a guide effect here, simply that these students had the guide who was less easy to hear.

DISCUSSION OF NEGATIVE CASES

There were many reasons why these students may not have understood the rock cycle concepts, even though other students with the same guide learned them well. After reviewing the digital video discs that were recorded during the field trip, I found that although these students did participate in the field trip, they were not situated up front close to the guide. The guide for these students had the tendency to walk and talk at the same time, making hearing her difficult. They did not fully understand the material even though they had fully participated on the field trip. After reexamination of the video footage and interviews with the students I believe that these students would have comprehended more of the material had they been better able to utilize the expertise of the guide.

As with any learning situation some children will thrive in an environment that inhibits others. I found that while the majority of these third grade students did significantly increase their learning, there were some who simply did not. I was unable to determine if the three students who had no interest in the field trip, would succeed better in an indoor facility (i.e., a science museum), or if it was the subject matter alone that hindered their learning efforts. My interviews with these students were very one sided (reactions to my asking questions) and although I attempted two interviews with each of them, I was unable to establish rapport.

CONCLUSION

Field trips provide the opportunity to connect abstract classroom learning to real-world experiences. This importance cannot be underestimated. When students are able to make real-world connections to classroom learning, the learning takes on significance. This in turn will direct the students' attention and engagement. When the students are engaged, meaningful learning can start to take place.

While there are classroom activities that make real-world connections such as guest speakers, multi-media technology, and journaling these do not have the same staying power as a field trip. Field trips are particularly important for two reasons. First is the social angle, the shared experience of a field trip allows for student discourse to reflect with each other on this common experience and enhance learning beyond the personal connections each student was able to make. This field trip allowed for the students to talk with each other on the hikes. They formed into groups and in these groups had discussions about the rocks they were finding. They also had discussions about the natural area itself. It was within these discussions that new ideas arose and the students would often run to seek clarification. However not all the discussions were supplemented with information from the guide.

Second is the connection of cognitive and physical, the students' attention during an outdoor field trip is drawn to the sounds, smells textures and possibly tastes of the real world. This provides more powerful connections which are absorbed into the memory more significantly than the spoken or written word (Dewey, 1916).

It is the concrete, real world experiences that are critical in facilitating the building of connections, understanding, vocabulary and stimulating interest in the students. An outdoor guided field trip provides this experience.

In this study I found that there was an overall increase in cognition based on the interviews with the students as well as the results of the pre and post tests. This outcome rests chiefly from the success of the field trip as there was little if any classroom work done on the subject prior to the field trip and as there was no class work between the field trip and the post test, this was also the case. This was evident when looking at the post test scores not only when examined in relation to the pretest scores but also when compared to national scores (Appendix D).

The class who had Erik as their guide preformed slightly better than the class with Nahdia. The change in Nahdia's group was considered statistically significant (Table 2), while the change in Erik's group was considered extremely statistically significant (Table 3).

Table 2. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs C's Class

Group	**Pretest**	**Posttest**
Mean	5.32	6.68
SD	1.63	2.33
SEM	0.38	0.54
N	19	19

The two-tailed P value equals 0.0201

Table 3. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs H's Class

Group	Pretest	Posttest
Mean	4.50	6.25
SD	1.50	2.15
SEM	0.34	0.48
N	20	20

The two-tailed P value is less than 0.0001

So while the class with Erik understood the bigger picture with more clarity, both classes had significant changes in their understanding of the subject.

Students in both classes had significant changes in their pre to post test scores on average (Appendix F). As the teacher was unable to work with the students between the pretest and the field trip or the field trip and the post test, these increases can be attributed to the experiences gained on the field trip.

Post field trip student percentages are higher than those on the national level. The questions for this exam were pulled from 4th and 8th grade NAEP exams (Tables 3-6). The students in this study were in the 3rd grade. Prior to the field trip, the students in the study scored either below or close to the same percentages as the national percentages. However, post field trip these scores increased dramatically and in some cases to a much higher level of percentage correct than the national scores. Based on the change in test scores and the interviews I believe what led to the success of the field trip was the setting and the unique outdoor elements that integrated into the setting.

. Student voice

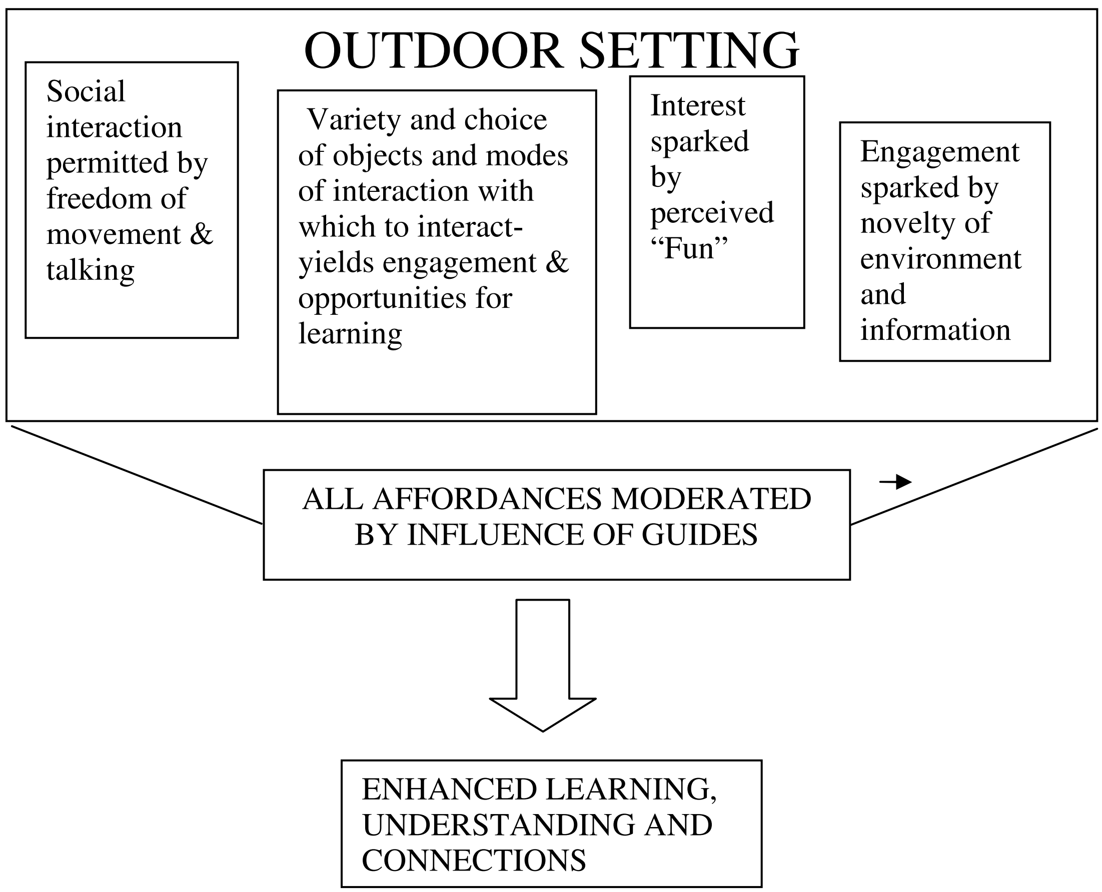
The cases explored validate Bamberger and Tal's theory of the "student voice." The student is often overlooked when taking school field trips. The voice of the student is important because it is often ignored. listening to the student voice brings to light the opinions of the students and their feelings of how the field trip contributed to their learning.

This look at the student voice is appropriate, as the teachers interviewed did not feel that getting out of the classroom was important or that being in the outdoors was an important part of the learning process for the students. While the data gleaned from the interviews shows that being outdoors and the independences provided by the setting as well as the social element were essential, in the words of the students.   When listening to the student voice there are many properties that are coming to the surface.

An important condition found in many of the interviews is that of the ability to move around; the freedom to move and explore. When the students have this option they are utilizing it and moving around touching outdoor elements such as rocks and tree bark. They are not merely listening to the guide, but rather they are directly experiencing the objects around them. The consequence or outcome of this is the increased interest in the lesson, and with the increased interest, comes the potential to listen and learn.

Model of Mechanisms that may Influence Understanding

I have developed a model of the interplay between the concepts I found to be most important. Setting, the outdoor location, is the main idea and most important element attributable to the reason for why students learned on this field trip. However, merely being at an outdoor location will not cause learning to occur spontaneously. Therefore it is the interplay of the outdoor element concepts that take place in the setting that act as the mechanisms by which students learned to follow their curiosity for increasing their cognition of the subject matter. Each of these concepts was covered in detail in the findings section (see Appendix B).



Discussion of Setting and Relation to other Components of Mechanisms

It is the setting of the field trip that provides the venue for the other concepts to elicit a response from the students in such a manner that cognition about the subject matter takes place. In an art museum or even in a science museum many of these concepts would not be as fluid.

Setting

The setting, being in the outdoors, was significant in this study. A portion of the field trip (approximately twenty minutes) was conducted inside a building where the guide showed the students different rock types. Overwhelmingly the students agreed this was the least interesting, or fun, part of the field trip.

Rather the students expressed the preference to be outdoors. They would prefer to be in an" interesting place" and it was this place that would stimulate their interest and in turn their learning. Being outdoors was seen as "more fun" than the indoor field trip. Being outdoors had more opportunity for them to examine new information and to witness the variety of plants and animals in their situation. They were presented with the setting in which to stimulate their learning. There were multiple opportunities for learning and exploration that were not available at school or on the previous field trip.

On the outside portion of the field trip (the majority of the time) the students had the freedom to walk, talk, ask questions, observe, listen, and see new things, etcetera. The variety of what they are seeing and are able to do stimulate their interest. It is a new location, different than a classroom in many ways. There is freedom, interest, fun and the guide that all are important components of the setting. It is the integration of the listed components of the field trip that work within the natural setting to provide the mechanisms and visual stimuli by which student understanding of the rock cycle was increased.

FREEDOM

Indoor field trips do not provide students with the same degree of freedom as an indoor field trip. In the out of doors the students voiced their preference to be able to touch the objects. This hands-on style was not suggested to them but rather they took it upon themselves to do it as a way to learn, that was superior to simply listening. They had the freedom to talk and were not bounded by the same type of restraints as they found in the classroom or on previous indoor field trips. The conversations between the students and between the students and their guides were often in depth and subject related. While there were many "what if" type questions ("what if we took one of these lava rocks" for example), or off task questions ("I am looking at your buckle and were you like an Eagle scout?" or " How do you become a beekeeper?") there were as many, if not more, complex questions regarding rock formation and ecology (" How come there is so much flint rock up here but down there there is quartz" or " you said this sand was from the Rocky Mountains and that there are pine trees that grow here- why is it better for the pine trees? And where are the pine trees?" or "If that was a coral reef, were there things like squid there? Would you not know if there were because squid don't usually make fossils?".) This opportunity to express their individual questions and interests was evidently, based on the data, important to the students. This allowed them to gain a modicum of control over their learning. And to be able to ask questions without fear of repercussions from a teacher.

The students expressed their preference to be able to ask questions as they arose and to share insights with their friends. Also to have the opportunity to touch without restrictions was noted multiple times.

In addition to the academic freedom there was more physical freedom as well. The students were able to walk around and talk to each other. They could explore a bit off the path and at times were able to set their own pace. But even when this was not possible they were able to talk to their friends and choose their groups if they chose to be in groups. This freedom to choose their groups is an aspect to be further examined. Would the trip have been as successful were they put in assigned groups similar to the classroom? The groups they chose were majorly with their friends. For example, most groups consisted of girls only or boys only, while, they were able to make mixed gender groups they chose same sex groups.

Table 8. Approximate group sizes

Group size	Nahdia	Erik
2	9	15
3	8	11
4	3	2
>4	8	7

Table 9. Approximate group genders (Erik)

group size	2	3	4
M	8	2	0
F	7	9	1
Mixed	0	0	1

Table 10. Approximate group genders (Nahdia)

group size	2	3	4
M	5	2	0
F	6	5	2
Mixed	0	1	1

These are approximations based on the field notes as well as the video of the group dynamics. As stated these groups were very fluid and students would move from a group to being alone or insert themselves into a new group. Additionally a group might move from being a group of two to becoming a group of three then back to a group of two different from the initial group of two.

One aspect of these groups was that the students when in groups, did talk to each other. They picked up rocks and discussed the rocks or the area around them. I only examined the groups when the students were on the walk, since when the guide had them gathered around to discuss a formation or to give information the students were not acting as individual groups but rather as one large group interacting with the guide.

INTEREST

According to Csikszentmihalyi (1990) interest in conjunction with enjoyment provides an opportunity for learning. These students expressed that the field trip was "interesting". Their interest was piqued by the location as well as by the way the information was presented from the guide. However, they particularly enjoyed the ability to touch and examine up close the subject matter (different rock types). It is this interest that makes the learning meaningful as well as long-lasting (Csikszentmihalyi, 1990). When the students are interested they are more likely then to seek out new knowledge about the subject or related subjects (Dewey, 1975).

Personal interest also has a profound effect on learning. If a child is interested in what they are doing they will have greater attention, persistence, and curiosity (Dierking, 2002). Having an interest in learning increases intrinsic motivation and when learning occurs due to intrinsic reasons it is profoundly effective (Falk and Dierking, 2002; Ramey-Gassert, 1987). In this outdoor program many of the students were intrinsically motivated to learn and from this gain personal significance. The reasons for wanting to learn ranged from simply being interested in the rocks to wanting to know more than their family members. These reasons carried importance to the students and increased their interest in learning.

These students spoke many times of the field trip being interesting and "not boring". Many of the students verbalize that it is the interest that helped them learn. These students are showing that they recognize that they are learning and at times are able to express how they are learning. Being in the outdoors is interesting and possibly more interesting than being in an art or other type of museum. This is seen multiple times in the data from the interviews with the students.

