An Examination of the State of Science Education in Four Elementary Schools with a Majority of Native American Students

By

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Abstract

National trends show there has been a decrease in the amount of time science is taught in elementary schools in the last two decades. This study investigates the extent to which elementary schools in Native American communities face similar issues regarding science education. The purpose of this study was to examine the state of science education in four elementary schools in which the majority of students are Native American, with a primary focus on districts in the Intermountain West. Educators and administrators were interviewed to obtain descriptive data to examine the state of science education: identifying what is being taught in terms of science curriculum, and challenges teachers face. The research found that in the four districts interviewed science is being taught less than two hours a week, and often is not incorporated into the school day at all. The primary challenges teachers face are funding and support, which is reflected in a lack of science education supplies and coordinated curriculum. Without sufficient funding to purchase science materials and supplies, teachers struggle to incorporate science into the curriculum. Teachers are creating curriculum independently, and struggle with creating activities that are culturally relevant and age appropriate to Native American students. To address these challenges, this study identified the need to develop a science curriculum for K-5, which incorporates Native knowledge, to develop students' critical thinking skills.

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Chapter 1

Introduction

> "Learning is finding out what we already know. Doing is demonstrating that you know it. Teaching is reminding others that they know just as well as you. You are all learners, doers, and teachers."~ Richard Bach

When elementary students enter the classroom, teachers greet them with equal enthusiasm about the content and activities planned for the day. Enthusiasm is contagious among the students, who anticipate what the day will hold and hope they will be able to "get dirty" and learn through sensory experiences. Students become engaged when teachers provide hands-on experiences during which the student is in charge of their learning. Having tangible experiences, the ability to see, smell, and/or touch, creates a sense of excitement in students. Elementary schools are places where students will be able to explore and discover various topics that spark their interest. Providing activities and lessons across a range of academic subjects is an effective way for students to begin to explore subjects or fields that are of interest to them (Davis, 2001).

Elementary school students are at a critical point in their development; they have the ability soak in knowledge quickly. Exposure to various subjects enables students to latch onto information and develop an enjoyment for a subject area (Davis, 2001). As students develop cognitively, they gain various skill-sets to become critical thinkers and understand how concepts are connected to one another (Blank, 2013). Science education can provide hands-on learning experiences, discovery about local ecosystems, and practice in critical thinking.

Statement of the Problem

It is important to capture students' interests and motivation in science early in their education (Davis, 2001). Science incorporates life skills, critical thinking, and is

interdisciplinary, which allows students to gain additional skills outside of learning about scientific concepts (Blank, 2013). Science can provide elementary students with a skill set that can be used in several different disciplines, help students understand real-world questions and issues, and develop effective problem-solving skills (Blank, 2013).

There has been a change in elementary schools' curriculum in the last few decades as education initiatives such as No Child Left Behind and the Common Core have been implemented. Currently, the focus in elementary school education has shifted to language arts and math, with science often not a priority (Blank, 2013). Though hands-on science offers students opportunities to experience science first hand, it is not the primary focus in elementary schools nationwide. If students do not become engaged in science at a young age, it will become increasingly difficult for them to engage in scientific content as they get older, therefore missing the opportunity to gain skills that can be useful in other facets of their education (Davis, 2001).

In elementary schools across the nation, the state of education continues to be discussed and evaluated. Education initiatives continue to be developed, altered, and implemented to help increase students' achievement levels. Though initiatives continue to change and evolve, the primary goal is to set a standard throughout the country that all teachers and administrators can use to measure students' achievement successes across disciplines (Wyoming Department of Education, 2008). The majority of current initiatives focus on language arts and math, which has affected how science is being taught and the amount of instructional time in the classroom (Griffith & Scharmann, 2008).

Over the past two decades there has been a significant decrease in the amount of time devoted to science education in the classroom in public schools nationwide. Elementary school teachers spend an average of 28 minutes per day on science, compared to two hours per day on

language arts and math (Blank, 2013). With the implementation of No Child Left Behind (NCLB) legislation in 2001, schools were accountable for English and math scores; however, they were not required to report students' achievement scores in science until 2008 in their annual yearly progress reports (National Assessment of Educational Progress, 2013).

The subjects that did not require reporting of test scores, science, social studies, and the arts, were placed in lower priority in the classroom than other subjects that did require scores (National Assessment of Educational Progress, 2013). Without a strong understanding of basic scientific concepts early in their education, students may struggle in future years with more advanced concepts because they do not have a basic understanding of some foundational concepts. More challenging material often relies on building upon prior knowledge and connecting ideas, indicating that a strong educational base in elementary education can be essential for building strong secondary education programs (Davis, 2001).

Science Instruction for Native American Students in the Intermountain West

In 2008, school districts in the Intermountain West adopted the Common Core State Standards (National Assessment of Educational Progress, 2013). Scientific inquiry is an important aspect of the Common Core, believing inquiry is the foundation for students to construct an understanding and build on their knowledge of science (National Assessment of Educational Progress, 2013). The Common Core establishes benchmarks students should achieve by 4^{th}, 8^{th}, and 11^{th} grade, and standards are broken down by grade, skill, and knowledge students should be attaining by each grade level (Wyoming Department of Education, 2008).

Science instruction time in the Intermountain West is similar to national averages, and elementary teachers in the Intermountain West only spend two hours a week on science instruction (National Assessment of Educational Progress, 2013). Time has been identified as a

significant issue in schools where the majority of students are Native American (Mack et al., 2011). Some challenges associated with teaching science to Native American students that have been identified are language barriers and cultural difference that can negatively affect Native American students' enjoyment of the sciences (Rhodes, 1988). For instance in some Native American communities, elementary aged students speak the tribe's traditional language while common core science curriculum is tailored to English speakers. Further, the common core's failure to incorporate traditional ecological knowledge creates a cultural divide for Native American students who can feel disconnected from the science curriculum (Mack et al., 2011).

There are several strategies that have been identified that can improve Native American students understanding of scientific concepts in elementary school and lead to student success in the classroom. Native American students are successful when teachers highlight the importance of their cultural identities, taking a holistic approach to science instruction (Neumann et al., 1999).

Purpose and scope of the project

There is a lack of information on the current state of elementary science education in schools with a majority of Native American students in the Intermountain West. The purpose of this research project was to understand some of the current ways science is being taught in elementary schools where the majority of students are Native American, with a primary focus on schools in the American West. This research explored ways in which science is being incorporated into the classroom curriculum, teaching pedagogy in elementary schools, and identified challenges and issues teachers are facing in science education. Specifically, this project was designed to identify the approaches being used and the challenges teachers are facing in teaching science to Native American students.

Research was conducted in four school districts in the American West, with the majority of research focused on two school systems in the Intermountain West. Through a series of interviews with teachers and administrators, I began to understand how science is taught in these elementary schools. Administrators and teachers were asked questions regarding the practices of science education, how science lessons are implemented in the classroom, and the strengths and challenges of classroom science in their schools. The questions that were posed to the participants were intended to provide participants an opportunity to think critically about how science is implemented in elementary schools where the majority of students are Native American.

Research questions

Through this research project the following questions were explored:

1. What is the state of science education in elementary schools where the majority of students are Native American?
2. Are there challenges specific to teaching science in predominately Native American elementary schools? What are those challenges?

Chapter 2

Literature Review

This review of the literature covers the following areas that are relevant to the research topic and questions being addressed:

1. Importance of elementary science education
2. Nationwide elementary school classroom science practices
3. Impact of education initiatives
4. Trends in schools where the majority of students are minorities
5. Science education for Native American students
6. Strategies used for educating Native American students in science education

Importance of Elementary Science Education

Science is important to incorporate in early elementary grades because it provides an opportunity for students to be exposed to science content. Blank (2013) found that kindergarten is a critical period for students academically capturing students' interests and motivation in science. Early exposure to science education has been shown to impact students' abilities and interests in multiple areas. Exposing students to science is important because science offers a skill set that can be used in language arts and math. Science also offers skills that enable students to contemplate real-world issues, applying what they are learning in the classroom to a larger context. Exposure to science early on is important allowing students to gain interest in the sciences (Davis, 2001).

According to Davis (2001), educators believe that science education in the classroom should be taught through four different strands of learning. These four strands are the foundation

of science curricula, and each strands builds on the others to foster students' critical thinking skills. The first strand develops skills in students to investigate the rationale behind certain phenomena. Students start to interpret scientific explanations of the natural world focusing on learning science content, concepts, and how to apply student's knowledge to science. The second strand of science learning focuses on generating and evaluating scientific evidence and explanations. Students gather information to design and analyze investigations, and defend their opinions based on evidence. Understanding the natural world is the third strand of science learning. Students begin to develop scientific knowledge basing explanations on new evidence gained through experiences. The fourth strand of science learning incorporates inquiry-based activities. Students begin to participate in scientific practices, becoming skillful participants in the scientific community. Through the four strands of science learning students begin to think critically, represent personal opinions and beliefs, and can begin to interact with peers about science (Davis, 2001).

Nationwide Elementary School Science Practices

Though science is considered an important component of a student's academic development, over the past two decades, the amount of classroom time spent on science education has decreased (Blank, 2013). This change has occurred as current federal policies have been implemented in districts, which hold schools accountable for improving reading and mathematics scores (Blank, 2013). Science is not a primary focus for elementary schools due to a decrease of funding, inconsistency, and lack of science curriculum development (Dorph et al., 2007). Schools do not receive sufficient funding, federal or state level, to purchase science supplies or provide teachers with outside resources. There is a lack of investment from schools to

improve science education and several districts nationwide do not have the capacity to support science education (Dorph et al., 2007).