The novelty of the situation was also important to the students. The novelty of the new location as well as the new information amassed to create an interesting trip for the students. The fact that there were more objects to examine and a new person presenting the material all worked to stimulate their interest. It was this novelty that allowed them to find more interest in the subject matter. They enjoyed being away from school but their reasoning was more complex than that. The new information was relevant to the students in some manner. For some it was learning where the rocks they see everyday came from while for others learning that a GPS unit is not simply something to be found in the car. The students acknowledged this as a reason for enjoying the trip and learning.

It was not just the new information that the students spoke of. They also spoke of being in a new place and the excitement that that brought to it. None of the students interviewed had concerns of being at a new place without a parent. Additionally several of them noted that it was being in a new place that was not the classroom or just outside the classroom that made it more interesting and pushed the information forward. They were not only learning new information but they were able to experience the new information in its situation. Many of the students were excited about the new information, but additionally they enjoyed the novelty of the location and seeing the subject matter as a concrete subject rather than as an abstract concept.

In learning the material the students spoke of more interest in the subject and were excited to be able to talk about the information to their peers and the knowledge that when they went home they were going to know something that other members of their family would not.

Since the students were in a new location and they were able to see what they were discussing in situ they had more interest and in turn learned more information. There were more examples to see than in the classroom, there were different rocks than they had at home. They enjoyed learning in the outdoors and going beyond the classroom and putting the information into its specific situations.

The other novelty that was noted by students was meeting the guide and working with the new person. That this person was not their teacher, seemed, in their opinion to lead more credence to them. As the guide they were seen as an expert and therefore knew more than the teachers or parents.

FUN

"Fun" is another term that was used by the students and put in as an in vivo term. While fun itself is not necessarily linked to learning it was nonetheless important to the students. The perception and reinforcement of the field trip as being "fun," was seen over and over again. To the students, having fun while learning stimulated their interest in the subject matter of the field trip, and in turn, they paid attention and retained the information. According to the students they felt they learned more on this field trip than they had on the previous field trip. Additionally, they stated that this field trip was "not boring" and was "fun" and was more interesting.

It was "fun" to walk with their friends and "fun" to be able to "just walk and talk and look at the rocks". There were many aspects of the field trip that the students felt was much more "fun" than the indoor field trip. And it was not simply this perception of "fun" that was relevant. It was through the social interactions the students were having that they were able to stimulate their interest and thus further their understanding of the rock cycle.

The students had "fun" talking with each other and having the opportunity to work together. This ability to socialize was important to the students. They shared interesting observations with each other. They assisted each other on the hikes and practiced working with each other and were able to spend the time with their friends rather than assigned partners.

Simply going outside and having fun does not destine one to learning. There are other properties that are necessary to facilitate learning. These include: being interested in the material; having the freedom to move about, to walk, to wander a bit, to touch and smell the artifacts; the sharing of information with a friend; and the opportunity to explore. While they may have learned the information without the "fun" and the freedoms the overall experience would likely not have been so positive. One of the most important essential components of this field trip was the guide.

GUIDE

The use of the guide is not trivial. Without the guide the students would have simply had a nice hike in the woods, which is beneficial, but in an affective sense rather than any cognitive movement. The presence and knowledge of the guide positively affected the outcome of this field trip. In my findings I found that while one guide, Erik, was a bit more effective with general ecology, the students in both groups had significant change and learning. Therefore, while the students in Erik's group may have learned more science, both groups had definite improvements in their understanding and knowledge of the rock cycle. Additionally, the questions asked were from fourth or eighth grade exams, while these students were in the third grade. This is important when considering potential uses of the outdoor guided field trip.

This guide should be able to speak to students at the students' level and adjust accordingly. There will be some students who either can not hear or understand the guide and the guide needs to be attuned to these differences. The guide should make sure to speak to the children rather than speak while walking as this is speaking to the air in front rather than to the children. There will be students who are simply not interested in science or may be nervous of the outdoors the guide must also attempt to draw the students in. this may be through the use of more "games" or by breaking the students into small groups to discuss an idea for a few minutes. The training of the guide is important, simply having high content knowledge does not make one a guide suitable for younger students.

Any person with content knowledge does not necessarily make a good guide. Both of the guides were good guides. One of the guides had higher content knowledge and an ability to relate to the students through stories and examples. However, students in both groups learned from their guide. The students felt comfortable with their respective guide and it was because of this that they learned and enjoyed the trip. The same guide may not have done as well in a school setting or in a museum setting. As this study examined an outdoor setting the guides in this setting became a part of the setting.

Cognitive Gains and the Outdoor Setting

While simply the act of being outside may not have contributed directly to their cognitive gains, it did create an environment where learning was more likely to occur in a natural manner (Dewey, 1975). By being outside they were provided with opportunities for learning and exploration that they may not have had at school; more educational and entertaining.

Learning in the outdoors is a less individual learning experience and more a collective or small group experience. The students discussed between themselves as well as with the guide and attending parents: different rock types, how one type of rock may have come to be in the area, what they found in their own yards as well as pointing out other ecological features that were not related to the rock types.

How learning in the outdoors is not a question with a simple answer. There are several ways in which the students learn: through social behaviors, through listening to the guide (if there is one), through examination and questioning, are some examples. The research is rather sparse in the area of how students learn in the outdoors.

Conceptual Model of a Successful Outdoor Field Trip

The mechanisms necessary by which an outdoor guided field trip might influence the understanding of scientific concepts work in a semi-circular mode. Multiple concepts work in tandem with each other to create the environment necessary for learning to occur (see Appendix B)

On an outdoor field trip the students have more autonomy and it is because of this that they may learn. However, this does not mean the students have complete independence. For a successful field trip a knowledgeable well trained guide is necessary. This guide is integrated into the setting. The guide should work to become a part of the social portion of the field trip. A field trip is different than the classroom in that there is more movement the students are able to talk and to walk and move and gesture, actions that are usually limited in a classroom. An outdoor field trip allows for even more activity. This activity increases interactions between the students and their teachers, the students and each other and the students and the guide. The students are able to ask questions of the guide which is imperative. This sense of comfort and control assists the students in their desire to learn.

The students are learning on the field trip. They are aware of this learning and are excited to be able to impart this new knowledge to their family, friends, and anyone else who will listen to them. This learning of the new information inspires them. It is this inspiration and new found curiosity that must be cultivated. The science teacher must work to keep this interest and relate the field trip to the classroom work. The students build connections between the field trip and the classroom and "real life". These connections and new understanding will make learning "fun" and in turn bring happiness into their learning.

The new location with different manipulatives and meeting new people stimulates their interest. It is this novelty that is dissonant with the current research. This dissonance is where the interest lies. The students in this study enjoyed the novelty and expressed that it increased their interest in learning the information. How this fits into the model creates a complication. However, as this model is based on the observations from this study, I maintain the importance of keeping it in the model.

The guide additionally stimulates the students' interest. This is through talking with them, exploring, questioning and reasoning with the students. The students articulated to me that they found the guide to be "very interesting" and "knows a lot". It was the expertise of the guide that helped to engage the students. So the guide is important from the social approach as someone they are able to talk to and listen to, but additionally from the interest as not only a new person, but also as a person who has interesting information to impart. The guide has the ability to boost the learning and interest in science.

While some students will be more difficult to engage, this is not unexpected. The guide and teachers can work to engage the students. A guide who is aware of the needs of the students may attempt to draw these students in. However, they may not be successful in all situations.

An outdoor guided field trip is more than the sum of its parts. There are multiple aspects that alone are important but it is the meshing of these parcels that will lead to a field trip in which the students come away with more information than they had previously. Information that is more than facts but is also an understanding of how or why, critical thinking skills should be utilized and thus increased. This model addresses the need for specific components but it is how these components fit together and work together that will lead to a successful in learning field trip.

This model addresses the need for certain specific requirements to be in place for a successful outdoor field trip. When students are interested in the subject matter, having an enjoyable time with the freedom to socialize all the while acquiring information from their guide, they will learn.

Importance in Understanding Science

Teachers and principals must recognize the importance of an outdoor guided field trip not only for providing many teachable moments, but also as a tool for furthering their understanding of science. The students increased their understanding of science in part because of the setting and what the suggested components to this field trip. The guide is seen as part of the setting and because the guides knew how to adjust and how to read the students they were able get the students to respond in a way that generated learning. This increase was seen not only in lower level knowledge, but also in more complex level thinking and understanding. These students were able to put together the “big picture” of the science concepts. On the post test the students were more inclined to write about connections between geology and the environment and how a change in geology could affect a change in the environment. This was not specifically covered in the field trip nor was it covered in class. However, five students were able to make these connections and during the interviews were able to expound on their ideas.

This field trip focused on geology, however, the principle may apply to other disciplines of science as well. An outdoor field trip could be taken with a focus on biology, ecology, aquatics, and wildlife management just to name a few. Additionally, the benefits of this type of learning do not need to be limited to science. An outdoor guided field trip could be conducted for an art class or a local history class. Coordination between teachers could result in a multi-curricular field trip for science and history.

Limitations

There were many limitations in this study. The mere homogeneity of the sample is a limiting factor. The students for this study all attended a private school and while fifteen to twenty percent of them had some type of learning disability this alone does not necessarily equate to diversity. However, in spite of the different learning styles, many of these children learned equally as much if not more than traditional students.

Additionally, most of the students came from families that were fairly well off monetarily, with almost thirty percent being scholarship students. All of these students had at least one parent who graduated from college. Of the forty students in the class, thirty five were Caucasian with three of the other four being African-American, and the other two of another race.

I found that the students in this study enjoyed the novelty of the field trip. Previous studies show that students have less anxiety and nervousness about field trips if they are prepared for the field trip (Falk and Ballling, 1982). These students were not prepared for the trip in any meaningful way. Additionally, the students interviewed expressed their excitement about "meeting new people" and "seeing new things" rather than hesitation. The attitude upon arrival was also one of excitement and exploration.

This study was performed at one location on two field trips. Had there been more study options, attending two field trips at different locations would have been more optimal. However, since there were two classes I was able to compare the differences between the two classes in terms of their guides. These limitations, however, do not invalidate the importance of this study, as addressed in the theory development section.

Practical Application

I believe that the usefulness of this study comes in to play when teachers consider outdoor venues for planning field trips. When students are allowed the freedom to question their guides, to participate in a meaningful way during their field trip, and when the guides are attentive to the students and their needs, cognitive gains can be achieved. I purposefully chose to use third grade students and to give them a pre and post test utilizing fourth and eighth grade standardized test questions. If these students could successfully answer more questions post field trip what would this mean to the use of an outdoor field trip as part of the curriculum for fourth, fifth, and eighth graders.

I believe that based on what I found on this field trip, a field trip designed within these parameters has the potential to increase understanding of science and this will, in turn, increase TAKS scores. The students in this study learned science facts which they were able to parlay them successfully into correct answers on the test. And of more importance, during the interviews, the students showed me that they had grasped the bigger picture of the interconnections of the different rocks types within the rock cycle and how geology affects the plant and animal life in an area.

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Theory development

The relational aspects of the concepts model that was developed are all important in how the students learn when on an outdoor guided field trip. Since I did not look at a field trip where the students do not know each other it is difficult to determine how relevant the social aspect really is; sharing information with their friends. However, in this case, since the students did not know what to expect, the presence of their friends was a calming factor and one that allowed them to compensate and relax. And this is the reasoning behind my leaving this concept in the findings. More research would need to be completed for verifying the accuracy of this assumption and could be determined in another study.

Since this study is conducted under the umbrella of grounded theory, what is found in one context may not prevail or be accurate in another. Grounded theory, by its very nature is responsive to each individual context (Lincoln and Guba, 1985). Therefore I am confident in putting forth a theory in this situation of the mechanisms by which an outdoor guided field trip influenced this third grade class's understanding of the rock cycle and ecology.

The concepts in this model led into the theory of students learning facts and increasing their knowledge when they are on an outdoor guided field trip. My theory is that the mechanisms that influence students' understanding of these concepts is their preference to be outdoors, for a multitude of reasons, and in conjunction with the manner with which the guide presents the material, this will stimulate their interest in the setting and lead to their further understanding of science and science concepts.

Future research

I would suggest that future research examine students at different schools. There is anecdotal evidence that outdoor guided field trips will increase knowledge and understanding of science. However, this has not, to my knowledge, been studied closely. Students from lower income schools often miss out on experiencing the big picture of science due to the necessity of passing the TAKS, or other assessment tests. It is my belief that if these students had the opportunity to participate in a relevant outdoor science field trip and the freedom to interact with each other and their guides, they would improve their scores in science. This need to further the understanding of Earth science is necessary as evidenced by the 2008 U.S. ten Brink study highlighting the struggle of Texas students in the earth sciences.

Teachers are another avenue for research. While there are studies highlighting the importance of field trips, teachers may or may not concur with this type of learning approach. As I found in my interviews with the classroom teachers the two teachers held different opinions, not only from each other, but of more interest, different opinions than what was seen by the researcher on the field trip and what the students were saying.

Finally, an in-depth look at the students who do not learn on these types of field trips could provide great insight. These students are the ones that may be of more interest in their differences from the majority of the students. What is it that makes the field trip unattractive to them and is it all field trips or merely those in this particular setting or subject matter? If these questions are delved into in more detail there is the potential to utilize this new information for improving field trip planning efforts by teachers.

No Child Left Inside

There are in this country an alarming number of children who do not understand the natural world or are actually frightened by it. Our country has a long standing tradition of understanding the natural world in the past. However, with the advent of video games, television, shopping malls, increased travel in cars, organized sports and community layout many children are not encountering the natural world in a way their parents or grandparents did.