Currently, the primary focus in elementary classrooms is on language arts and math; teachers struggle with finding enough time in the day to incorporate science into the school day. According to the National Center on Time & Learning (2011), science is taught less than 2.53 hours a week in elementary schools. Compared to language arts and math, which are taught two hours per day (10 hours a week), science is taught 28 minutes a day on average (Blank, 2013). Science education continues to suffer due to the demands on schools to emphasize math and reading. According to Griffith and Scharmann (2008), school districts across the nation reported that there has been a decrease in the time devoted to science in order to create more time for reading and mathematics.

Educators face two specific challenges with regards to implanting science curriculum: teacher training and time. Elementary teachers often do not feel prepared to teach science (Weiss, 1993). Currently, there is a lack of elementary school teachers with a science background, and teachers tend to teach content areas that they are comfortable with (Griffith & Scharmann, 2008). This is not only a challenge in elementary schools; middle school teachers often do not feel that they have the proper training to successfully teach science (Davis, 2001; Griffith & Scharmann, 2008).

The amount of time spent on science instruction in elementary schools was identified as a significant issue. As currently structured, the traditional school calendar does not allow for students to receive a well-rounded education. As most schools are focusing on language arts and math, science is often not incorporated into the day in elementary schools. Because of the limited amount of the school day devoted to science education, students do not become engaged in the

sciences. Students are struggling on standards tests starting in the fourth grade due to the focus of elementary education shifting away from the sciences (Cole, 2006).

As students transition from elementary school to middle school, states exert pressure on students to perform well on tests. However, many students lack the inquiry skills and scientific background to do so (Weiss, 1993). Most teachers are not able to focus on science instruction; as a result, students struggle to gain inquiry-based skills required to solve real-world problems (Cole, 2006).

Lack of a strong support network of collaboration among colleagues is another challenge that science teachers face across the nation (NCTL, 2011). Schools districts are not providing structured time and space for teachers to share ideas and collaborate, so there is no shared vision of science from one classroom to the next (Davis, 2001). Nationwide, elementary schools do not have a set science curriculum K-5, putting pressure on local teachers and school districts to create their own science curriculum (Blank, 2013).

The Next Generation Science Standards (NGSS) are the first national science standards to be developed since 1996 (NRC, 2007). Before NGSS was developed, school districts relied on the American Association for Advancement of Science's (AAAS) Benchmarks for Science Literacy (Benchmarks) (AAAS, 1993) and the National Resource Council's National Science Education Standards (NSES) (NRC, 1996). Individual states and districts were creating their own science standards based on the recommendations of these two documents (Schmidt, 2003). NGSS was created by a group of scientists, educational researchers, and educators. Published in 2012, NGSS is a compiled set of frameworks describing what all students K-12 should know (NRC, 2012). NGSS is constructed to build on previous knowledge, generate scientific evidence, understand the natural of scientific knowledge, and actively participate in scientific practices

(NRC, 2012). States have the option to adopt NGSS, and as of March 2013 eleven states and the District of Colombia had adopted the standards.

Impact of Education Initiatives

School districts across the nation struggle with how to effectively implement national education initiatives. "No Child Left Behind" was implemented in 2001 in every public school in America. The rationale behind the initiative was to increase student achievement and hold schools more accountable for student progress (Duschl et al., 2007). In 2008, the Common Core State Standards, a similar education initiative, was introduced. Common Core set benchmarks for what students should learn in mathematics and literacy at each grade level (NCTL, 2011).

Reform efforts continue to be developed at a federal level with the goal of increasing scientific literacy in the classroom. In November 2009, President Obama announced the implementation of the Educate to Innovate Campaign. The goal of this education initiative was to increase STEM literacy among all American students (NCTL, 2011).

In recent years there has been a shift in elementary schools to focus their curriculum on literacy and mathematics (Dorph et al., 2007). Students are being tested in language arts and math, and scores must be reported to the state annually. Schools were not required to report science scores until 2008, and so science is typically not a priority in the classroom. If educators are not held accountable, science will not be incorporated into the school day (NCTL, 2011).

Trends in Schools Where the Majority of Students are Minorities

Students from minority cultures often experience a disconnect between their cultural norms at home and the classroom norms when their culture is left at the door. According to Aikenhead and Olugbemiro (1999), students coming from different cultural backgrounds go through a "border crossing" when entering school, moving from one social group to another.

Students need to feel empowered to successfully cross borders into the classroom. Cultural values need to be incorporated into the classroom, and teachers need to take a cross-cultural approach to education. Creating opportunities for various cultural groups to discuss their personal traditions and values will better engage students in the learning process (Aikenhead & Olugbemiro, 1999).

Teachers working with students from a diverse background can face additional challenges in the classroom. Students from diverse backgrounds can have different levels of family and community support, which may affect their attitude towards school, in particular science education (Blank, 2013). Students who have the ability to go to museums and similar settings where they can engage in science outside of the classroom may have an advantage over student who do not have those experiences. If students do not have access to these experiences, they have the ability to lose interest in science content at an early age, and often will not pursue an interest in inquiry-based learning (Blank, 2013).

Schools with a majority of minority students often have a difficult time attracting quality teachers with the necessary training (Davis, 2001). It can be difficult and time consuming for teachers to prepare lessons that incorporate a student's culture into the science content. Often educators are not drawn to schools with minority students because of the additional time and energy required to create successfully meaningful educational experiences for minority students (Davis, 2001). To engage minority students in science, teachers often need additional training in how to deliver culturally relevant instruction (Barton et al., 2003). The scientific process, scientific writing, and the work of different scientists need to be incorporated into the curriculum to create student buy-in (Barton et al., 2003).

Barton et al. (2003) and Aikenhead & Olugbemiro (1999) found that there are three components that need to be present to engage minority students in science education. Curriculum should be relevant to students, it should build community within the classroom, and students should learn to interpret science as a tool for change (Aikenhead & Olugbemiro, 1999). To effectively instruct minority students, teachers need to be transparent about the goals and objectives of classroom activities. This can help students build on prior experiences and understand how lessons build off each other (Barton et al., 2003). Teachers should facilitate experiences that help build a sense of community among students, creating a positive learning environment (Barton et al., 2003). Once an environment is established where students feel supported, students will then feel more invested in their learning (Barton et al., 2003). Meaningful science experiences for minority students come from teachers making connections that students will understand, empowering them to think critically (Barton et al., 2003).

Science Education for Native American Students

In general, science education literature discusses the Native American population as a whole and does not differentiate among tribes. However, it was recognized as important that different tribes view science through their own tribal lens. It is important to consider that different tribes will emphasize certain aspects of their culture and values in education (The Education Trust, 2013). For this project, the literature review looks at Native Americans as a specific demographic, understanding that there are differences among tribes and elementary science education issues.

It is important to understand the history of Native American education as it has had a large impact on current science education programs and how they are perceived. In the late 19th century Native American students were sent to boarding schools with the intention of

"cleansing" Native Americans of their traditions and culture and introducing them to American values and beliefs. Boarding school curricula focused on educating Native Americans in Christian doctrine, hoping to assimilate students into mainstream society. In the early 1900s, criticism of boarding schools increased and investigations were conducted to understand the conditions of schools (Cross, 1998-1999).

The Meriam Report published in 1928 documented the state of Native American boarding schools (Cross, 1998-1999). As a result, federal aid was given to local school districts and reservation day schools, and public schools were established on Native American trust lands. The Indian Reorganization Act of 1934 created more day schools on reservations, provided students with textbooks in Native languages, and emphasized the teaching of Native American cultures and languages. In 1970, a National Study of American Indian Education reported the curricula of federal reservations schools typically mimicked that of public schools (Garroutte, 1999). Two years later the Indian Education Act was amended to include Bureau of Indian Affairs (B.I.A.) programs that created a precedent for recognizing urban Native American populations, and deemed tribes eligible to receive federal education funds (Cross, 1998-1999). As a result, administrators in Native American schools struggle to create a curriculum that is culturally relevant.

Since the early 1980s, the U.S. federal government has become aware of specific issues facing Native American schools and has been developing and implementing programs to address these concerns (Lomawaima, 2000). Two important needs were identified: local power and control. These two issues have emerged and evolved in Native American education, and Native American schools now have the power to control education on their lands and tribes now have the authority to implement their own education initiatives creating a significant shift in how

Native American education is applied. However, many schools continue to struggle to construct curriculum that build on the strengths of Native languages and culture (Swisher & Tippeconnic, 1999).

To create a positive learning environment for Native American students, it is important to educate the whole child (The Education Trust, 2013). Students may face cultural barriers in school, often feeling like they must leave their cultural identities behind as they enter school. As a consequence, students often fall behind and will often drop out before finishing high school (National Indian Education Study, 2011).

One of the challenges many Native American schools face is finding enough qualified teachers who have training or experience working with Native American students (The Education Trust, 2013). Many teachers do not recognize either Native students' knowledge, or their learning strategies (Nelson-Barber & Estrin, 1995; National Education Study, 2011). Engaging qualified teachers with an understanding of Native American cultures and values is fundamental to creating lessons and activities that are relevant to the student population (The Education Trust, 2013).

To create positive learning environments in the classroom, teachers need to draw on student cultures and traditions. The role of the teacher is to transmit effective practices around language and cultural maintenance, rather than focusing on increasing student achievement (Deyhle & Swisher, 1997). Studies have shown that Native American students tend to learn best using the "watch then do" strategy rather than the "trial by error" approach often taught in Western schools (Nelson-Barber & Estrin, 1995; The Education Trust, 2013). To fully engage Native American students in the learning process, teachers need to understand how Native

American students learn, paying attention to tribal differences, and develop lesson plans and activities that will help students succeed.