It is this change of lifestyle and society that has led people in many fields to explore the long term effects of minimal exposure to the natural world. How will this play out in the future of environmental science or policy? While a single field trip to the out of doors may open students' minds to the understanding of science it is but a blip on the road to understanding science. However, if teachers, principals and policy makers see the change that can be made in a student's understanding of science through participation in an out door guided field trip, this type of field trip can be encompassed into the curriculum.

The No Child Left Inside Act (NCLI) focuses on ensuring that students are learning and are aware of environmental education. The research done in this study has worked to further the evidence that a student's understanding and enjoyment of learning can be advanced through the use of an outdoor guided field trip.

APPENDICES

APPENDIX A

IRB and School Review

FWA # 00002030

Date: 03/05/09
PI(s): **Nourah A. Caskey** Department & Mail Code:
Title: **The Outdoor Field trip and its Effect on Student Learning**
IRB APPROVAL – IRB Protocol #**2008-08-0067**
Dear: **Nourah A. Caskey**
In accordance with Federal Regulations for review of research protocols, the Institutional Review Board has reviewed the above referenced protocol and found that it met approval under an Expedited category for the following period of time: - **03/05/2009 -03/04/2010** . (*expires 12am [midnight] of this date.)*
Expedited category of approval:
(1) Clinical studies of drugs and medical devices only when condition (a) or (b) is met. (a) Research on
drugs for which an investigational new drug application (21 CFR Part 312) is not required. (Note: Research
on marketed drugs that significantly increases the risks or decreases the acceptability of the risks associated with the use of the product is not eligible for expedited review). (b) Research on medical devices
for which (i) an investigational device exemption application (21 CFR Part 812) is not required; or (ii) the
medical device is cleared/approved for marketing and the medical device is being used in accordance with
its cleared/approved labeling.
(2) Collection of blood samples by finger stick, heel stick, ear stick, or venipuncture as follows: (a) from
healthy, non-pregnant adults who weigh at least 110 pounds. For these subjects, the amounts drawn may
not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per
week; or (b) from other adults and children2, considering the age, weight, and health of the subjects, the
collection procedure, the amount of blood to be collected, and the frequency with which it will be collected.
For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week
period and collection may not occur more frequently than 2 times per week.
3) Prospective collection of biological specimens for research purposes by Non-invasive means.
Examples:
(a) hair and nail clippings in a non-disfiguring manner;
(b) deciduous teeth at time of exfoliation or if routine patient care indicates a need for extraction;
(c) permanent teeth if routine patient care indicates a need for extraction;
(d) excreta and external secretions (including sweat);
(e) uncannulated saliva collected either in an un-stimulated fashion or stimulated by chewing gumbase

or wax or by applying a dilute citric solution to the tongue;
(f) placenta removed at delivery;
(g) amniotic fluid obtained at the time of rupture of the membrane prior to or during labor;
OFFICE OF RESEARCH SUPPORT
THE UNIVERSITY OF TEXAS AT AUSTIN
P.O. Box 7426, Austin, Texas 78713 (512) 471-8871 -FAX (512 471-8873)
North Office Building A, Suite 5.200 (Mail code A3200)
(h) supra- and subgingival dental plaque and calculus, provided the collection procedure is not more
invasive than routine prophylactic scaling of the teeth and the Process is accomplished in accordance with accepted prophylactic techniques;
(i) mucosal and skin cells collected by buccal scraping or swab, skin swab, or mouth washings;
(j) sputum collected after saline mist nebulization.
(4) Collection of data through noninvasive procedures (not involving general anesthesia or sedation)
routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where
medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate
the safety and effectiveness of the medical device are not generally eligible for expedited review, including
studies of cleared medical devices for new indications). Examples:
(a) physical sensors that are applied either to the surface of the body or at a distance and do not involve input of significant amounts of energy into the subject or an invasion of the subject's privacy;
(b) weighing or testing sensory acuity;
(c) magnetic resonance imaging;
(d) electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, electroretinography, ultrasound, diagnostic infrared imaging, doppler blood flow, and echocardiography;
(e) moderate exercise, muscular strength testing, body composition assessment, and flexibility testing
where appropriate given the age, weight, and health of the individual.
(5) Research involving materials (data, documents, records, or specimens) that have been collected, or
will be collected solely for non-research purposes (such as medical treatment or diagnosis). (NOTE: Some
research in this category may be exempt from the HHS regulations for the protection of human subjects. 45
CFR 46.101(b)(4). This listing refers only to research that is not exempt).
X(6) Collection of data from voice, video, digital, or image recordings made for research purposes.
X(7) Research on individual or group characteristics or behavior (including, but not limited to, research on
perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social
behavior) or research employing survey, interview, oral history, focus group, program evaluation, human
factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be
exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3).
This listing refers only to research that is not exempt).
Please use the attached approved informed consent
You have been granted Waiver of Documentation of Consent
According to 45 CFR 46.117, an IRB may waive the requirement for the investigator to obtain a
signed consent form for some or all subjects if it finds either:

The research presents no more than minimal risk
AND
The research involves procedures that do not require written consent when performed outside of a research setting
<**OR>**
The principal risks are those associated with a breach of confidentiality concerning the subject's participation in the research
AND
The consent document is the only record linking the subject with the research
AND
This study is not FDA regulated (45 CFR 46.117)
AND
Each participant will be asked whether the participant wishes documentation linking the participant with the research, and the participants wishes will govern.
You have been granted Waiver of Informed Consent
According to 45 CFR 46.116(d), an IRB may waive or alter some or all of the requirements for Informed consent if:
The research presents no more than minimal risk to subjects;
The waiver will not adversely affect the rights and welfare of subjects;
The research could not practicably be carried out without the waiver; and
Whenever appropriate, the subjects will be provided with additional pertinent information they have participated in the study.
This study is not FDA regulated (45 CFR 46.117)
RESPONSIBILITIES OF PRINCIPAL INVESTIGATOR FOR ONGOING PROTOCOLS:
(1) Report **immediately** to the IRB any unanticipated problems.
(2) Proposed changes in approved research during the period for which IRB approval cannot be initiated without IRB review and approval, except when necessary to eliminate apparent immediate hazards to the participant. Changes in approved research initiated without IRB review and approval initiated to eliminate apparent immediate hazards to the participant must be promptly reported to the IRB, and reviewed under the unanticipated problems policy to determine whether the change was consistent with ensuring the participants continued welfare.
(3) Report any significant findings that become known in the course of the research that might affect the willingness of subjects to continue to take part.
(4) Insure that only persons formally approved by the IRB enroll subjects.
(5) Use **only** a currently approved consent form (remember approval periods are for 12 months or less).
(6) **Protect the confidentiality of all persons and personally identifiable data, and train your staff and collaborators on policies and procedures for ensuring the privacy and confidentiality of participants and information.**
(7) Submit for review and approval by the IRB all modifications to the protocol or consent form(s) prior to the implementation of the change.
(8) Submit a **Continuing Review Report** for continuing review by the IRB. Federal regulations require **IRB review of on-going projects no less than once a year** (a Continuing Review Report form and a reminder

letter will be sent to you 2 months before your expiration date). Please note however, that if you do not
receive a reminder from this office about your upcoming continuing review, it is the primary responsibility of
the PI not to exceed the expiration date in collection of any information. Finally, it is the responsibility of the
PI to submit the Continuing Review Report before the expiration period.
(9) Notify the IRB when the study has been completed and complete the Final Report Form.
(10) Please help us help you by including the above protocol number on all future correspondence relating
to this protocol.
Sincerely,

Jody L. Jensen, Ph.D.
Professor
Chair, Institutional Review Board
Protocol Number: 2008-08-0067 **Approval Dates: - 03/05/2009-03/04/2010**

TRINITY
Episcopal School

December 15, 2008

Dr. Jody Jensen, Ph. D.
Chair, Institutional Review Board
P.O. Box 7426
Austin, Tx 78713
irbchair@austin.utexas.edu

Dear Dr. Jensen:

The purpose of this letter is to grant Nourah Caskey, a graduate student at the University of Texas at Austin, permission to conduct research with the students at Trinity Episcopal School.

The project, "How Learning and Understanding of Science is Negotiated by Elementary Students Participating in an Out of Doors, Guided Field Trip," entails Nourah working in conjunction with our science teacher and also accompanying classes on off-site field trips. Nourah will conduct interviews with no more than fifteen students from each trip and these interviews will be audiotaped.

The purpose of this research is to further understand the learning occurring on an outdoor guided field trip. Trinity Episcopal School was selected because of our continued interest in furthering the understanding of learning and providing the most current education to the students of Trinity Episcopal School. As Head of the Lower School, I do hereby grant permission for Nourah Caskey to conduct "How Learning and Understanding of Science is Negotiated by Elementary Students Participating in an Out of Doors, Guided Field Trip" at Trinity Episcopal School.

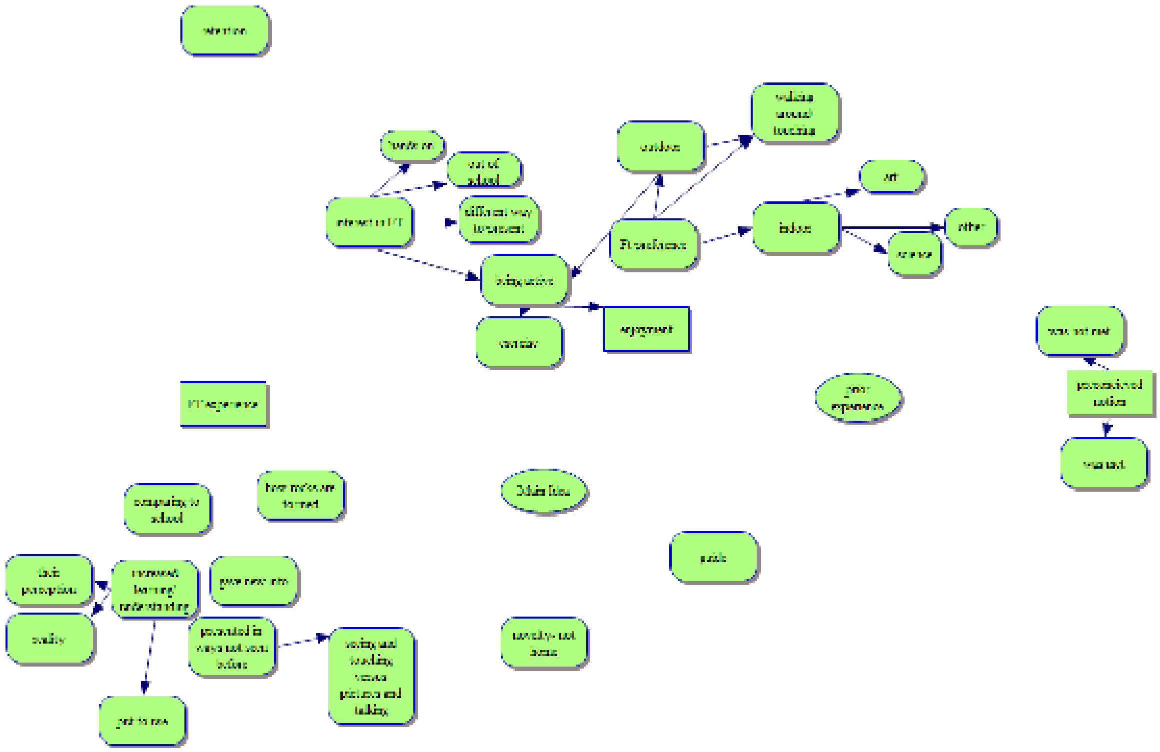
Sincerely,

Lisa Zapalac
Head of Lower School
Trinity Episcopal School
lzapalac@trinitykids.com

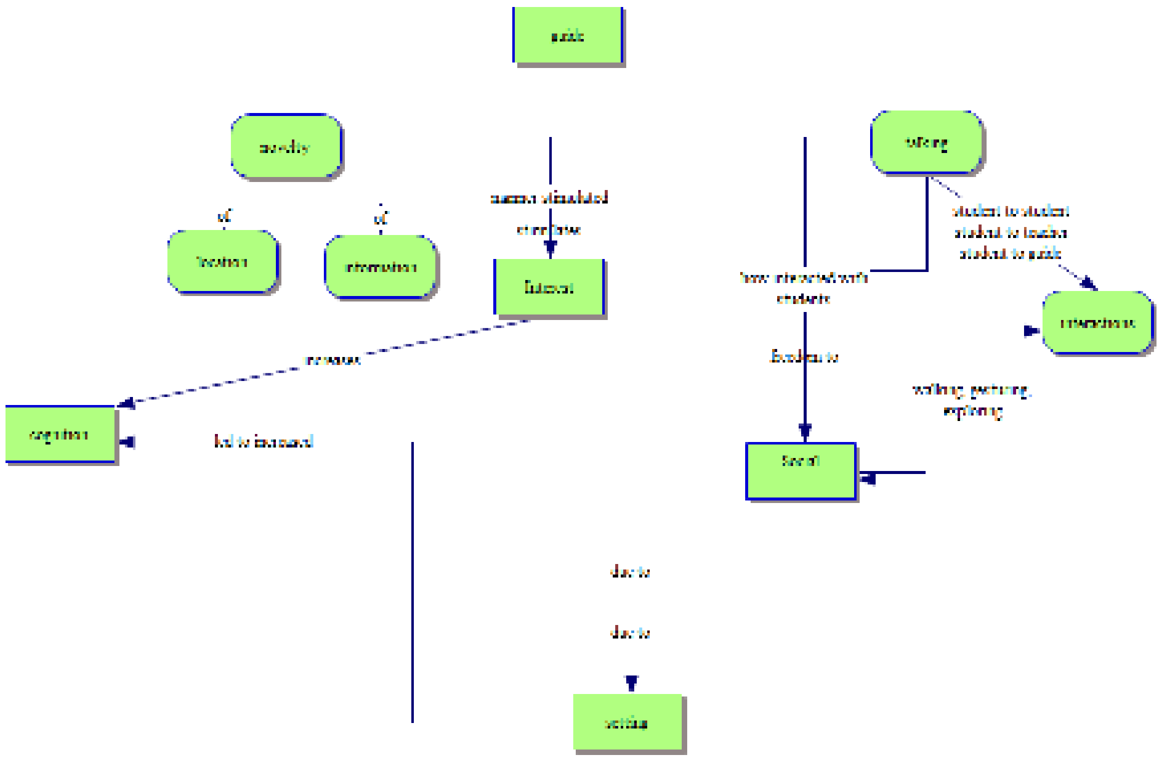
APPENDIX B

Concepts and relations

BREAKDOWN AND RELATIONSHIP OF CONCEPTS



ADVANCED RELATIONS BETWEEN CONCEPTS



APPENDIX C

Sample of pre and post test

Pre/post test

1. Where does water in a lake get most of its energy to evaporate?

A) The sun heating the lake
B) Green plants living in the lake
C) Streams entering the lake
D) Cold springs under the lake

2. Which of the following is NOT a form of precipitation?

A) Hail
B) Wind
C) Rain
D) Snow

3) Which is an example of water condensing?