Creating appropriate space and hands-on experiences are two factors that have been shown to be effective in Native American Science education. Creating space in the classroom for students to relate material to their Native traditions and cultures is an important aspect of creating positive learning environments. When teachers highlight the importance of their students' cultural identities, students are propelled to further their understanding of the material being taught (Neumann et al., 1999; The Education Trust, 2013). Hands-on experiences have been used successfully to help students draw on their own cultural knowledge and experiences in order to grasp concepts engage them in the material (Neumann et al., 1999).

Educators in Native American communities struggle to educate students while respecting cultural boundaries and traditions (Neumann et al., 1999). Many Native American tribes teach children to avoid eye contact and teachers often enter schools without the proper training and background to work with Native students (Massey 2004). Though education jobs are often some of the best (due to job stability) found in Native American communities, districts have a difficult time recruiting educators who understand how to create culturally relevant lessons and activities (Massey, 2004).

Native American students may lack some of the necessary language arts skills when they enter kindergarten. Students often enter school systems significantly lacking vocabulary development and often cannot recognize words or letters (Margolis, 2007). Children in Native American communities have little or no access to books, magazines, or other sources of current events (Reily, 1980). Students will often enter kindergarten without having seen or heard adults reading (The Education Trust, 2013). Native American communities have begun addressing this

issue by creating early learning programs to encourage reading in classrooms and in students' homes (Margolis, 2007).

The Reading Is Fundamental (RIF) program is being adopted in several schools in Native American communities (National Assessment of Educational Progress, 2013). RIF make books available to low income communities, putting books in the hands of children. Schools in Intermountain West have worked with RIF to make books available to students in the classroom, and encourage students to take books home with them to continue to explore their interests. RIF's goal is to inspire children in low-income households to read, because reading is believed to help individuals become "productive people who help create strong communities" (The Education Trust, 2013).

The Bureau of Indian Affairs is trying to address the issue of illiteracy by creating programs and incentives for schools to increase student interest in reading. Annually, the Bureau of Indian Affairs publishes a reading list filled with books published by Native American authors or regarding Native American stories, traditions, and values. This list is aimed at young readers encouraging them to become invested in their cultural identity while enjoying reading (The Education Trust, 2013). Schools in Native American communities are also struggling with classroom textbooks. Often textbooks are created based on Western beliefs and do not include traditional values. Students struggle with textbooks unable to relate to the content and examples discussed in the literature (The Education Trust, 2013).

Though Native American schools face several challenges, many districts are creating programs and education initiatives to address these issues (The Education Trust, 2013). The first step is creating a dialogue defining the specific challenges and developing approaches to create a positive learning experience for students. Administrators play a crucial role in trying to address

issues in the classroom while taking into consideration problems faced by Native American communities (The Education Trust, 2013). Conversations among community members and within districts will lead to a greater understanding of the student population and issues in there (National Indian Education Study, 2011).

Effective Strategies for Educating Native American Students in Science

Holistic education is a strategy often used to teach science content to Native American students. This process has been introduced in school systems to address the lack of interest some Native American students feel in school. Rhodes (1988), defines holistic as "creating a broader context for students to take ownership of an issue, and become invested in a subject that affects them" (Rhodes, 1988, p.23). Over the decades the importance of holistic education, creating opportunities for teachers to connect material to students cultural values and beliefs, continues to be discussed (National Indian Education Study, 2011).

Science and math can be understood as interpretations of cultural knowledge or cultural products rather than objective bodies of truth. For students to successfully engage in science, innovative curriculum needs to be developed that incorporates Native knowledge. In many schools, students are being taught science content through Western views and objectives, and students are unable to relate to the material. Native ways of learning are often overlooked in an academic environment. Western values interpret cause and effect relationships as linear opposed to Native American values, which tend to follow patterns to allow for many possible directions in cause and effect relationships (The Education Trust, 2013). This is one example of the difference between how Westerners approach science opposed to Native Americans. With a fundamental difference in the interpretation of science, schools serving Native American

students struggle to engage their population in science education (Nelson-Barber, & Estrin, 1995; National Indian Education Study, 2011).

Models of inquiry that incorporate traditional scientific knowledge should be considered when curriculum is constructed (Garoutte, 1999). Science curriculum should be a combination of traditional knowledge and scientific information (Garoutte, 1999). Currently Native Americans struggle with how scientific content in the classroom is presented to them (Nelson-Barber & Estrin, 1995). Students need to be able to connect formal symbolic representations to real objects, actions, and experiences. If teachers create lessons and activities that emphasize these components, then students will create their own understandings rather than just go through various learning procedures (National Indian Education Study, 2011).

Teachers are a fundamental component of a student's education and need to facilitate experiences rooted in cultural relevance. Through problem-solving activities that emphasize observation, classification, and categorization, students are more likely to understand scientific concepts (The Education Trust, 2013). Teachers also need to provide experiences to students that are rooted in modeling instead of expecting students to understand concepts through teaching it once and students memorizing content (National Indian Education Study, 2011). Lessons and activities in science need to incorporate language arts skills (National Indian Education Study, 2011). "Science teachers need to be concerned with developing listening, reading, speaking, and writing skills of Native students" (Rubendall et al., 1988, pg.160). Educating the whole child is crucial for instructing Native American students, and teachers must incorporate other aspects of education into science lessons.

Science content needs to have a real-world connection to Native American students. Teachers should have an understanding of issues related to the population they are working with,

creating space where conversations can take place for students to make connections between science, math, technology, and real world issues (Nelson-Barber & Estrin, 1988). To create student engagement in the sciences, teachers can draw upon local examples incorporating both plants and animals in their region (Rubendall et al., 1988) and include descriptions of both the traditional and modern uses. This creates space for students to understand the interface between traditional and Western science (The Education Trust, 2013).

Creating hands-on experiences for students is important, and experiences teachers provide need to be rooted in issues relative to students. Native American students may have first-hand experiences with issues regarding soil erosion, conservation, and it is important to draw upon these experiences. These experiences can also be used to create connections to formal science fields such as ecology, genetics, and geology. Teachers should be utilizing student experiences to build from, drawing their prior knowledge into the scientific process. Teaching techniques should be tapping into these resources to help improve student mastery of scientific concepts (The Education Trust, 2013).

Another framework of Native American science education is the importance of traditional ecological knowledge (TEK). TEK, "the knowledge, practice, and belief concerning the relationship of living to one another and to the physical environment" is held by people in relatively non-technological societies with a direct dependence upon local resources"(Kimmerer, 2002; pg. 2). Encompassing cultural beliefs, TEK is rooted in traditional knowledge and weaves in Western beliefs. Incorporating TEK into Native American schools allows an opportunity for teachers to integrate cultural values and moral perspectives into the curriculum (Kimmerer, 2002).

Chapter 3

Methods

A qualitative research approach was used in this study to determine current practices, resources, and challenges of science education in elementary schools in four school districts where the majority of students are Native American. This research project was designed to address the following research questions:

1. What is the state of science education in elementary schools where the majority of students are Native American?
2. Are there challenges specific to teaching science in predominately Native American elementary schools? What are those challenges?

There is a lack of current information on the state of elementary science education for Native American students in the western United States and for the Intermountain West region in particular. The purpose of this study is to research the state of science education in four elementary schools in which the majority of students are Native American. Using a series of interviews, the researcher evaluated the state of science education among this sample group by learning about the science curriculum being taught and classroom practices being used. Interviews were conducted to obtain descriptive data to examine the state of science education. The overall goal of the study was to understand how science is being incorporated into the classrooms in elementary schools, and identify the challenges the teachers interviewed are facing in science education. To answer these questions, data were gathered through semi-structured interviews with administrators and teachers from "Native American" school districts from three different western regions, the Pacific Northwest, the Intermountain West and the Southwest. The

researcher's written request to work with human subjects was presented and approved by the Institutional Review Board (IRB) at the University of Wyoming in the Fall 2013 (See appendix A for approval letter). This graduate research was conducted from January through March 2014 from the University of Wyoming, Laramie, Wyoming.

Rationale for Qualitative Research

As a result of the nature of the research questions, qualitative research methods were used for this study. Qualitative research describes, "what is" and how variables can be disturbed across a population. This method was chosen because the researcher was interested in "understanding how people interpret experiences, and what meaning attributes to their experiences" (Merriam, 2009 pg. 6). Through semi-structured interviews administrators and teachers portrayed an accurate depiction of current science education curriculum and practices. By using interviews as a qualitative research method, one is able to understand and interprets terms more accurately than other research methods. Qualitative research methods allow themes to emerge throughout the data collection process (Merriam, 2009).

Participation Selection

Internet searches were conducted to identify school districts that were located in Native American communities. The researcher searched for districts that fit the following criteria: (a) student population was majority Native American, (b) was an elementary school, and (c) located in the United States. The four districts were selected based on meeting the criteria and their willingness to participate in the study. Prior to the start of the study superintendents in the four school districts gave written approval that the researcher could conduct interviews with educators in their districts.

Internet searches were used to identify administrators and teachers who worked in the four selected districts in which the majority of the student population are Native American. Participants were selected based on the following criteria: (a) work in one of the identified school districts where the student population is primarily Native American and (b) have an understanding of the science being taught in the elementary schools.

Potential participants were initially contacted via email. The initial email contained a brief introduction to the research project (see appendix C for initial email). Participants were informed of the purpose and importance of the study, and their role in accepting the invitation to participate. An informed consent form (see appendix B for informed consent form) was included in the initial email.

Snowball sampling was used to gain additional participants. This method uses existing participants to provide names of other individuals who fit the criteria of the study. Those who were referred by others were later contacted and an initial email was sent to them. The researcher chose to use this method to increase the sample population. This method is especially useful when it is difficult to locate members of populations or when no sampling frame is available (Merriam, 2009).

Once confirmed, interviewees established a time, date, and location to conduct the interview with the researcher. Prior to interviews, participants received the interview questions to review and filled out the informed consent form, which was returned via email or in person.

Data Collection

Interviews were conducted with a total of twenty-one participants. Participants were interviewed from both private (District A) and public (District B) school systems in the Intermountain West region, one public district in the Southwest (District C), and one public

district in the Pacific Northwest (District D). The sample (21 participants) consisted of both administrators and teachers from the four districts (Table 1). Interviews were conducted in person and using Skype. Interviews with administrators and teachers in the District C were conducted over Skype, while the rest of the interviews were conducted in person. Interviews conducted in person were done in schools in which the participants worked.

Audio recordings were used for those participants who agreed on the informed consent form. Detailed notes were taken during all interviews. Interviews averaged 40-60 minutes with all participants. Following the interviews, the audio recordings were transcribed into text. Recordings were listened to a second time, to ensure accuracy of transcription and to edit any mistakes.

Table 1. *Participants interviewed.*

School District Region	Administrators	Upper Elementary School Teachers (3^{rd}-5^{th})	Lower Elementary School Teachers (K-2^{nd})
District A	2	1	3
District B	2	3	2
District C	2	2	1
District D	2		1
Total interviews: 21			

Data Analysis

Categories and general themes were identified based on reading the interview transcripts. During interviews notations were made and themes to the questions answered were highlighted during the interviews. General themes among all the districts interviewed were identified based on frequency of similar responses among participants. In addition, science practices and

challenges were identified for each school district based on frequency throughout interviews, and were included in the results. The results were summarized in tables and written analysis.

Individual identities were kept confidential throughout the study and analysis. From the beginning of the research, subjects were given a random numeric interview code to protect their privacy and identity. The numeric code was used in the final paper to identify interviewees while maintaining and preserving their anonymity.

Limitations

A limitation of the study was the short time frame the researcher had to complete interviews. With additional time, there could have been more interviews conducted with additional teachers in the four school districts. The available time with each of the schools did not allow for interviews with as many teachers as the researcher would have liked.

An additional limitation to the study was the difficulty of identifying willing participants. Though several initial emails were sent, and the researcher had permission from the head of districts to conduct interviews, teachers and administrators were apprehensive about participating in the study. However, once a teacher or administrator agreed to participate in the study, they were very helpful in engaging their colleagues in the purpose and importance of the study.

This study falls short of providing a comprehensive evaluation of the state of science education in the interviewed districts. The qualitative data reflect generalizations about elementary school science education in these four school districts with a majority of the student population being Native American. Though efforts were made to interview a large cross-section of teachers and administrators in a variety of school districts (and three regions of the country), there is a risk that the data may be biased due to small sample size and time constraints.

Chapter 4

Results

The results of the interviews are presented based on the overall research questions: the amount of time spent teaching science, how science is being taught, and the strengths and weaknesses of the science curricula and programs. The results are organized according to the specific research questions participants were asked during interviews.

This research addressed the following questions:

1. Currently, how is science education incorporated into the teaching day?
2. How often is science typically taught in a week? How many hours are devoted to science?

Additional questions that arose through the course of the interviews were:

3. Is there Support from Administrators in your District?
4. Does your school have a science program (textbook or science kit) in place?
5. Are the challenges specific to teaching science in predominately Native American elementary schools? What are those challenges?
6. What are the strengths of classroom science in your school? What are the challenges of classroom science in your school?

How is science education incorporated into the teaching day?

There is not a set science curriculum for K- 5 grades in the any of the participating school districts. If teachers are incorporating science into the curriculum, they are creating lessons on their own. Teachers often will use the Internet as a resource to find activities and videos to supplement the textbook.

When science is taught, teachers try and incorporate Native knowledge into science lessons. Teachers do this by tying science content into traditional stories and Native American values. Another way teacher's incorporate Native knowledge is by exposing students to local ecological issues faced by their communities and incorporating these into science lessons when possible. Teachers try to bring local issues faced by communities into the science curriculum, to create and encourage a dialogue about resources and the current local issues.

Though there is not a set curriculum until fifth grade, schools are still held accountable for science content. In fourth, eighth, and twelfth grade, students are required to take standardized tests created by the local states. In all three districts, student test scores in fourth grade are below average. Educators in all the districts interviews stated that students are not receiving enough science content to excel on the standardized tests.

How Many Hours are Typically Devoted to Science in a Week?

The amount of time science is taught in the elementary schools was similar across the four school districts. In the lower elementary grades, science education is not a priority; the primary focus is on language arts and math. In all districts interviewed, the morning curriculum focus is on language arts and math, which leaves a small block of time at the end of the day for science. If science is incorporated into the school day most teachers have between half hour to forty-five minutes to teach science at the end of the day (Table 2).

In the lower elementary grades, teachers struggle to integrate science into the curriculum. Science and social studies are supposed to be taught in the same period, at the end of the day. "You know so much time is spent on the reading and math now. Science and social studies and the arts are taking a backseat" (Interviewee 11). Across all four school districts, teachers alternate between teaching a unit of social studies and science. Neither science nor social studies

are incorporated into the curriculum on a daily basis. As students progress into the upper grades the amount of time science is taught increases. Beginning in sixth grade, science is incorporated everyday for fifty to sixty minute blocks of time.

Table 2. *Time science is being taught in the classroom.*

School District Region	Lower Elementary Grades (K-2nd)	Upper Elementary Grades (3rd-5th)	Middle School (6th-8th)
District A	Rarely taught in Kindergarten; 1st and 2nd taught 20 min. a day	Taught 30 minutes at the end of the day	55 min. everyday
District B	Science is taught less than 50 min. a week	4th grade students are exposed to science daily; 5th grade students get 40 minutes a day	50 min. everyday
District C	30 min a day	Teachers are mandated to teach 1 hour of science a day starting in 4th grade	60 min. everyday
District D	Incorporated into every subject	Incorporated into every subject	Incorporated into every subject

Is there Support from Administrators in your District?

District administrators are supportive of the current science practices taught in K-5. Across districts, administrators agreed that there is enough time allocated to science, and do not believe teachers are effectively teaching science. There is verbal support from administrators to incorporate more place-based and hands-on activities. Educators believe incorporating place-based activities would create student buy-in from students and increase interest in the sciences. Though administrators are encouraging teachers to teach science, the primary focus in all regions is on language arts and math.

What are the Strengths of Classroom Science in your School?

Administrators and teachers in all districts believe their greatest strength is the dedicated teachers in their schools. Teachers care about the student population and put the needs of the students first. Content sometimes is put aside, due to the teachers' commitment to ensuring the needs and concerns of students are met. Teachers report prioritizing the creation of a positive learning environment, and this always takes precedence before content. Teachers and administrators interviewed discussed that turnover rates were not high in their districts. However, in District A and B, there is often a high turnover rate for the position of superintendent and curriculum director.

Small class size is another strength mentioned throughout the interviews. "We can do a lot when the class is small. I like to go around to each student to see if they are getting it, so I think that is a big strength" (Interviewee 13). Having a small class sizes allows teachers to have more one-on-one time with each student and alter curriculum to meet student's needs. In all districts, community members are also supportive of science being incorporated into the school day. Elders are asked to come into the classroom to teach Native knowledge creating a dialogue between generations. Community members are eager to work with students and supplement the science curriculum with traditional Native knowledge.

What are the Challenges of Classroom Science in your School?

All interviewees mentioned that students entering kindergarten are already academically behind in language arts and reading. Most students start school not knowing how to read or recognize letters, which puts them at least a year behind developmentally and academically. When students are that far behind, the teachers in the lower grades feel they need to focus on reading and language arts and not on science. These districts also feel pressure to improve

student tests scores in reading and math. They all noted the shift to focus on language arts and math in schools K-5.

Two specific challenges to elementary science education were evident across interviews: time and support. Teachers do not have enough time in the day to incorporate science, and students have a difficult time retaining material. Beyond the classroom, there is a lack of parental support for their children's education. Without parental support, educators indicated students are not discussing science at home. Administrators have implemented professional development for teachers, however the focus of many of the workshops is on math and language arts. Without training opportunities, teachers often do not feel comfortable teaching science unless they have come from a science background.

In all four districts interviews, there was a disparity between the goals of the administrators and teachers. During interviews, several teachers mentioned that administrators do not have an accurate understanding of the science being taught in classrooms. " From the administration I hear they do not have the background in science, therefore it has affected their interest" (Interviewee 8). Information is being lost and administrators may not know explicitly what is being taught in the classrooms in their schools.

In the Intermountain West, teachers and administrators from the two districts, a private (A) and a public (B) school system, were interviewed. In District A, science is primarily taught in the lower elementary grades through a gifted and talented program, which has 40 students out of the school's student population of 250. However, some science is being taught in the classroom and the gifted and talented program does a school wide project annually in which all students in the school participate. The time devoted to science slowly increases in each grade, and middle school students receive science instruction fifty-five minutes a day (Table 2).

Similar to District A, only a small amount of time a day is devoted to science in District B. With a strong focus on language arts and math, teachers dedicate less than fifty minutes a week to science instruction (Table 2). Teachers rotate between social studies, science, and health units, teaching a unit in one subject for a week and then a unit in a different subject the next week. As students get older, science is increasingly emphasized and is taught on a daily basis. Although science is a greater focus in the upper elementary grades, teachers do not feel like they have adequate time to do hands-on exploratory activities.