A) A puddle disappearing on a hot summer afternoon

B) Sweat forming on your forehead after you do a lot of exercise

C) Ice cubes melting when you put them out in the sun

D) Dew forming on plants during a cold night

4) An unusual type of fossil clam is found in rock layers high in the Swiss Alps. The same type of fossil clam is also found in the Rocky Mountains of North America. From this, scientists conclude that

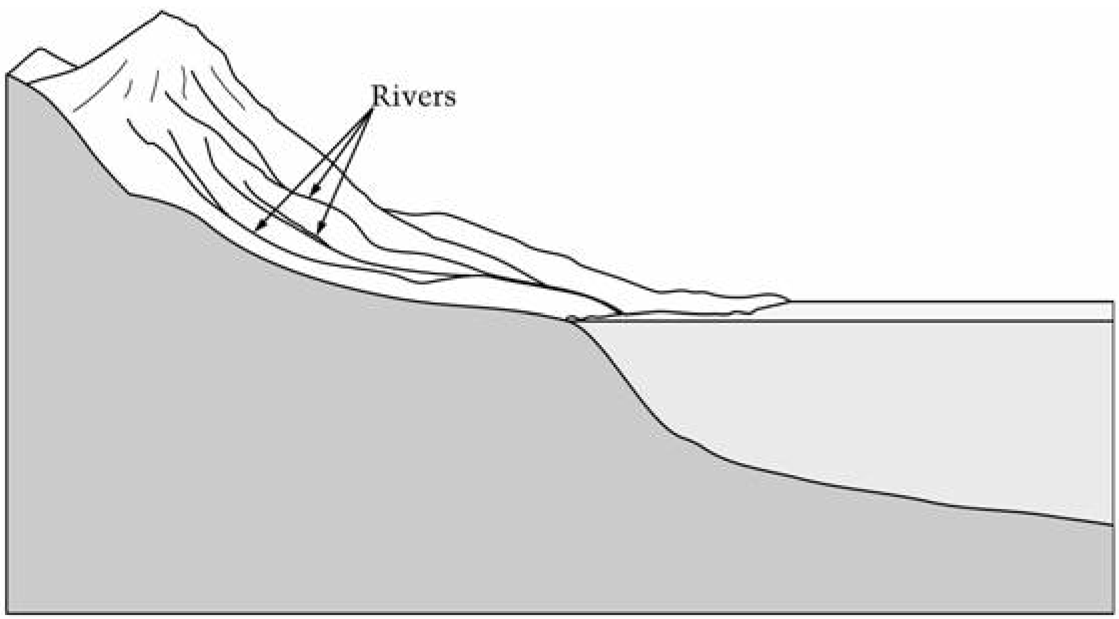
A) glaciers carried the fossils up the mountains

B) the Rocky Mountains and the Swiss Alps are both volcanic in origin

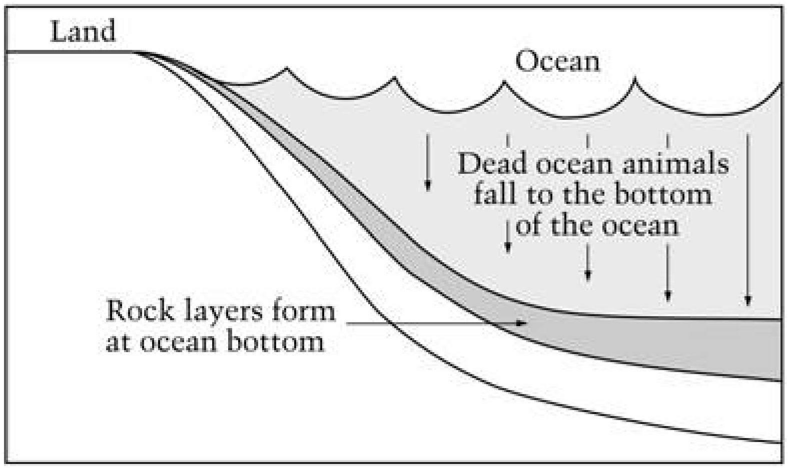
C) clams once lived in mountains, but have since evolved into sea-dwelling creatures

D) the layers of rocks in which the fossils were found are from the same geologic age

5. The picture below can be used to show how sandstone can form along the edge of a large lake. Draw and write on the picture to show the two main processes of sandstone formation.



6. The picture below shows how a type of rock forms at the bottom of the ocean. What type of rock is this?



A) Lava

B) Igneous

C) Sedimentary

D) Metamorphic

7. Rocks and Earth and on the Moon are made of similar materials. What does this observation most likely suggest?

A) Both the Moon and Earth split off from the Sun.

B) Life must have existed on the Moon at one time.

C) The Moon was probably formed from material from Earth.

D) The whole solar system is made up of the same kinds of rocks.

	 Mineral *A*	 Mineral *B*	 Mineral *C*
Mineral *A* scratches:	--	no	no
Mineral *B* scratches:	yes	--	yes
Mineral *C* scratches:	yes	no	--

8. The table above shows whether or not each mineral can scratch the other minerals. Based on the table, which mineral is the hardest? Fill in only one oval.

Ⓐ Mineral *A*

Ⓑ Mineral *B*

Ⓒ Mineral *C*

Explain your answer.

9. After a volcano erupts, new types of rock can form. Explain how this happens.

10. Think about where rain comes from and explain why the Earth never runs out of rain.

11. Beryl finds a rock and wants to know what kind it is. Which piece of information about the rock will best help her to identify it?

    A) The size of the rock

    B) The weight of the rock

    C) The temperature where the rock was found

    D) The minerals the rock contains

APPENDIX D

Interview Questions

(interviews were semi-structured so these are the backbone of the interviews)

All right. Can you tell me your name?

Have you ever been out to McKinney Roughs before?

You haven't been out there before the field trip. Did it look like what you thought it was going to look like?

:Tell me what you thought about the field trip.

But did you enjoy it?

Do you like to go on field trips better or do you like to stay at school better?

Do you like to go on all field trips?

So if you had to choose between a field trip like, say, to the opera or to McKinney Roughs? Which kind of field trip would you rather go on?

What about if you went to like a science museum?

So would you rather go to the Science museum or McKinney Roughs?

Do you like being outside as well?

So you told me quite a bit about your experience on this field trip, but could you tell me a little bit more about what it was that you did do on the field trip?

So how did going on this field trip help you understand more about rocks and the rock cycle?

So she talked a lot about the different rock types in that classroom and outside. Can you tell me a little bit about the different rock types?

So can you tell me about, say, sedimentary rock? How is it formed?

How about igneous? Do you remember igneous?

Yeah, that's true. So if Miss G was going to ask you something about metamorphic rock, would you be able to tell her something about metamorphic rock?

What about limestone?

Let me ask you this first. Sometimes when I look at a limestone in a building, I will see a shell fossil in the middle of that limestone. How could that shell fossil get into the limestone?

So how did it feel when you went out on that hike with _____(guide)

Were you glad you had GUIDE there to help you out?

So how could the oyster shells get there at the McKinney Roughs? Where do oysters usually live?

So what was your most absolute favorite part of the whole field trip?

Thank you so much.

[End of interview.]

APPENDIX E

Interview samples regarding cognition and understanding of material

ELIZA

Nourah: So can you tell me a little bit about your experience on this field trip?

Eliza: Okay. Well, I learned about, like, how a rock, a sedimentary rock is formed and a metamorphic rock is formed, and we – I learned how to identify a rock or a mineral and how… And I never, like, really know how to identify sandstone. I have always been wondering about that. And they told me that there's a layer of sand, then another. There's more. There gets to be more and more layers of sand.—*answering questions- new information- exciting to her- although wonder if she really has been wondering about how sandstone was formed but now she can explain how it was formed*

N: So I remember during that field trip, and this is something that confused me a little bit, she talked about how limestone is one type of rock, but then it can become metamorphic rock. And when it undergoes metamorphic, it becomes marble. Do you remember her talking about that?

E: Mm-hmm.

N: Do you know, how does limestone become marble?

E: I think limestone or the marble, I think it's getting pressured and heated and so it becomes marble.

N: So the limestone just gets pushed on?

E: Gets a lot of pressure and a lot of heat and it turns into marble.

N: Okay, thank you. Because as she kind of shared that, I was a little confused about that part. So if Ms. G was going to ask you about, say, sedimentary rock, what would you be able to tell her?

E: I'd be able to tell her the cycle of how it forms, a couple of types of sedimentary rocks, and probably what they need, like they need pressure. The, like, as I said, examples of the rocks.

N: Do you know more about sedimentary rocks than you did before you went on that field trip?

E: A lot. I didn't know. I didn't know there was such a thing as sedimentary, igneous, and metamorphic rock.

N: So you didn't even know about the three different rock types?

RORY

Rory: My experience was really to learn things, to like learn how to do a GPS, which is really fun, and to really – they also showed this poisonous plant. It's like a silver blooming plant. And I experienced that how you can draw your way points on a map and how – and what types of rock are sedimentary, metamorphic, and igneous, and how they're made, and especially the part that was funny where K got pushed. [laughs]

Nourah: Can you tell me something you learned about the different rock types on the field trip?
R: yes.
N: Can you tell me the differences between the rock types?
R: Well. Sedimentary has pressure, igneous has heat, and then metamorphic has both of them mixed together.

N: Pressure and heat?

R: Yes.

N: So how did going on this field trip then make you understand more about rocks and the rock cycle?

R: How they really explained it, and how they used human beings to really act out the part, and where, and they actually really explained it a couple of times just to really let you get it, and sort of in a fun way.
N: If Mrs G was going to ask you about metamorphic rock what could you tell her?
R: I could tell her that sometimes metamorphic rock would maybe… They didn't mostly… Well, I wouldn't say that… I wouldn't know that much about that rock, because that was sort of the last one. We only talked about it for a couple of minutes, but I really would understand sedimentary and igneous, but metamorphic rock is a little bit harder because it's mixed up both of them together. And then the sedimentary and igneous are made up of one thing, but they are sometimes hard to understand at first. But whenever somebody really explains it to you and makes good inferences on it, they really – I think that you could really understand how layers and layers get pressured into and that makes sedimentary rock. And then igneous, like a lava rock, could be blown out. It has lots of tiny air holes. And then like a hundred years later or at least a little bit later, it would actually form a rock.
N: So if the limestone became marble, then what would it be? How would it be making…? What would be happening to the limestone ? What happens to make metamorphic rock, I guess is my question? What does it need again?

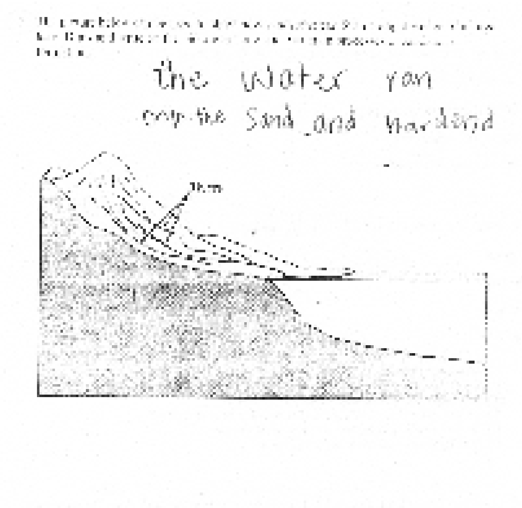
R: It needs pressure and heat. And, well, how it would be that, it would first have its own rock cycle to become limestone, and then it would have a whole other rock cycle again of being smooshed up, and then finally having to end up another type of rock.
N: what kind of rock cycle would there be to make limestone in the first place?
R: I would say that it would be probably lots of rocks coming in – coming from a mountain, then coming into water. Then as they flow and as they rest there in the seabed,

it would become lots of different minerals and crushed up rock. And then the layers would be coming, coming, coming, and finally make an actual sandstone rock of more what I learned or a type of sedimentary rock, because it had all lots of that pressure pushing down into the layers and making a rock.