Teachers in District C have a similar time deficit in science education as teachers do in Districts A and B. "In our district K-2 they are supposed to be doing it an hour a day, but I am guessing if we get thirty minutes a day that is good" (Interviewee 3). In the lower elementary grades teachers are fortunate if they have the opportunity to have 30 minutes of science instruction each day. In order to address the science deficit issue the district in the Pacific Northwest has implemented a new science program this year.

Starting in the fourth grade, teachers must incorporate an hour of science into each school day. Educators in District C indicated that although administrators mandate teaching science instruction daily, it is the subject most often pushed aside in the face of time constraints. Teachers and administrators are excited about this new initiative promoting daily science instruction starting in fourth grade, believing it will help increase science test scores.

In District D, teachers are trying to incorporate science everyday starting in the lower elementary grades. Though there is a large emphasis on math and language arts, teachers are able to incorporate science into the school day in the afternoons on a daily basis. Science instruction begins in the Montessori-based preschool, which incorporates critical thinking and hands-on investigations into the curriculum. The preschool program was developed a few years ago with

the intention of encouraging students to read, and so when they enter kindergarten they are not academically behind. Once teachers see an improvement in student achievement levels in language arts, they are encouraged to integrate science into their daily lessons.

In kindergarten through second grade in District A, teachers develop their science lessons and activities on their own. "When I came last year there was no set curriculum in science. Everything I teach is what I want to do" (Interviewee 10). There is no set science curriculum K-2 (Table 3), so teachers must develop their own lessons and activities based on their own expertise and experience. In first grade, the teacher is emphasizing science throughout the day, reading

Table 3. *How Science is Being Taught.*

School District Region	Lower Elementary Grades (K-2nd)	Upper Elementary Grades (3rd-5th)	Middle School (6th-8th)
District A	Lessons and activities are created by the teacher using the internet as a resource.	Teachers use a textbook and supplement the text with outside resources. Project Wet and Project Wild are resources used, and teachers have access to Foss Kits.	Science is primarily taught through a textbook; there is an emphasis on hands-on activities
District B	Teachers read books to students with scientific theme or science magazines. Teachers also have access to ipads.	Science is taught through a textbook.	Science is taught through a textbook and the teacher tries to incorporate hands-on activities if there is time.
District C	Foss Kits are the preferred way to teach science.	Foss Kits are used along with the textbook.	Foss Kits are used along with the textbook.
District D	Hands-on experiences are emphasized, and teachers have access to Foss Kits.	Students travel to a local university once a month for place-based science lessons to supplement the textbook.	Students travel to a local university once a month for place-based science lessons to supplement the textbook.

science books during reading time, and incorporating science into daily math lessons. Since there is only a limited amount of time allotted for science, the first grade teacher incorporates science content into other subjects, exposing her students to science as much as possible.

The upper elementary grade teachers primarily rely on a textbook to teach science content. To supplement the text, teachers have access to Foss Kits for use of materials and to guide students through hands-on activities. "We use Project Wet and Project Wild, and believe these are our greatest resources" (Interviewee 12). Teachers also use resources from Project Wet and Project Wild to supplement the textbook, believing these resources to help engage students in science content.

In District B, teachers struggle in the lower grades to incorporate science activities into their daily schedules. Though Foss Kits are available to use, many elementary teachers incorporate science from reading books. Teachers have access to iPads for all students in K-5, which they occasionally use in the classroom for students to explore different science games or applications. Though teachers have access to iPads, several do not feel comfortable with the technology and only use it sparingly.

District B teachers rely on the textbook as the primary resource for teaching science; however, they do incorporate hands-on activities and experiments. Lecture is the primary method they deliver science content at the middle and high school levels. Once students reach high school, technology is integrated more frequently, helping to engage students in the material. In middle and high school teachers develop their own lessons based on the textbook. However, these lessons and curricula are not automatically shared among faculty. A science curriculum for K-5 is currently being developed and teachers hope to begin to incorporate it into their teaching starting in 2014-15.

Teachers in District C have a different approach for teaching science than the districts in the Intermountain West. Similar to schools in the Intermountain West there is not a set curriculum K-5, putting pressure on teachers to create lessons individually based on the textbook. However, teachers in District C use Foss Kits as the primary approach to teach science; the kit includes all the components teachers need. "The Foss Kit prepares me and the students, and the kit makes it a lot easier for me to prepare lessons" (Interviewee 1). Though Foss Kits are the primary resource used to teach science, the 3rd/4th grade teacher also incorporates content from the textbook into lessons. The 5th/6th grade teacher alternates between the Foss Kit, textbook, and outside resources from the Internet. Historically, teachers in District C only taught with the textbook, and over the past few years they have begun to diversify their curriculum.

District D faces similar issues as districts in the Intermountain West as funding is a constant issue, and teachers sometimes do not have the supplies and materials needed for activities. Instead of using funding to bring in outside materials, teachers in this district focus on the surrounding outside environment to guide science instruction. "A lot of science curriculum is place-based education and caring for this place" (Interviewee 4). Administrators believe education should be relevant to students' lives, and solving real problems should be the focal point of science. Water quality, gardening, sustainability, and plant sciences are what the science curriculum is based upon. The scientific process is also a key component of the science curriculum, which teachers introduce to students in the lower elementary school and continue to emphasize throughout grade levels.

Educators in District D are working on developing a science curriculum for grades K-5. Recently there has been an emphasis on developing a cohesive science curriculum incorporating Foss Kits, environmental studies, and hands-on activities. The curriculum being developed is

called “Native Science Knowledge” and the premise is educating the whole child to become active in one’s community. The local Board of Education is supportive of the curriculum being developed, and are planning to duplicate the education model used in District D at over sixty preschools and lower elementary schools in nearby districts as well.

District D uses outside resources to supplement their science curriculum. On site there is a university professor who acts as a resource for teachers, and once a month students (3^{rd}-8^{th} grade) have an opportunity to travel to the university. Students in the teacher-training program do hands-on place-based activities with students, and teachers have taken various activities and integrated them into their curriculum.

Table 4. *Support from Administration.*

School District	Support From Administration
District A	Teachers are supported, however collaboration is not encouraged.
District B	Teachers are not sharing lessons, and there is a lack of communication and collaboration K-12^{th}.
District C	Administrators are encouraging of classroom science practices. Due to the small size of the school, teachers work together to develop lessons.
District D	Administrators are supportive of teachers, and hold weekly meetings for teachers to share ideas and activities.

In the Intermountain West, there is a lack of unified direction from individuals in administrative roles. Administrators support science being taught in the classroom and encourage teachers to incorporate hands-on activities into their lessons. However, there is no encouragement from administrators for teachers to collaborate and share activities, lesson plans or curricula. With pressure on teachers to meet standards, administrators interact with teachers separately and do not support collaboration, sharing of lessons, or weekly meetings to discuss

what is being taught in their classrooms. In District A, administrators view individual schools as separate entities, each with its own set of issues. School districts are not looking at other schools around the country with similar demographics and issues for ideas on how to engage students effectively in science content. “We do not look at any reservations as models. Every reservation is different and so why would I look at different schools” (Interviewee 9). District A works independently to address students’ needs and to create curriculum tailored to Native American students.

Compared to Intermountain West districts, there is a considerable amount of support from administrators in Districts C and D. Administrators in District C are supportive of classroom science practices. Administrators in this district understand they need to focus on language arts and math; however, they believe science also needs to be incorporated into the curriculum. District D administration provides support from the top down to encourage teachers to share and work together to create lesson places. Meetings are held every Friday afternoon for teachers to discuss what they are doing in their classroom and share activities that might be of interest to other teachers.

Table 5. *Reported strengths and weaknesses of Classroom Science.*

School District	Strengths of Classroom Science	Weaknesses of Classroom Science
District A	Small class size, gifted and talented program, and collaboration among teachers	Funding, slow internet, and a lack of resources
District B	Dedicated teachers, greenhouse, and support outside organizations	Lack of confidence in teachers without a science background
District C	Small class size, support from administrators, and integration of place-based education	Lack of science curriculum, and lack of resources
District	Collaboration among teachers, and integration of place-based education	Funding, lack or resources, and student interests in science curriculum

Strengths of Classroom Science

District A

The interviewees identified several strengths of the elementary science education program in District A. “The biggest strength is classroom size. We can do a lot when the class is small” (Interviewee 10). Having small class sizes allows teachers to alter lessons and activities to fit the needs of their students. Another strength identified in District A was the gifted and talented program, which serves 40 students in the school. Students have the opportunity to experience hands-on science outside of the classroom, and work with the community. The gifted and talented program acts as a bridge for teachers to incorporate more science into the classroom, building off the content discussed in the gifted and talented program. As this program continues to grow students continue to enjoy learning science in a hands-on way.

District B

Elementary teachers in District B are dedicated to educating students in Native American knowledge, incorporating indigenous science and storytelling in the classroom. A few years ago an elementary school teacher wrote a proposal for an afterschool science program that integrated the language arts and math. District B received the grant, and elementary students had the opportunity to stay after school three days a week and go on field trips one Saturday every month. The program was deemed a success, however funding has since run out and no one has written a similar proposal.

District C

Integration of place-based education came up in all interviews with educators in District C. Located near the ocean; teachers take students outside to learn about tide pools and marine biology. Hands-on activities are also incorporated into the science curriculum, and administrators

support teaching science in dynamic and innovative ways. Funding is not issue; teachers have access to wonderful lab facilities and are encouraged to lead experiments in the classroom.

District D

The greatest strength of classroom science in District D is their multi-disciplinary approach to education. “I want all our kids to come out of this school as effective problem solvers. I want them to be able to take the scientific process and apply it to helping solve problems in the community” (Interviewee 4). Teachers do not see each subject as a topic that stands alone. Teachers in District D incorporate science into language arts, math, and cultural subjects with the aim of fostering well-rounded students.

In addition, science education teachers in District D are provided opportunities for professional development. Two years ago teachers attended an outdoor education conference that was offered over two summers; they were able to workshop with other teachers and share science lessons with each other. Lessons were focused on science and place-based education. Once teachers completed the second summer workshop, teachers received $2,000 for science supplies. Teachers and administrators continue to look for similar opportunities, and hope to gain insight and skills from other districts around the country.

Challenges facing Classroom Science

District A

Administrators and teachers in District A identified funding as an obstacle. Without adequate financial support, teachers don’t have access to resources to take students on field trips or purchase supplies for hands-on activities. Teachers see the Internet as one of their greatest potential resources, however the connection within the school is slow and unreliable. This can

create significant issues if a particular lesson plan is relying on resources from the internet.

District B

Administrators in District B indicated teachers did not have confidence in science content, identifying this as a weakness of science education. Administrators indicated that there is a shortage of elementary school teachers with a science background, and existing educators do not feel comfortable with science content, and therefore focus on areas of their expertise at the expense of science instruction.

A few years ago, K-12 teachers would take students to a nearby river to measure water quality. However, these field trips stopped due to tribal politics. Non-Native teachers were reportedly asked to stop bringing students to the site because they were trespassing on tribal lands. Water is an important issue on the reservation, and these activities provided students with an understanding of both local ecology and community issues. “Water is an important topic here, and when we tie in the culture of the Treaty Rights, and how water is seen in a traditional sense, and you have those discussions as much as you can” (Interviewee 7). Without access to the river, teachers feel they do not have as many opportunities activities outside.

In District B, there is also a lack of communication and collaboration at the administrative level. Administrators identified the afterschool science program as a great way to engage students in science; however, they also saw it as a burden. Having teachers stay after school meant administrators would have to compensate their time with additional pay, and were worried teachers would get burned out. Administrators are encouraging science to be taught, but believe it should be incorporated into the school day.

District C

The challenges this district faces are similar to those in the Intermountain West. In

interviews educators discussed that science has always been a deficit in the area and administrators are trying to come up with solutions to this problem by mandating science being taught daily starting in 4th grade. Districts in the Intermountain West and District C do not have a science curriculum in place. However, administrators hope to have a science curriculum developed by the beginning of the next school year (2014). "Last year we had no kids pass the state tests in science at the 4th grade level, and so we are making a change" (Interviewee 3). As a result of low test scores the district is has begun implementing new science instruction. District C faces similar issues to the Intermountain West, however they are implementing programs and offering resources to teachers to improve science education.

District D

District D has several of the same issues and challenges as the Intermountain West (Districts A & B). Funding and a lack of resources are the primary concerns that are facing these schools. Poor standardized test scores are also an issue in several of the schools in the districts, and administrators mentioned 80% of elementary students scoring below average in science. In District D there have been great improvements in reading and math scores, however science scores are still a weakness. With the focus of the curriculum on sustainability and the local environment, students struggle on standardized tests because the material is being assessed is not related to what is being taught in the classroom. Educators in the District D do not want to teach to the test, however struggle with integrating material covered on standardized tests with the schools science curriculum.

In all of the interviews conducted, teachers identified similar challenges: they are working to create student buy-in in science education with a limited amount of time and resources. Teachers work within the boundaries created by administrators to educate students in

current science practices; however, they often fall short as the majority of classroom time is focused on math and language arts.

Chapter 5

Discussion

Semi-structured interviews were conducted in four school districts to understand the current state of elementary science education and challenges teachers are facing in schools with a majority of Native American students. Educators in all schools interviewed agreed they would like to have science taught everyday. However, they there is not enough time within the current school day structure.

The interviews found that a wide variety of approaches and tools are being used to teach science in elementary schools in these four districts. There is not an established science curriculum for kindergarten through fifth grade. When teachers do incorporate science, they are often using lessons they created. Using the Internet as a resource, teachers will supplement textbooks with activities and videos. In the lower elementary school grades (K-2), teachers are focusing on incorporating hands-on activities in the classroom. In the upper elementary grades science education is based on textbooks.

"A strength is my hands-on approach and differentiating my instruction. I try and incorporate as many formative and summative assessments as possible" (Interviewee 7). Whether teachers are relying on textbooks or Foss Kits, one commonality among all districts was the incorporation of Native science. For Native American students to flourish in the sciences the material needs to be relative to students and bring in cultural knowledge (The Education Trust, 2013). Teachers in all districts noted the importance of students connecting to Native science, and make sure to incorporate local environmental issues facing communities into the science classes. Plant science has a prevalent history in Native cultures, and teachers try and connect Western plant science to traditional and cultural values and beliefs.

In addition to incorporating Native science, teachers are relating scientific concepts to local issues facing tribes. “The kids learn about local politics, take water samples, and learn to take responsibility over water issues on the reservation” (Interviewee 6). Schools are incorporating water quality testing methods into science classes and including discussions about water use into the curriculum. Teachers believe connecting social and cultural issues to science content will create well-rounded students (Interviewee 8, personal communication, February 12, 2014).

Assessing the strengths of classroom science in their districts, interviewees from several schools discussed the importance of using outside resources. Many of the outside resources teachers employ are designed to create hands-on experiences for students, which lead to discussions around topics with which students are familiar. Outside organizations such as 4-H, Tribal Fish and Game, and the National Outdoor Leadership School (NOLS) come into the classroom to help students understand local issues. Bringing local issues tribes are facing into science curriculum creates a dialogue about natural resources and the importance of conserving the natural resources and the environment (Interviewee 6, personal communication, February 12, 2014).

All districts identified the dedicated teachers they have in their schools as their greatest strength. Teachers care about the student population and put the needs of the students first. Specific content sometimes is not the priority; the teachers’ are committed to ensure the needs and concerns of students are met. Class size is another strength mentioned throughout the interviews. Having a small class allows teachers to have more one-on-one time with each student and allows them to adjust the curriculum to meet individual student needs.

Challenges in Science Education

In the districts examined, the challenges that were identified were similar to challenges discussed in the literature. The primary challenges in elementary science education identified in the four districts are: time, resources, support and training. Though, similar to challenges mentioned in the literature, through the interviews, this study was able to looked at how these issues directly affect individual districts. Teachers and administrators would like to increase the amount of science specific curriculum incorporated into the school day. "Ideally I would like to see more science being incorporated. I see science as interdisciplinary as well" (Interviewee 17).

Funding was identified as a challenge in Districts A, B, and D. Without adequate financial support teachers do not have access to teaching tools and resources. This can limit many of the potential learning experiences such as taking students on field trips and provide supplies for hands-on activities. Some of the districts have secured grants for teaching supplies and materials; however, teachers noted that there are not many grant opportunities for science education in the lower elementary school grades.

This study revealed there is not enough support from administrators. The administrators interviewed stated that science needs to be taught in the classroom, "There is zero collaboration between us and administrators. Every teacher is on their own little island, and we do not share our experiences in the classroom" (Interviewee 8).Teachers also reported not feeling prepared to deliver science content. There is a shortage of elementary school teachers who have a science background, focusing instead on areas of expertise. With a strong emphasis on language arts and math, administrators are encouraging teachers to focus on those subjects, and are not supporting science instruction.

Across all districts, interviewed teachers discussed the lack of science curriculum in elementary schools. Teachers are working independently to create lesson plans that will engage students in science content. Though there is not a set science curriculum until fifth grade, schools are still held accountable for science content. In grades four, eight, and twelve students are required to take standardized tests created by the state. In all districts science test scores in fourth grade were below average. Without time being allocated to teach science, students are not getting enough science content to excel on standardized tests.

How Districts Deal with Challenges

Though these districts face several challenges regarding elementary science education, many districts have come up with strategies to overcome issues. Districts are creating their own science curriculum, developing gifted and talented programs, using resources found on the internet, and working with outside organization to overcome challenges.

District D is developing a science curriculum rooted in Native knowledge and sustainability practices. Unique to this district is an emphasis on giving back to the community. Throughout elementary school students learn about environmental issues in the community, and in eighth grade every student does a community service project based in STEM fields and shares their findings at a public event open to their community. Teachers in District D are using the landscape and tribal issues to dictate the science content being taught. Through learning opportunities provided to students, teachers are encouraging students to think beyond the classroom, and incorporate what they are learning in the classroom into their everyday lives.

District C is diversifying the teaching approaches and is working on integrating science into the curriculum on a daily basis. District C uses Foss Kits as the primary approach to teach

science in K-8. Educators in District C supplement Foss Kits by using the textbook and resources found on the Internet. Historically District C relied on textbooks as the primary method to teach science, and over the past few years educators have begun to diversify the curriculum. In addition, this year the district began to mandate that teachers incorporate an hour of science into the school day. Though this is challenging, the teachers are optimistic that this new initiative will help increase science test scores in the fourth grade.

Schools in District A and B have begun to create an innovative curriculum that is hands-on and encourages students to explore scientific concepts. The gifted and talented program (District A) was established a few years ago as a way to integrate science into the curriculum and spark students' interest in science. This program is modeled after the Renzulli Model based out of the University of Connecticut, and is a talent pool model. There are 40 students in the program and they range from kindergarten through high school. Students are selected for the gifted and talented program for different reasons: leadership skills, performing arts, and academics.

"The kids get pulled out with their talent pool and we all work together, but then we do the whole group as well to tap into the rest of the school" (Interviewee 12). For example, authors will come in and give presentations to students, and every year students in the entire school will work on a museum project. This year the focus is on the rainforest, and each student (regardless of whether they are in the gifted and talented program) will work on the museum project. As a result of this program teachers have begun collaborating on lessons and sharing resources with each other.