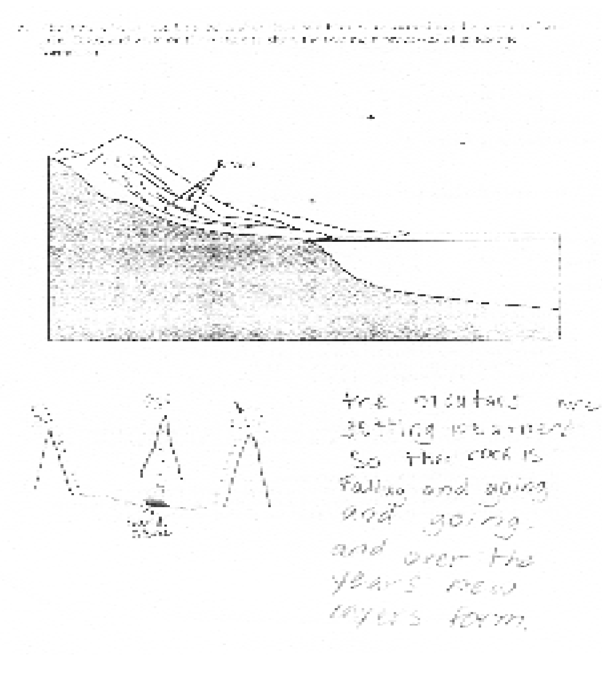
APPENDIX F

Examples of pre and post test answers

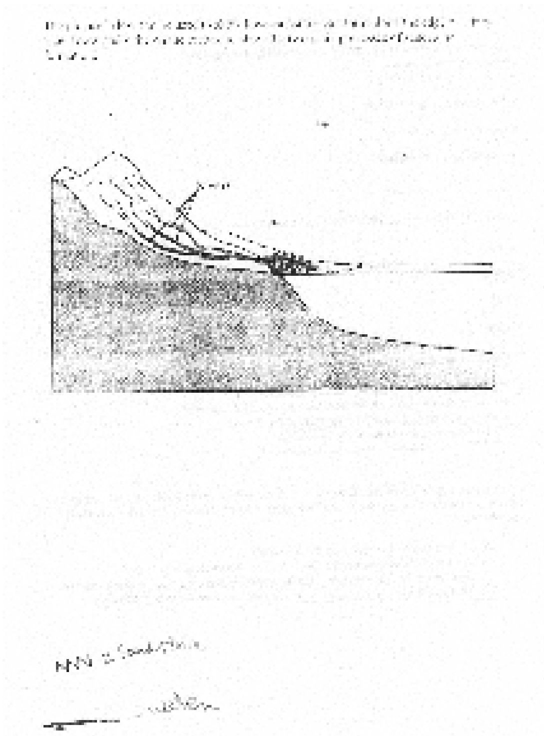
JENNY PRETEST



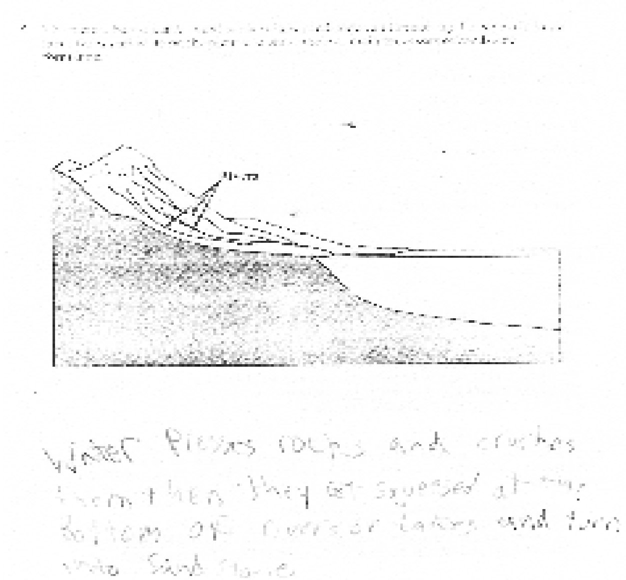
JENNY POSTTEST



MARTY PRETEST

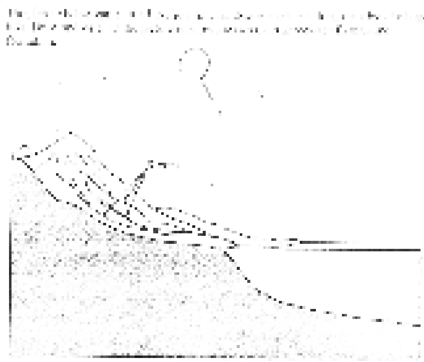


MARTY POSTTEST

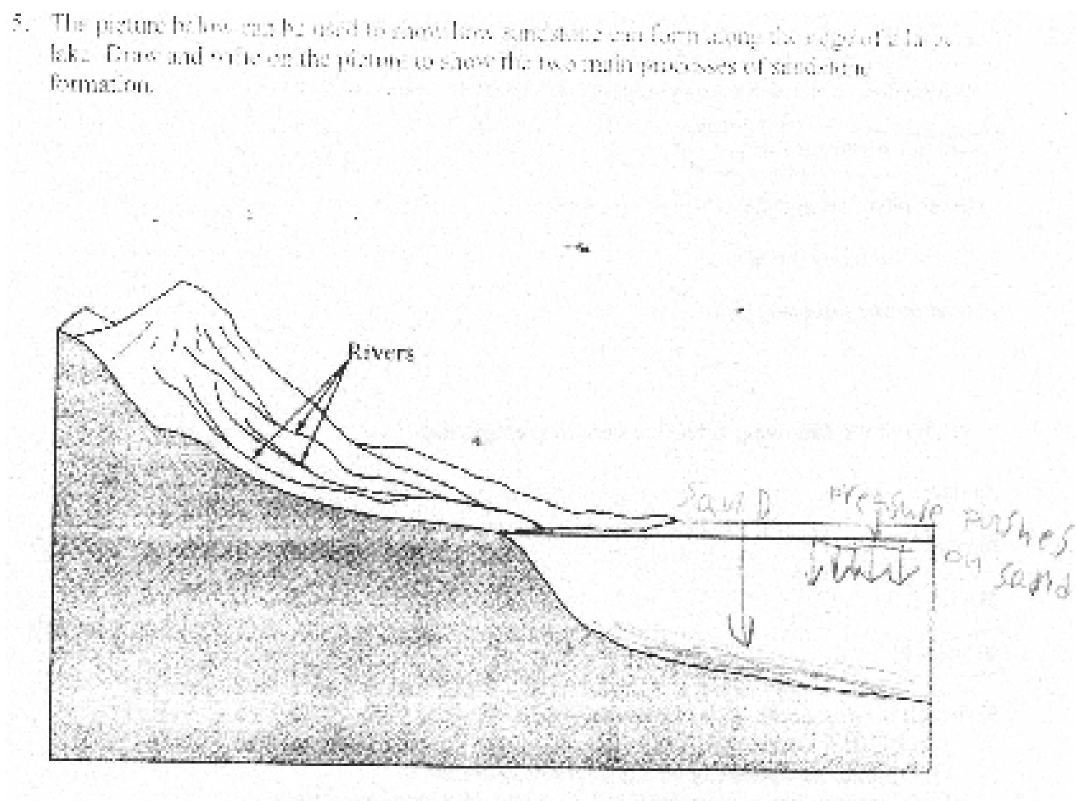


(Water Presses rocks and crushes them then they get squeesed at the bottom of rivers or Lakes and turn into sandstone)

SEAN PRETEST

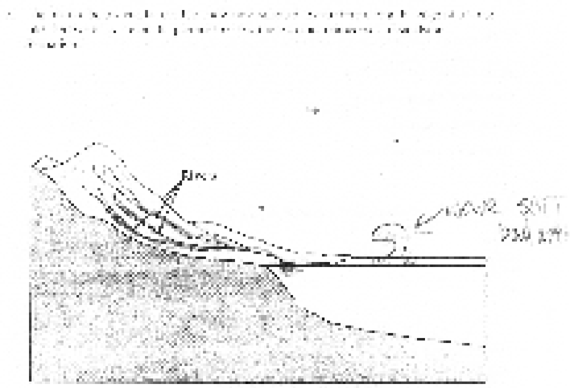


SEAN POSTTEST

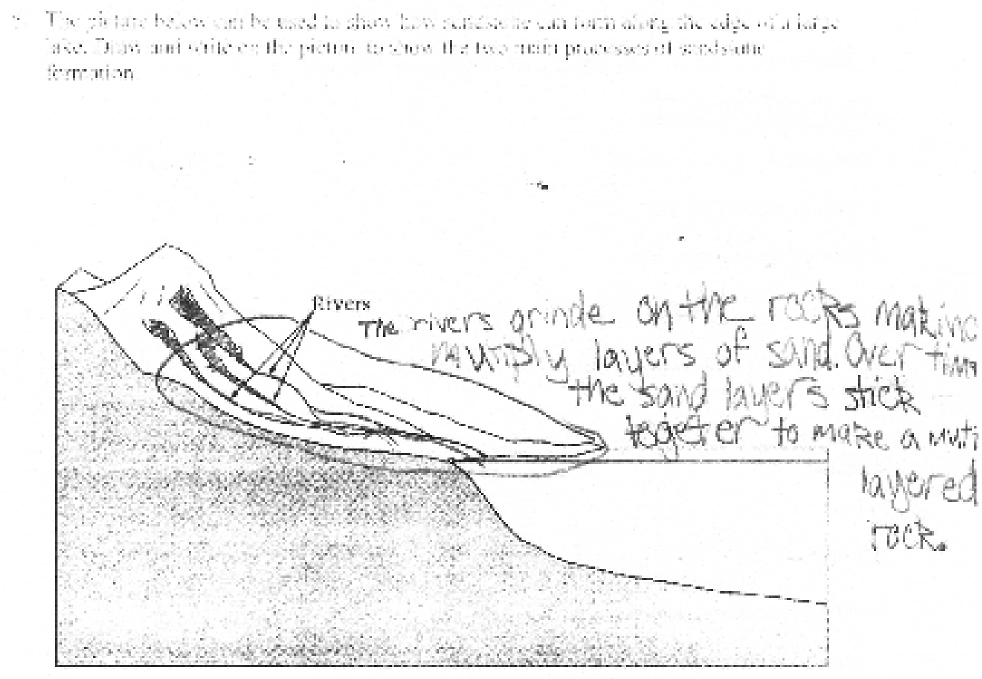


Sand (sinks) water pressure pushes on sand

ROCK PRETEST



ROCK POSTTEST



APPENDIX G

Samples of Journal Entries

cur. dev. theory 4/8/09

initial interviews from post tests. -

the answers that were often given were very interesting

- particular interest - how ~~they~~ some could explain the water cycle but not the evaporation question.

- but @ least 2 of them explained that water was lost b/c the springs really moved water along and this was what they experienced when swimming

— using personal experience

— another used some stuff as magnetism in the clouds that she recalls from church (?)

- at this point they don't know rock types.

Reflexion

- make sure to ask them if they can explain why they didn't give certain answers.

4/28

as I looked over the initial interviews I was abt of a learning curve. I did better I think w/ the second set

4-27

Susie - she has me a little confused - I am not sure about where some of this is coming from. how

- how do rivers go up the hill - the way she is explaining is so backwards.

- also her answer for the ~~[illegible]~~ clams - she says they are made into fossils b/c of lava.

- she seems to be taking a tiny bit of knowledge and making theories out of them.

how am I going to narrow down??

is there enuf of a diff

there is a diff between

the two classes but is it

relevant?

make sure to grab Riley's

Comment ab. nature being art

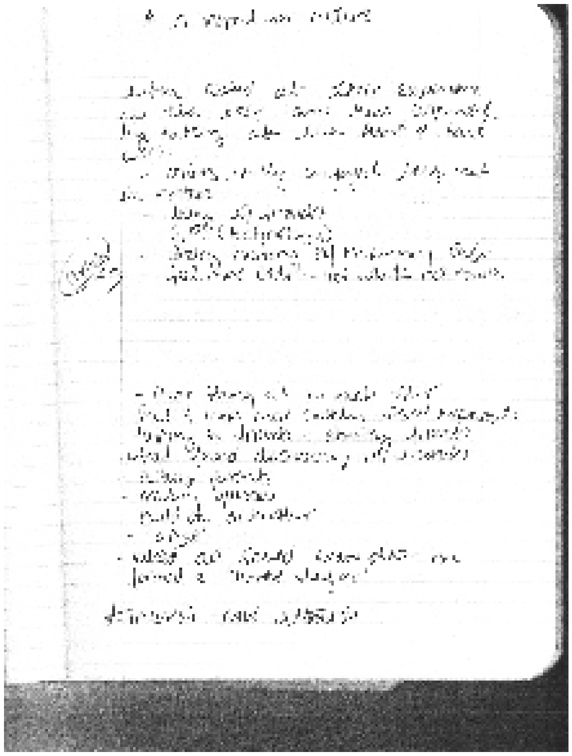
guides really explained what

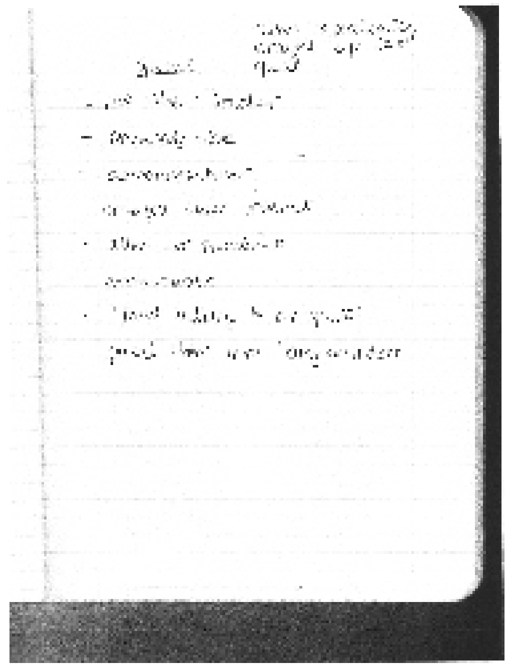
was happening

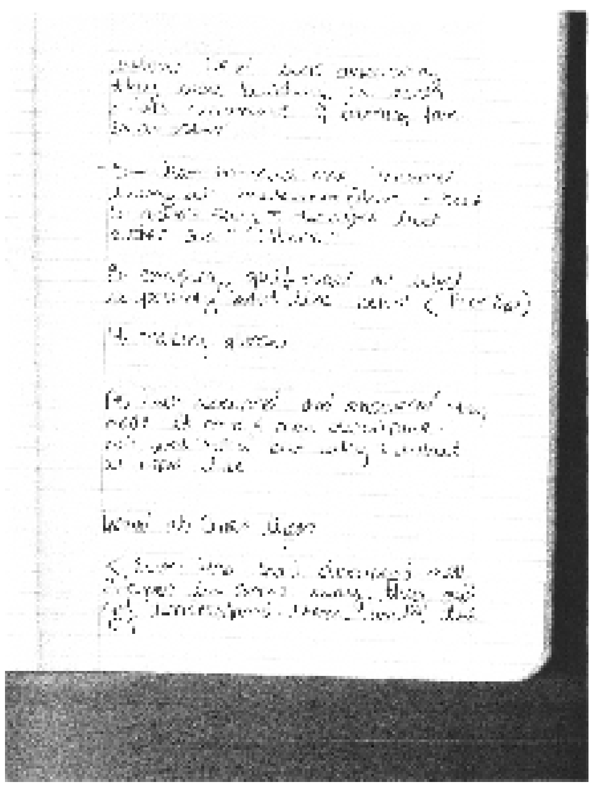
even on FT - prefers the

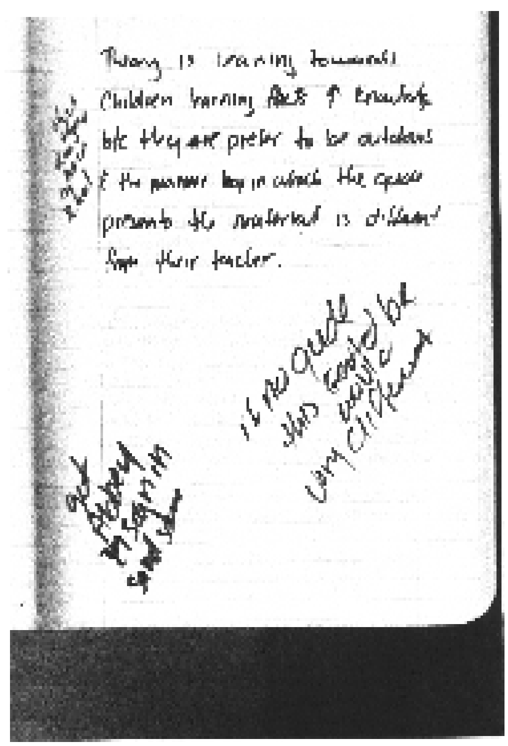
outdoors to the classroom part

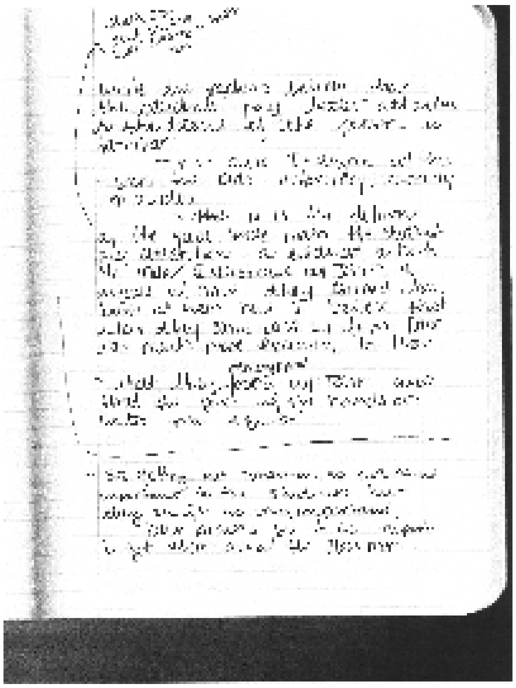
learned about all the rock types

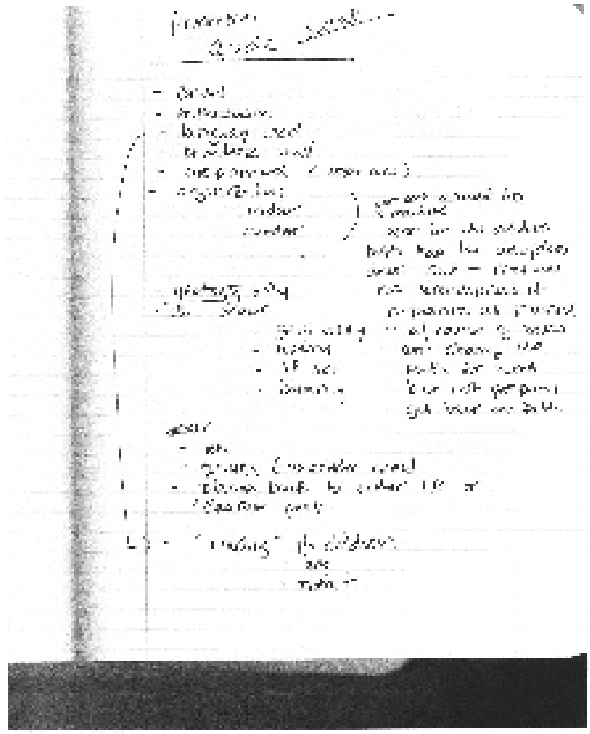


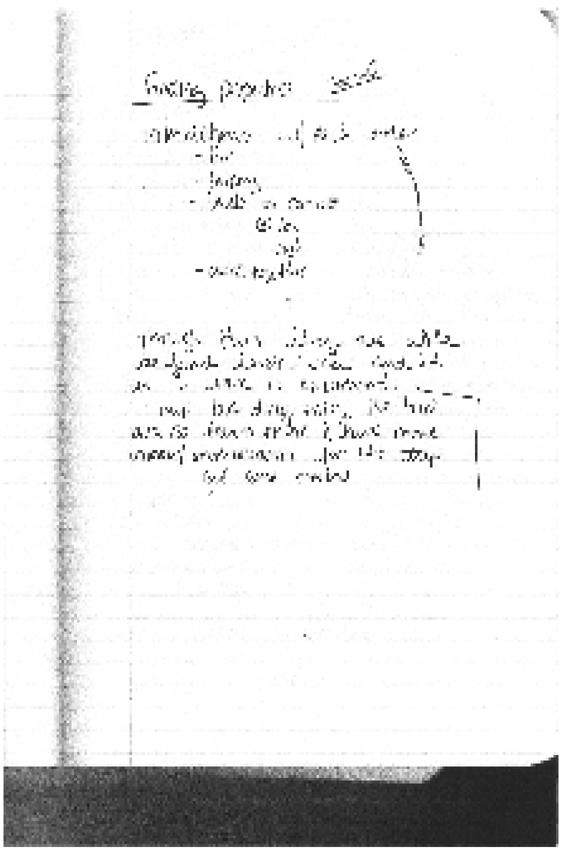





Theory is leaning towards
Children learning facts & knowledge
b/c they are prefer to be outdoors
& the manner in which the space
presents the material is different
from their teacher.





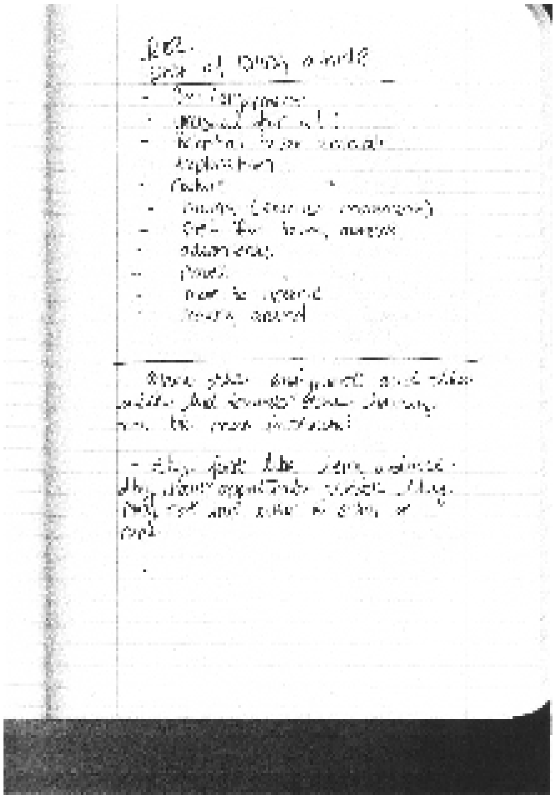


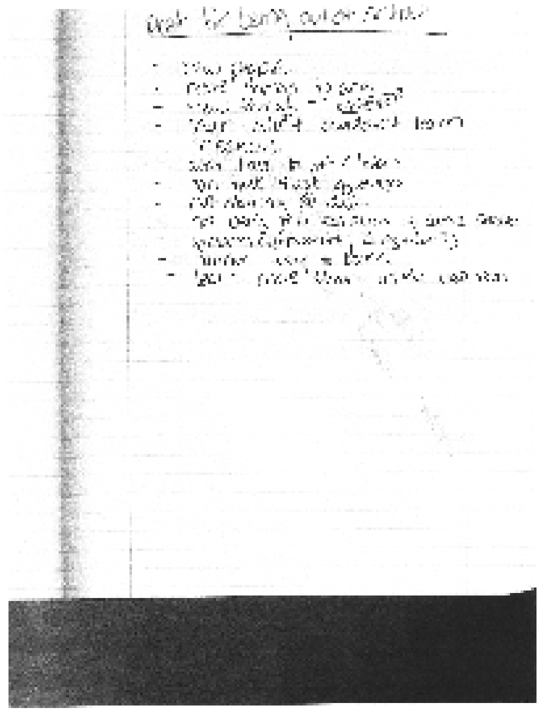
- talking w/ guide - asking questions
- hands on
- demonstrations
- different person than their teacher

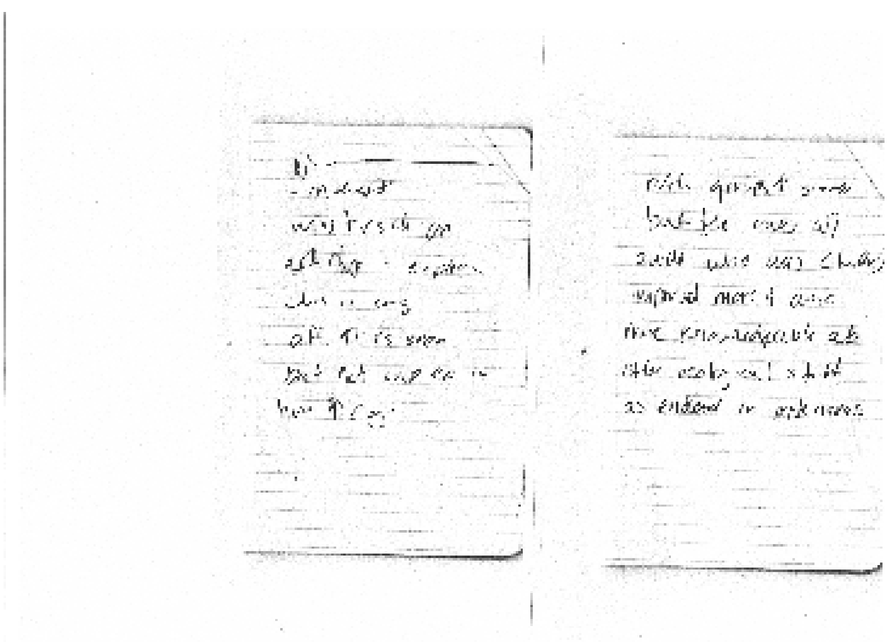
- feeling - physical as well as - knew what taking abt

The children interviewed all showed a preference for being outside on the F.T. being outdoors provided more opportunities for real exploration & discovery and this in turn lead to further engagement.

While ~~just~~ simply the actual being outside ~~and~~ may not have contributed directly to their cognitive gains, it did create an environment where learning was more likely to occur in a natural manner.