District B focuses their science curriculum on creating space to incorporate Native knowledge into discussions. An academic goal of educators in District B is to create opportunities for students to develop a cultural awareness in their constantly changing world.

Every year the district devotes one day to the learning and understanding of Native cultures. This day allows for Elders and community members to share stories, history, and offer various workshops for students encouraging them to connect to there past. Tribal Fish and Game will also come in and discuss their role on the reservation, emphasizing the important relationship the local community has with the natural world.

District B works with outside agencies and organizations to increase student exposure to science. 4-H educators come in to the elementary school once a week working with 25 students K-5. 4-H is supplementing the science curriculum providing opportunities for students that they do not get in the classroom. District B teachers are working directly with 4-H discussing ways to increase attendance in sciences focused extra curricular activities. Students also have an opportunity in fourth and fifth grade to travel to a nearby regional National Park where rangers will discuss various ecological issues while providing a detailed history of the park. Teachers look forward to exposing their students to a different atmosphere, using the opportunity to develop observation skills.

To foster collaboration and communication between administration and teachers, the district is in the process of becoming a Response To Intervention (RTI) model school. The elementary school is trying to reach out to struggling students by creating an atmosphere focusing on consensus team building. Instead of having a top down approach to education, administrators are encouraging collaboration between teachers. The goal of becoming an RTI model is for teachers to work together, creating continuity in curriculum from one grade level to the next.

Implications

Throughout the study the common theme was having enough instructional time in the school day. With a focus on language arts and math, educators do not have enough time in the day to incorporate science into the curriculum. The literature discusses how science builds critical thinking skills for students, and the importance of capturing the interest of students early in their academic careers (Davis, 2001). Ideally, districts need to develop science curriculum and implement it beginning in kindergarten. Curriculum needs to incorporate Western science, however it should have a strong connection to Native knowledge and be relevant to students. Having students exposed to science beginning in early elementary school will allow students to engage in science at a critical point in their development.

Another strategy districts could employ is to take a multidisciplinary approach to science education. Creating science lessons and activities that bring in a reading and math component would allow students to be exposed to science without losing out on the time devoted to the core subjects. Districts have an opportunity to build a curriculum based on the needs of the students, which has a focus on reading, writing, and building critical thinking skills.

An issue in all four districts is that many teachers do not have an adequate science background. Schools need to create opportunities for professional development in the sciences. Teachers K-12 would benefit from annual workshops focused on developing lessons and activities catered towards the needs of Native American students. This would also create space for collaboration and communication to increase among teachers. Professional development offers an opportunity for teachers to gain confidence and generate excitement in the sciences (Blank, 2013).

Throughout districts educators indicated the use of Foss Kits to supplement science curriculum. Foss Kits contain activities that draw from different instruction pedagogies, such as inquiry-based learning, investigations guided by questions, hands-on learning, and scientific writing. Also, Foss Kits have science journals for students, which incorporates writing skills into science lessons. Foss Kits are divided into content units, and each unit provides materials for students, a teacher guide, and a student-reading book (NRC, 2007). Though Foss Kits have draw from different educational strategies and creates hands-on opportunities, there are downfalls to the Foss Kits. Teachers often are overwhelmed when Foss Kits first arrive due to the ample amount of space kits take up, and numerous parts the Foss Kits possesses. There are online training opportunities for teachers, and for Foss Kits to be successfully implemented teachers need teacher trainings or professional development to become familiar with all of the different components. Foss Kits are criticized for focusing too much on hands-on science taking away from students' basic understanding of scientific concepts (NRC, 2007).

Future Research and Discussion

Several studies have discussed the need for science for Native American students to be based in cultural values of Native Americans and educate the whole child (Mack et al., 2011). Based on this study, there is agreement with the literature that science curriculum is more effective if it can be grounded in cultural values and incorporate hands-on activities for students. Though not directly addressed, it was suggested that science curriculum should be rooted in place-based education. Teachers interviewed revealed that students were most engaged when learning about their community and local issues. Currently, all the districts where interviews were conducted, the staff is in the process of developing and hope to implement science curriculum in the next few years.

There is a dearth of information on the effectiveness of implementing science practices in the classroom starting in kindergarten. Further studies will need to be conducted to assess the effects of implementing a science curriculum beginning in the lower elementary schools. A longitudinal study examining the effect of implementing science in elementary school, measuring if student buy-in for the sciences has increased and attitudes towards science have changed, would be very useful. In addition, there are not a lot of studies that have examined the effectiveness of implementing different science practices. Schools adopting the use of a Foss Kit, place-based education philosophy, etc. should be longitudinally studied to see if these techniques are successful in the classroom. Once studies of this nature are complete, districts will have a better understanding of how to effectively integrate and teach science in the classroom.

In addition, there is a need for a more in-depth study of science education for Native American students in the Intermountain West. Currently, many of the studies to date have focused on reading and writing, examining strategies and initiatives that are successful in increasing student achievement levels. To fully understand the needs of Native American students in the Intermountain West more studies need to be conducted that examine how science is being taught, and successful ways districts can teach science to benefit the Native American students directly.

Conclusion

The objective of this study was to increase our understanding of how science is currently being taught in several elementary schools with a majority of Native American students, and to identify challenges these teachers may face. The literature review indicated a decrease in the amount of time science is being taught in elementary schools nationwide. This research shows

that school districts with a majority of students being Native American in these four districts face similar issues. Due to recent education initiatives, these districts focus on language arts and math, especially in the elementary grades. The schools do not have an established science curriculum for K-5. Interviews with educators revealed there is no continuity from one grade to the next. The literature and the interviews identified that schools (students) need daily science instruction, and districts need to create curriculum that builds on content from one year to the next. The study found that teachers, and students, would benefit from sharing teaching resources within and among school districts. For Native American students to be successful in the sciences they need to be exposed and engaged in the sciences starting in early elementary school, gaining the skills to think critically and apply scientific concepts to real-world issues and situations.

References

American Association for the Advancement of Science [AAAS]. (1993). *Benchmarks for science literacy,* New York, NY: Oxford University Press.

Aikenhead, G., & Olugbemiro, J. (1999). Cross-Cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research In Science Teaching, 36*(3), 269-287.

Barton, A., Burket, T., Ermer, J., & Osborne, M.D. (2003). *Teaching science for social justice*. New York: Teachers College Press.

Blank, R. (2013). Science instructional time is declining in elementary schools: What are the implications for student achievement and closing the gap? *Science Education, 97*(6), 830-847.

Cole, C. (2006). What is the impact of NCLB on the inclusion of students with disabilities? *Center for Evaluation & Education Policy, 4*(11), 1-10.

Cross, R. (1998-1999). American Indian education: The terror of history and the nation's debt to the Indian peoples. *UALR Law Review*, (21), 941-977.

Davis, K. (2001). *Change is hard: What science teachers are telling us about reform and teacher learning of innovative practices*. Wiley Periodicals, Inc. 4-30.

Deyhle, D. & Swisher, K. (1997). Research in American Indian and Alaska Native education: From assimilation to self-determination. *Review of Research in Education, 22*, 113-194.

Dorph, R., Goldstein, D., Lee, S., & Leiori, K. (2007). *The status of science education in the Bay Area: Research brief*. Lawrence Hall of Science, University of California. 1-4.

Duschl, R.A., Schweingruber, H.A., Shouse, A. (2007). *Taking science to school: Learning and teaching science in grades K-8*. Washington DC: The National Academic Center.

Garroutte, E. (1999). American Indian science education: The second step. *American Indian Culture & Research Journal, 23*(4), 91-114.

Griffith, G. & Scharmann, L. (2008). Initial impacts of No Child Left Behind on elementary Science education. *Journal of Elementary Science Education, 20*(3). 35-48.

Kimmerer, R. (2002). Weaving traditional ecological knowledge into biological education: a call to action. *Bioscience, 52*(5), 432-438.

Lomawaima, T. (2000). Tribal sovereigns: Reframing research in American Indian education. *Harvard Educational Review, 70*(1),1-21.

Mack, E., Augare, H., Cloud-Jones, L.D., David, D., Gaddie, H.Q., Honey, Wippert R. (2011). Effective practices for creating transformative informal science education programs grounded in Native ways of knowing. *Cultural Studies of Science Education, 22*(1), 49-70.

Margolis, R. (2007). "Best in the west." *School Library Journal*, 37-39.

Massey, G. (2004). Making sense of work on the Wind River Reservation. *American Indian Quarterly, 28*(3/4), 786-816.

Merriam, S. (2009) *Qualitative Research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

National Assessment of Educational Progress. (2013). NAEP: Overview. Retrieved from http://nces.ed.gov/nationsreportcard/about/#overview

National Center on Time & Learning [NCTL] (2011). Strengthening science education: The power of more time to deepen inquiry and engagement. 3-65.

National Indian Education Study (2011). The education experiences of American Indian and Alaska Native students at grades 4 and 8. *National Assessment of Educational Progress*, 1-64.

Nelson-Barber, S. & Estrin, E.T. (1995). Bringing Native American perspectives to mathematics and science teaching. *Theory Into Practice, 34*(3), 174-185.

Neumann, A., Mason V., Chase, E., & Albaugh, B. (1999). Factors associated with success among southern Cheyenne and Arapaho Indians. *Journal of Community Health, 16*(2). 103-115.

National Research Council [NRC]. (1996). *National science education standards.* Washington, DC: The National Academies Press.

NRC. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Quinn, H., Schweingruber, H., & Keller, T (Eds.). Washington, DC: The National Academies Press.