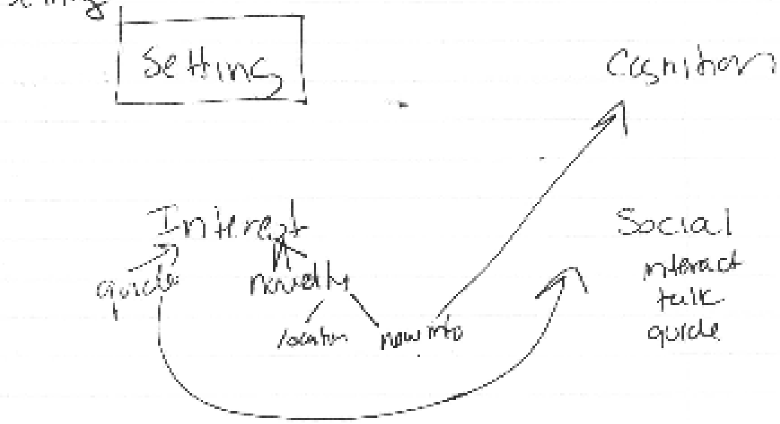






overall ↑ in cognition based on interviews & tests. this results from the success of the F.T.

what led to the success of the FT was the setting & the sr that are integrated in the setting



Look @ Questions

Setting

Setting

I. Social
a interactions
b talking
c. guide

II Interest
a) guide
b) Novelty
1) location
2) New info

~~II Interest~~
a)

APPENDIX H

Table 1. Table 1 Number of times code used in interview.

	k	s	m	a	n	s	c	a	e	m	r	sm	rq	j	aa	f	k	fc	t		total
fun	5	4	3	5	4	3	3	4	3	4	5	5	4	2	4	5	4	3	4	fun	74
walk		1	1	2	1	1	1	3	4	2	5	3	4		5	4	3	2	3	walk	45
outside	3	2	1	2	3	1	2	2	1	2	2	3	4		4	4	3	4	2	outside	45
friend	3	1	1	3	1	1	2	2	4	3	2	3	2	3	3	4	2	2	2	friend	44
talk	2		1	3	1		1	1	4	4	3	4	3	3	3	4	2	2	3	talk	44
observation		2	2	5	4	1	1			2	2	2	4		3	1	4	3	2	observation	38
interesting	2	1	1	1	2	3			2	1	4	3	3		4	2	3	2	3	interesting	37
share	3			1			1	2	2	2	3	3	2		2	4	4	3	2	share	34
guide	2	1		2	3	1	1	1	2	1	4	2	1		2	2	2	2	1	guide	30
setting	1	1		1	2	1	1	1	1	2	1	1	4		2	2	3	2	3	setting	29
different		1	2	2		1	1		2	2	2	1	2		3	2	2		1	different	24
understanding	1	2				1	3		2	1	1	2	1		4		1	1	2	understanding	22
social				2			1	1	2	2	3	2	2	3	1	3				social	22
learning			2	1	3	2	1	2	1	2			1		2		2	1	1	learning	21
new info	3		2		1	3	1	1		1	1		2		2		1	1		new info	19
explore		3	1		2						2		2		2		2	3	2	explore	19
like field trip	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	like field trip	18
hands on		2		1			3	1	1		3	1	2		2	1				hands on	17
like guide	1			1	2				1	1	2	2	1	1	1	1	1	1	1	like guide	17
prefer outside		1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	prefer outside	17
enjoy learning	1		1	1		1	1	1		1		1	3		3	1	1			enjoy learning	16
new location	1		1	1		2		1	1			1	2	1	1	1	2			new location	15
not school			1			3	1			1	1	1	1	1		3		1	1	not school	15
new pple				2	2	2	2		1	1	2	1								new pple	13
help	1			1			2	2	1		1	3	1			1				help	13
comfortable	2					1	3	1	1	1	1			1	1	1				comfortable	13
how learning	1				1	1	2	1	1		1				1		1	2		how learning	12
misconception	1			1	1	1							1	5						misconception	10
pride				1		2		3		1		1					1			pride	9
recall guide			1	1	1	1				1	1			1		1				recall guide	8
talk to guide				1	2				1		1						1			talk to guide	6
why learning						1			1				2							why learning	4
prefer museum						1														prefer museum	1
no opinion on FT														1						no opinion on FT	1

Table 2. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs C's Class

Group	Pretest	Posttest
Mean	5.32	6.68
SD	1.63	2.33
SEM	0.38	0.54
N	19	19

The two-tailed P value equals 0.0201.

Table 3. T-test comparing test scores pre and post field trip

Statistical Analysis for Mrs H's Class

Group	Pretest	Posttest
Mean	4.50	6.25
SD	1.50	2.15
SEM	0.34	0.48
N	20	20

The two-tailed P value is less than 0.0001

Table 4 Interest/exam score matrix

Low scores 0-19, Medium scores 20-29, High score >30

Codes related to interest	k	s	m	a	n	s	c	a	e	m	r	sm	rq	j	aa	f	k	fc	t
fun	5	4	3	5	4	3	3	4	3	4	5	5	4	2	4	5	4	3	4
walk		1	1	2	1	1	1	3	4	2	5	3	4		5	4	3	2	3
outside	3	4	1	2	3	1	2	2	1	2	2	3	4		4	4	3	4	2
friend	3	1	2	3	1	1	2	2	4	3	2	3	2	3	3	4	2	2	2
talk	2		1	3	1		1	1	4	4	3	4	3	3	3	4	2	2	3
interesting	2	1	1	1	2	3			2	1	4	3	3		4	2	3	2	3
guide	2	2		2	3	1	1	1	2	1	4	2	1		2	2	2	2	1
setting	1	1		1	2	1	1	1	1	2	1	1	4		2	2	3	2	3
different		2	2	2		1	1		2	2	2	1	2		3	2	2		1
learning			2	1	3	2	1	2	1	2			1		2		2	1	1
new info	3	1	3		1	3	1	1		1	1		2		2		1	1	
explore		3	1		2						2		2		2		2	3	2
like guide	1			1	2				1	1	2	2	1	1	1	1	1	1	1
enjoy learning	1		2	1		1	1	1		1		1	3		3	1	1		
new location	1	1	1	1		2		1	1			1	2	1	1	1	2		
new pple				2	2	2	2		1	1	2	1							
pride				1		2		3		1		1					1		
talk to guide				1	2				1		1						1		
Interest	24	21	20	29	29	24	17	22	28	28	36	31	38	10	41	32	35	25	26
level	med	med	med	med	med	med	low	med	med	med	high	high	high	low	high	high	high	med	med
change in	80-65	95-80	100-85	80-75	85-75	85-75	70-60	75-60	80-75	75-65	85-70	85-75	90-80	55-50	95-85	75-65	80-65	70-60	65-60
test score	15%	15%	15%	5%	10%	10%	10%	15%	15%	10%	15%	10%	10%	5%	10%	10%	15%	10%	5%

Tables 5-7 Interest levels and exam score changes

Table 5
Interest level low changes

Medium interest level	10	70	60
	5	65	60
	10	75	65
	5	80	75
	10	85	60
	10	85	75
	5	80	75
	15	100	85
	15	95	80
	15	80	65
average	9.4231	77.115	66.538

Table 6.
Interest level medium changes

High interest level	15	80	65
	10	75	65
	10	95	85
	10	90	80
	10	85	75
	15	85	70
average	11.667	85	73.333

Table 7.
Interest level high changes

Tables 8-10 Group make up on hike

Table 8.
Group sizes on walk (approximate)

Group size	Nahdia	Erik
2	9	15
3	8	11
4	3	2
>4	8	7

Table 9.
Gender of Erik's groups (approximate)

group size	2	3	4
M	8	2	0
F	7	9	1
Mixed	0	0	1

Table 10.
Gender of Nahdia's groups (approximate)

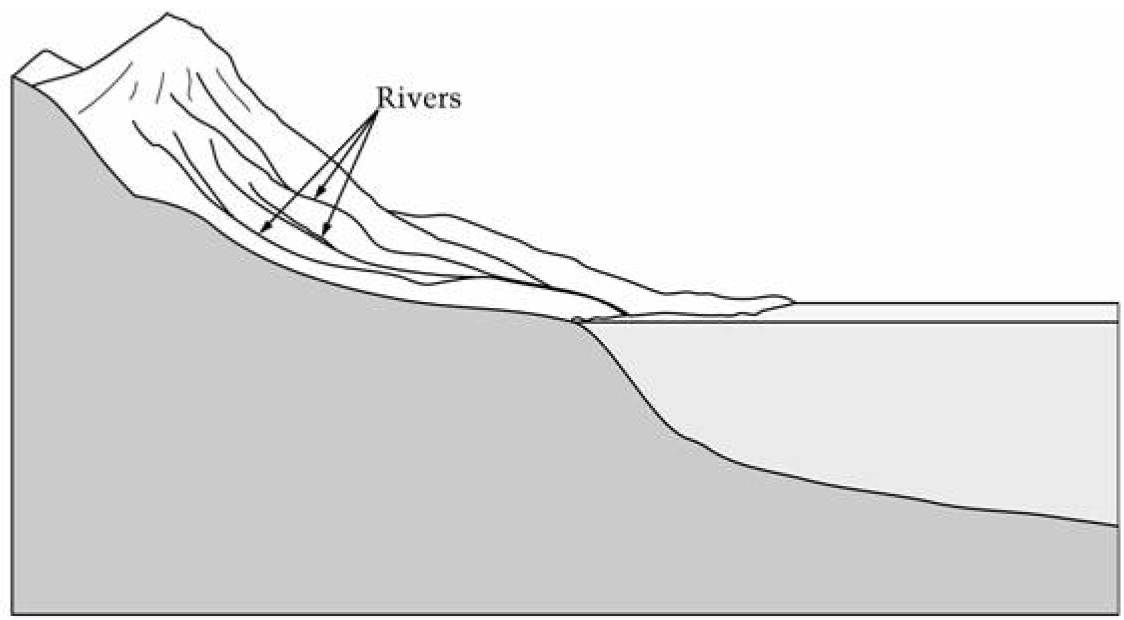
group size	2	3	4
M	5	2	0
F	6	5	2
Mixed	0	1	1

Scores from students in study compared to national scores Q5

Question number 5 on pre and post test. Taken from 4th and 8th grade NAEP exam

Subject: Science Grade: 4 Block: 2005- 4S14 No.: 5

5. The picture below can be used to show how sandstone can form along the edge of a large lake. Draw and write on the picture to show the two main processes of sandstone formation.



2005 National Performance Results

Score	Percentage of Students
Unsatisfac/incorrect	**69%**
Partial	**5%**
Complete	**1%**
Omitted	**23%**
Off task	**2%**

0 100

Study Student Performance Results Post Field Trip

Score	Percentage of Students
Unsatisfac/incorrect	20%
Partial	31%
Complete	40%
Omitted	10%

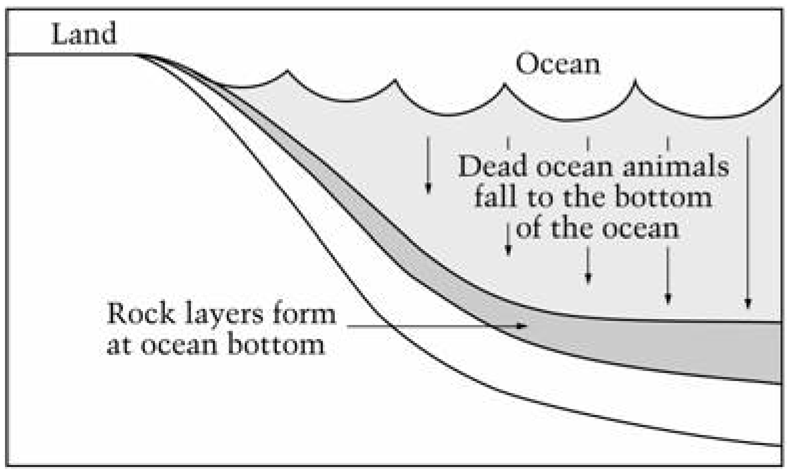
0 100

. Scores from students in study compared to national scores Q6

Question number 6 on pre and post test. Taken from 4th and 8th grade NAEP exam

Subject: ScienceGrade: 4Block: 2005- 4S13No.: 7

7. The picture below shows how a type of rock forms at the bottom of the ocean. What type of rock is this?



A) Lava

B) Igneous

C) Sedimentary

D) Metamorphic

2005 National Performance Results

Score	Percentage of Students
Correct	**35%**
Incorrect	**64%**

Omitted	1%
	0 100

Study Student Performance Results Post Field trip

Score	Percentage of Students
Correct	56%
Incorrect	44%
Omitted	1%
	0 100

. Scores from students in study compared to national scores Q6

Question number 6 on pre and post test. Taken from 4th grade NAEP exam

Subject: Science Grade: 4 Block: 2005- 4S12 No.: 10

10. After a volcano erupts, new types of rock can form. Explain how this happens.

Score	Percentage of Students
Unsatisfac/incorrect	**50%**
Partial	**15%**
Complete	**29%**
Omitted	**5%**
Off task	**1%**

0 100

Score	Percentage of Study Students Post Field Trip
Unsatisfac/incorrect	**13%**
Partial	**33%**
Complete	**46%**
Omitted	**8%**

0 100

Table 6. Scores from students in study compared to national scores Q4

Question number 4 on pre and post test. Taken from 8th grade NAEP exam

Subject: Science Grade: 8 Block: 2005- 8S11 No.: 3

3. An unusual type of fossil clam is found in rock layers high in the Swiss Alps. The same type of fossil clam is also found in the Rocky Mountains of North America. From this, scientists conclude that

A) glaciers carried the fossils up the mountains

B) the Rocky Mountains and the Swiss Alps are both volcanic in origin

C) clams once lived in mountains, but have since evolved into sea-dwelling creatures

D) the layers of rocks in which the fossils were found are from the same geologic age

Subject: Science Grade: 8 Block: 2005- 8S11 No.: 3

2005 National Performance Results

Score	Percentage of Students
Correct	**48%**
Incorrect	**52%**
Omitted	**#**
	0 100

Student Study Performance Results Post Field Trip

Score	Percentage of Students
Correct	67%
Incorrect	33%
Omitted	#
	0 100

References

Adey, P., & Shayer, M. (1993). An Exploration of Long-Term Far-Transfer Effects Following an Extended Intervention Program in the High School Science Curriculum. *Cognition and Instruction, 11*(1), 1-29.

Anderson, D. (1997). The effectiveness of orienting students to the physical features of a science museum prior to visitation. *Research in Science Education , 27*(4).

Anderson, D., Lucas, K., & Ginns, I. (2003). Theoretical perspectives on learning in an informal setting. *Journal of research in science teaching, 84*(5), 658-697.

Anderson, D., Lucas, K., & Ginns, I. (2003). Theoretical perspectives on Learning in an Informal Setting. *Journal of Research Science Teaching, 40*, 177-199.

Ash, D. (2003). Dialogic Inquiry in Life Science Conversations of Family Groups in a Museum. *Journal of Research in Science Teaching , 40*, 138–162.

Bamberger, Y., & Tal, T. (2008). Multiple Outcomes of Class Visits to Natural History Museums: The Students' View. *Journal of Science Education in Technology, 17*, 274-284.

Baram-Tsabari, A., & Yarden, A. (2005). 'Characterizing children's spontaneous interests in science and technology'. *International Journal of Science Education, 27*(7), 803 -826.

Basile, C. G., & Copley, J. V. (1997). *The effect of an outdoor nature investigation program on young childrens ability to transfer knowledge* (AERA, Ed.). (ERIC Document Reproduction Service No. ED409139))

Berk, L., & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood learning*. Washington, DC:: . National Association for the Education of Young Children.

Borun, M., & Dritsas, J. (1997). Developing family-friendly exhibits. *Curator, 40*, 178–196.

Boyer, L., & Wolff-, M. R. (2006). Learning and teaching as emergent features of informal settings: An ethnographic study in an environmental action group. *Science Education, 90*(6), 1028-1049.

Campione, ,. C. (1989, March). Assisted Assessment: A Taxonomy of Approaches and an Outline of Strengths and Weaknesses. *Journal of Learning Disabilities; , 22*(3).

Charlesworth, R., & Lind, K. K. (1999). *Math and science for young children* . Clifton Park, NY: Thomson Delmar Learning.

Collins, R. (2004). *Interaction Ritual Chains* . Princeton and Oxford: Princeton University Press .

Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (3rd ed.). Thousand Oaks, CA: Sage.

Cox-Peterson, A., & Spencer, B. (2006). Access to science and literacy through inquiry and schoolyard habitats. *Science activities, 43*(2), 21-27.

Crowley, K., Callanan, M., Jipson, J., Galco, J., Topping, K., & Shrager, J. (2001). Shared Scientific Thinking in Everyday Parent-Child Activity. *Science Education, 85*, 712-732.

Csikszentmihalyi, M. (1988). The flow experience and human psychology. . In .*),* *Optimal experience: Psychological studies of flow in consciousness*. New York: University of Cambridge Press.

Dawson, C. (2001). Upper primary boysʼ and girlsʼ interests in science: have they changed since 1980? *International Journal of Science Education, , 22*(6), 557 – 570.

Dierking, L. D., & Falk, J. H. (1997). School field trips: Assessing their long-term impact. *Curator, 40*(3), 211-218.

Dillon, J., Rickinson, M., Teamey, K., Morris, M., Choi, M. Y., & Sanders, D. (2006, March). The value of outdoor learning: evidence from research in the UK and elsewhere . *School Science Review,, 87*, 107-112.

Disinger,, J. F. (1984). Field instruction in school settings. *Environmental Education Digest , 1.*

Disinger, J. F. (2001). K-12 Education and the Environment: Perspectives, Expectations, and Practice. *The Journal of Environmental Education, 33*(1), 4 – 12. .

Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. New York, NY: Macmillan Publishing Compan.

Erlandson, D. A., Harris, E. L., & Skipper, B. L. (1993). *Doing Naturalistic Inquiry: A Guide to Methods*. Newbury Park, CA: Sage Publications.

Falk, J., Moussouri, T., & Coulson, D. (1998). The effect of visitors' agendas on museum learning. . *Curator, , 41*(2), 107–120.

Fido, H. S., & Gayford, C. G. (1982, Spring). The name assigned to the document by the author. This field may also contain sub-titles, series names, and report numbers. Field Work and the Biology Teacher: A Survey in Secondary Schools in England and Wales. *Journal of Biological Education, 16*(1), 27-34.

Gallagher, J. J. (1991). Prospective and practicing secondary school science teachers' knowledge and beliefs about the philosophy of science. *Science Education, 75*(1), 121-133.

Goodrum, D., Hackling, M., & Rennie, L. J. (2001). Science Teaching and Learning in Australian Schools: Results of a National Study Source. *Research in science education , 31*(4), 455.

Greenfield, P. (1997). You Can't Take It With You: Why Ability Assessments Don't Cross Cultures. *American Psychologist, , 52*(10), 1115-1124.

Griffin,, J. (2004). Research on students and museums: Looking more closely at the students in school groups. *Science Education , 88*(supplement 1), S59-S70.

Guba, E. G., & Lincoln, Y. S. (1985). *Naturalistic Inquiry.* . Newbury Park, CA: :Sage Publications.

Ham, S., & Sewing, D. R. (1987-88, Winter). Barriers to Environmental Education. *Journal of Environmental Education, 19*(2), 17-24 .

Hmelo-Siver, C., & Barrows, H. (2006). Goals and Strategies of a Problem-based Learning Facilitator. *The Interdisciplinary Journal of Problem-based Learning •, 1*(1), 21-39.

Howie, T. R. (1974). Indoor or outdoor environmental education? *Journal of Environmental Education , 6*(2), 32-36.

Jarvis, T., & Pell, A. (2005). Factors influencing elementary school children's attitudes toward science before, during, and after a visit to the UK National Space Centre. *Journal of Research in Science Teaching, 42*(1), Pages 53 - 83.

Jonassen, D. H. (1991). Evaluating constructivistic learning. *Educational Technology, 28*(13), 13-16.

Kanselaar, G., de Jong, T., Andriessen, J., & Goodyear, P. (2000). New Technologies. In *New Learning* (pp. 55-83). Dordrecht: Kluwer Academic Publishers.

Kanuka, H., & Anderson, T. (2007, August 11). Online Social Interchange, Discord, and Knowledge Construction. *The Journal of Distance Education / Revue de l'Éducation à Distance, 13*(1). Retrieved from http://www.jofde.ca/.php/////

Kliebard, H. M. (1995). *The Struggle for the American Curriculum* (2nd ed.). New York, NY: Routladge.

Knapp, C. (1996). *Just beyond the Classroom: Community Adventures for Interdisciplinary Learning*. Charlestown, WV: ERIC publications.

Kunin, M. M. (1991). Pathways To Partnerships: Coalitions for Environmental Education. . In *Annual Conference of the North American Association for Environmental Education* . Symposium conducted at 22 Annual Conference of the North American Association for Environmental Education , Big Sky, Montana, .

Lee, C. C. (1984, Spring). The name assigned to the document by the author. This field may also contain sub-titles, series names, and report numbers. An Investigation of the Psychosocial Variables in the Occupational Aspirations and Expectations of Rural Black and White Adolescents: Implications for Vocational Education. *Journal of Research and Development in Education, 17*(3), 28-34 .

Lemke, J. L. (1990). *Talking science: Language, learning and values*. Norwood, NJ: Ablex Publishing.

Levy, P. (2003). A methodological framework for practice-based research in networked learning. *Instructional Science , 31*, 87–109.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

Lisowski, M., & Disinger, J. F. (1991). The effect of field-based instruction on student understanding of ecological concepts. *Journal of Environmental Education, 23*(1), 19-23.

Mackenzie, A. A., & White, R. T. (1982). Fieldwork in Geography and long-term memory structures. *American Educational Research Journal, , 19*(4), 623-632.

MacPherson, S. (2002, May 2). Learning Our Relations: Teaching reverence for living beings. In *Global, Environmental and Outdoor Education Committee (GEOEC) Conference*. Symposium conducted at vironmental and Outdoor Education Committee (GEOEC) Conference, Edmonton, Alberta, . Retrieved March 13, 2009, from http://://www.geoec.org//relations.pdf

Malterud, K. (2001). Qualitative research: Standards, challenges and guidelines. *The Lancet, 358*, . 483-488.

Malterud, K. (2001). Qualitative research: Standards, challenges and guidelines. *The Lancet, 358*, . 483-488.

McIntosh,, W. J., & Zeidler, Dana L, D. L. (1998). Teachers' conceptions of the contemporary goals of science education . *Journal of Research in Science Teaching, 25*(2), .93-102.

McKenzie, A., & White, R. (1986). Field work in geography and long term memory structure. *American Educational Research Journal, 19*, 623-632.

Munby, H., & Roberts, D. A. (1998). Intellectual independence: A potential link between science teaching and responsible citizenship. . In D. A. Roberts & L. O. Ostman (Trans.), *.), Problems of meaning in science curriculum* (pp. 101– 114). New York: Teachers College Press.

Nichols, D. R. (1989). Enhancing learning in the outdoors. *Journal of Physical Education, Recreation and Dance, 60*(2), 44-46.

Olitsky, S. (2007). Promoting student engagement in science: Interaction rituals and the pursuit of a community of practice. *Journal of Research in Science Teaching, 44*(1), 33-56.

Orion, N. (1993). A model for the deelopment and implementation of field trips as and integral part of the science curriculum. *School Science and Mathematics, 93*(6), 325-331.

Orion, N., & Hofstein, A. (1994).). Factors that influence learning during a field trip in a natural environment. *Journal of Research in Science Teaching, 31*(10), 1097-1119.

Osborn, J., & Collins, S. (2001). Pupils views of the role and value of the science curriculum: a focus-group study . *International Journal of Science Education , 23*(5), :44.

Osborne, J. (2007, May). Engaging young people with science: Thoughts about future direction of science education. In *Linnaeus Tercentenary 2007 Symposium "Promoting Scientific Literacy,"*. Symposium conducted at Uppsala University, Uppsala, Sweden. Retrieved November 11, 2008, from http://66.102.1.104/?hl=en&lr=&q=cache:VTSbEgf11RAJ:www.did.uu.se///070528ProceedingsScientificLiteracy_000.pdf%23page%3D103+haste+2004+education

Osborne, J., & Collins, S. (2001). Pupilsʼ views of the role and value of the science curriculum: a focus-group study. *International Journal of Science Education, 23*(5), 441 – 467.

Osborne, J., Collins, S., Ratcliffe, M., Millar, R., & Duschl, R. (2003). What ideas about science should be taught in school science? A Delphi study of the expert community. *Journal of Research in Science Teaching, 40*(7), 692-720.

Packer, J., & Ballantyne, R. (2002). Motivational factors and the visitor experience: A comparison of three sites. . *Curator, 45*(3), 183-198.

Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods* (2nd ed.). Newbury Park, CA: Sage Publications, Inc.

Piaget, J. (1971). *Biology and knowledge; an essay on the relations between organic regulations and cognitive processes*. Chicago: Univeristy of Chicago Press.

Prather, P., & Hartshorn, R. (1989, Spring). Evaluation of a Model for Reform of Elementary Science Instruction in Rural and Small School Systems. *Journal of Rural and Small Schools, 3*(3), 6-13 .

Project 2061Benchmarks for scientific literacy. (1993). New York: Oxford University Press.

Rahm, J. (2004). Multiple Modes of Meaning- Making in a Science Center. *Science Education, 88*, 223– 247.

Roth, W. M., & Bowen, G. M. (1995).). Knowing and interacting: a study of culture, practices, and resources in a grade 8 open-inquiry science classroom guided by a cognitive apprenticeship metaphor. *Cognition and Instruction, 13*(1), 73-128.

Schatz, C. (2004). *AN EXAMINATION OF EVALUATION METHODS FOR COMPARING TWO INFORMATION RETRIEVAL SYSTEMS SUPPORTING TEACHER PERFORMANCE*. Unpublished doctoral dissertation, Indiana University,. Retrieved from http://uhaweb.hartford.edu///_10_04_5_15PM.pdf

Seever, M. (1991).*Knotts Environmental Science Magnet Elementary School: 1988-1989, 1989-1990, 1990-1991. Summative Evaluation* (Kansas City Public Schools, Ed.). (ERIC Document Reproduction Service No. ED350158)

Simmons,, D. A. (1994, September). Urban Children's Preferences for Nature: Lessons for Environmental Education. . *Children's Environments, v11 , 11*(3), 194-203 .

Tal, T., & Morag, O. (2007, May). School Visits to Natural History Museums: Teaching or Enriching? *Journal of Research in Science Teaching,, 44*(5), 747-769 .

Thorn, T. F., Blahna, D. J., & Johnston, B. (1994). a process for developing wilderness user education plans. *journal of environmental education, 25*(2), 37-43.

Vygotsky, L. (1978). *Mind and society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wasley, P. A., Donmoyer, R., & Maxwell, L. (1995, Winter). Navigating Change in High School Science and Mathematics: Lessons Teachers Taught Us . *Theory into Practice, 34*(1), 51-59 .

Winn, W., Stahr, F., Sarason, C., Fruland, R., Oppenheimer, P., & Lee, Y. (2006). Learning oceanography from a computer simulation compared with direct experience at sea. *Journal of Research in Science Teaching, 43*(1), 25-42.

Young, G. (1997). *Adult development, therapy, and culture: A postmodern synthesis*. New York: Plenum Press.

Vita

Nourah Al-Rashid Caskey was born to Nasser and Gaye Al-Rashid in 1968 in Austin, Texas. She attended various schools in Saudi Arabia and Austin, Texas until the 6th grade where she entered Kirby Hall School and graduated in May 1986. She received a Bachelor of Arts in Psychology in 1991 with a minor in Sociology from the University of Texas at Austin. She studied at the Univesidad de Salamanca for the summer of 1990. In December 1998 she received a Masters of Science degree in Biology from Southwest Texas State University. Nourah opened and managed a private horse show barn in 1997. In this capacity she and her customers won many awards in the horse community; including several State championships as well as national recognition. After having her first child she gave up horses as a profession. In 1999 she took a position as Adjunct Biology Professor at Austin Community College. She entered the Graduate program at the University of Texas at Austin in 2006. She has continued to teach at Austin Community College and has recently been involved in developing a Children in Nature Collaborative in central Texas as well as statewide.

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