NRC. (2007). *Ready, set science!:putting research to work in K-8 Science Classrooms.* Washington, DC: The National Academies Press.

Reily, R. (1980). Wind River changes its course: The St. Stephens experience. *Phi Delta Kappan, 62*(3), 200-202.

Rhodes, R. (1988). Holistic teaching/learning for Native American students. *Journal of American Indian Education, 27*(2), 21-29.

Rubendall, S.M., Reyner, J., & Gilliland, H. (1988). Science for Native Americans. In G. Gilliland, Schaffer R., & J. Reyhner. *Teaching the Native American* (159-163). Dubuque IA: Kendall/Hunt Publishing Company.

Schmidt, W.H. (2003). The quest for a coherent school science curriculum: The need for an organizing principle. *Review of Policy Research, 20*(1), 7-32.

Swisher, K. & Tippenconnic, J. (1999). *Next steps: Research and practices to advance Indian education*. Charleston, WV: Clearinghouse on Rural Education and Small Schools.

The Education Trust, (2013). *Education for Native American students*. Retrieved from http://niea.org/data/files/research/2013_stateofedfornatstudents_edtrust.pdf.

Weiss, I. (1993). *A profile of science and mathematics education in the United States*, 1993. Horizon Research, Inc., 1-26.

Wyoming Department of Education, (2008). Wyoming science content and performance standards: Overview. Retrieved from http://edu.wyoming.gov/downloads/standards/Standards/_2008_Science_PDF.pdf

Appendix A

Letter of Research Approval

UNIVERSITY
OF WYOMING

Vice President for Research & Economic Development
1000 E. University Avenue, Department 3355 • Room 305/308, Old Main • Laramie, WY 82071
(307) 766-5353 • (307) 766-5320 • fax (307) 766-2608 • www.uwyo.edu/research

December 4, 2013

Ms. Lara Mann
Graduate Student Masters of Science
Science and Mathematics Teaching Center
University of Wyoming
Faculty Advisor: Dr. Kate Welsh

Protocol # 20131204LM00204

Re: IRB Proposal, *"Examining the State of Science Education in Elementary Schools with a Majority of Native American Students"*

Dear Ms. Mann:

The proposal referenced above (proposal received November 21, 2013) qualifies for exempt review and is approved as one that would not involve more than minimal risk to participants. Our exempt review and approval will be reported to the IRB at their next convened meeting December 19, 2013.

Any significant change(s) in the research/project protocol(s) from what was approved should be submitted to the IRB (Protocol Update Form) for review and approval prior to initiating any change. Per recent policy and compliance requirements, any investigator with an active research protocol may be contacted by the recently convened Data Safety Monitoring Board (DSMB) for periodic review. The DSMB's charge (sections 7.3 and 7.4 of the IRB Policy and Procedures Manual) is to review active human subject(s) projects to assure that the procedures, data management, and protection of human participants follow approved protocols. Further information and the forms referenced above may be accessed at the "Human Subjects" link on the Office of Research and Economic Development website: http://www.uwyo.edu/research/human-subjects/index.html.

You may proceed with the project/research and we wish you luck in the endeavor. Please feel free to call me if you have any questions.

Sincerely,

Colette Kuhfuss
Colette Kuhfuss
IRB Coordinator
On behalf of the Chairman,
Institutional Review Board

Appendix B

Informed Consent Form

Dear <Participant>,

My name is Lara Mann and I am a graduate student at the University of Wyoming in Natural Science Education. I am conducting a study on the state of science education in schools in which the majority of students are Native American in the Southwest, Pacific Northwest, primarily focusing on the Intermountain West. The objective of this research is to understand how science is currently being taught in elementary schools, and to identify the challenges teachers face. Based on your involvement in the school district, I would like to invite you to participate in this research study.

Your participation would involve an interview that will not exceed 60 minutes, at a location of your preference. Before the scheduled interview you will receive an overview of the research and the five to ten open-ended interview questions that I will ask orally during the interview. Written interview notes will be kept electronically. With your permission, I would like to audio record the interview. If you do not wish to be audio recorded, only written notes will be taken. The audio recordings will only be used to verify the written notes, and will not be shared or used in any public or research forum.

Due to the topic and interview methods used in this study, it is possible you may be uncomfortable sharing your personal opinions about the state of science education in elementary schools where the majority of students are Native American. You may feel uncomfortable sharing your thoughts involving science being implemented in the classroom. There is also the potential that you could be identified, even if you choose to not allow the use of your name, based on your responses, the nature and location of your work, and the small number of other possible participants with similar backgrounds. However, the risk for this is minimal and the potential discomfort that this research may cause does not exceed that of ordinary encounters in daily life conversations.

To keep your identity confidential, I will assign you a pseudonym. I will not discuss your name or background information with anyone other than my research advisor.

There are no costs or incentives for participating in this study. I am not receiving funding and it is not being sponsored by any governmental or private organization. For participating in this research study, you will be provided with an electronic copy of my research paper.

Only my University of Wyoming research advisor, Dr. Kate Welsh, and I will have access to the notes and recordings, which will be stored in a locked filing cabinet. The data will be destroyed no more than three years after the completion of my research project.

If you have any questions about the study or this form at this time, or anytime during or after the interview, please feel free to contact me at (781) 820-9184, lmann@uwyo.edu, or Dr. Welsh at (307) 766-2013, kmuir@uwyo.edu. *If you have any questions regarding your rights as*

a research participant, please contact the University of Wyoming IRB Administrator at (307) 766-5320.

Your signature indicates that you have read and understand the information provided above. You may withdraw your consent at any time and discontinue participation without penalty. A copy of this form will be available for you to keep. Interviews will not be conducted until the researcher has received a copy of this form in person or mailed to the researchers office at: Lara Mann c/o SMTC 1000 E. University Avenue Dept. 3992, Laramie, WY 82071.

Consent/assent to participate

_____

Printed name of participant Date

_____ _____

Participant signature

_____

Consent/assent to have your interview audio recorded:

Participant signature Date

_____ _____

Consent/assent to use your recordings in other studies and/or future research that the researcher, Lara Mann, and/or her adviser, Dr. Kate Welsh, conduct:

Participant signature Date

_____ _____

Appendix C

Recruitment Email

Dear <participant>,

I hope you are doing well. My name is Lara Mann and I am a graduate student at the University of Wyoming in Natural Science Education. I am conducting a study on the state of science education in schools in which the majority of students are Native American in the Southwest, Pacific Northwest, primarily focusing on the Intermountain West. The objective of this research is to understand how science is currently being taught in elementary schools, and to identify the challenges teachers face. Through this study I am trying to understand how science is being incorporated into the classroom in elementary schools. Based on your involvement with the school district, I would like to invite you to participate in this research study.

When reviewing the literature I came across studies done nationwide indicating there has been a decrease in the amount of time science is being taught in elementary schools. I would like to interview superintendents, principles, and teachers in the Southwest, Pacific Northwest, primarily focusing on the Intermountain West to understand what the state of science education looks like in elementary schools.

Your participation would involve an interview that will not exceed 60 minutes, at a location of your preference. If you agree to be interviewed, before the scheduled interview you will receive an overview of the research and the five to ten open-ended interview questions that I will ask you orally during the interview. I will assign you a pseudonym to keep your identity confidential.

If you are interested in becoming involved in this study please reply to this email by January 10th, 2014. If you would like to be a participant please review the informed consent form attached to this email. When I receive your reply, I can provide you with more details on the research, and how the interview process will work.

If you have any questions about this study please feel free to contact me by email or phone at (781) 820-9184.

Sincerely,

Lara Mann

Appendix D

Research Questions

Participant Information:

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1. Please spell your full name.
2. What is your professional title?
3. What school district are you associated with? Please explain your role with your schools district.

Research Questions:

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1. What are the current practices of classroom science education in your school?
    a. Does your school have a science program (textbook or science kit) in place? If yes, what is it?
    b. Has there been any recent Professional Development on this program? Has there been any science Professional Development in classrooms in your school?

2. Currently, how is science education incorporated into the teaching day?
    a. How often is science taught in a week? How many hours a week are devoted to science?
    b. Are you interested in seeing science being more incorporated into the teaching day? If so, how?

3. What is your perspective on the integration of science instruction into the classroom and/or grade-level curricula?

4. Have recent education initiatives (Educate to Innovate, No Child Left Behind, and Next Generation Science Standards) affected classroom teachers' instructional practices of science? Why or why not?

5. What are the strengths of classroom science in your school? What are the challenges?

Appendix E

Rationale Behind Study

The idea for this research study began in the summer of 2010 when I was working for an outdoor outfitting company in southern Colorado, and each trip had a service-learning component. During the summer of 2010 I had the opportunity to interact with Native American tribes, and became interested in their cultural values towards the natural world. This experience working on Navajo Nation left a lasting impression on me, and while contemplating graduate research ideas I reflected on my time spent working with youth on Navajo Nation.

While working on this study I had a difficult time initially gaining participants. I am not Native American, and potential participants were apprehensive to work with a non-Native graduate student. Potential participants expressed concerns about a non-Native going into their community and showing negative aspects of their schools in my research. Throughout the study I learned about the places I worked in, and how important community is. Having the opportunity to conduct research within Native American communities was a humbling experience and I am grateful to those who were willing to let me conduct interviews in their communities.

Educators welcomed me into their classrooms and were excited about my research. Watching their interactions with students enabled me to understand how important it is to create a supportive environment for students. I deeply appreciate all the educators I interviewed, and grateful for them allowing me into their schools. In the future I hope to continue to work with Native American students, learning how different cultures interact with the natural world.