Voices of Place: The Affordances and Barriers for Teaching Underrepresented Students Who Employ Digital Stories to Articulate Their Interpretations of Place Meaning

A Dissertation
Presented in Partial Fulfillment of the Requirements for the
Degree of Doctorate of Philosophy
with a
Major in Education
in the
College of Graduate Studies
by
Marcie A. Galbreath

Major Professor: Paul Gathercoal, Ph.D.
Committee Members: Julie Amador, Ph.D.; Brant Miller, Ph.D.; Bert Baumgaertner, Ph.D.
Department Administrator: Paul Gathercoal, Ph.D.

November 2015

AUTHORIZATION TO SUBMIT DISSERTATION

This dissertation of Marcie A. Galbreath, submitted for the degree of Doctorate of Philosophy with a Major in Education and titled "Voices of Place: The Affordances and Barriers for Teaching Underrepresented Students Who Employ Digital Stories to Articulate Their Interpretations of Place Meaning," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor: _____ Date: _____
Paul Gathercoal, Ph.D.

Committee Members: _____ Date: _____
Julie Amador, Ph.D.

_____ Date: _____
Brant Miller, Ph.D.

_____ Date: _____
Bert Baumgaertner, Ph.D.

Department Administrator: _____ Date: _____
Paul Gathercoal, Ph.D.

ABSTRACT

Marginalized and underrepresented students struggle to find meaning in mainstream curriculum and instruction. This study was designed to explore the affordances and barriers for teaching underrepresented students who make digital stories to articulate place meaning as part of an environmental science curriculum. Additional questions were developed to examine: 1) what key experiences contribute to deeper place meaning? 2) what affect digital storytelling has on border crossing? and 3) how the introduction of technologies positively or negatively impact novelty space?

A mixed methods case study design was employed. The study used a non-equivalent control group design. The control and treatment groups were assigned by random draw and consisted of fifth grade students in two intact classrooms from one rural school. The instrument used for pre- and post-test surveys as well as coding storyboards and digital stories was based on the Semken and Freeman (2008) model of Young's (1999) *Place Meaning Survey (PMS)*. All participants produced storyboards. The treatment consisted of digital stories created on iPads by the treatment group.

Quantitative results from this study were confounded by the PMS. The PMS was described as being too subjective and this raised questions regarding its' validity and reliability with the subject population. Novelty space, the Hawthorne effect, and diffusion had a negative impact on a connection to and articulation of place meaning; all limitations resulted from technology use, not digital storytelling. The findings did show a relationship between digital storytelling and border crossing at the dependent collateral learning level. When examining key experiences to deeper place meaning, all qualitative data points to the environmental activities and storyboards as affordances. The digital stories displayed

nuances of place meaning; however, deeper place meaning was only explicit in participants' storyboards. Compared to the control group, the treatment group displayed significant growth in perceived science competency after completing the treatment, $\chi 2$ (4, N = 50) = 5.89, p = 0.02.

ACKNOWLEDGEMENTS

I did not take this journey alone. I have been fortunate to have many supporters in my life. Some people have generously supported me during this graduate school experience and many others were there for me long before life took me down this path. Some I will acknowledge by name and others are in my thoughts and heart.

I would first like to thank my Major Professor, Dr. Paul Gathercoal for your mentorship, guidance, and unwavering support. Without you this journey would have been, without a doubt, longer and more challenging. I would like to extend a special thank you to Drs. Julie Amador, Brant Miller, and Bert Baumgaertner for serving on my committee and offering me your time, support, and expertise as I take this journey to become a researcher and academic. I would also like to thank Dr. Anne Kern who afforded me the opportunity to work on the *Back to the Earth* grant as a Research Assistant, which both started me on this journey and provided me the opportunity to conduct my pilot study. And, thank you to Dr. Mary Orr and Diane Swenson for your encouragement, guidance, and friendship.

To my mom, Alexandria Brighton, my dad and step-mom, Gary and Jean Lasater, and my sister, Shannon Lasater, thank you for your love, support and constant encouragement. Knowing you are always there for me made this journey a little easier. Thank you for always supporting my goals. To my children, Danny, Lexii, and Darian, thank you for your unconditional love, support, and patience as I worked on this dissertation. Yes, now I can go to a movie with you. And, to Rod Rawls: you were by my side as I started this journey and you are by my side as I complete it. I cannot express in words how much your love and support mean to me. Thank you for believing in me.

DEDICATION

This dissertation is dedicated to my children who have been constant and enthusiastic supports as I have taken this journey. You inspire me everyday.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

Context

According to Richard Louv (2005), today's youth have a complex and conflicting understanding of nature. While on one hand they "are aware of [today's] global threats to the environment, [on the other hand], …their physical contact, their intimacy with nature is fading" (Louv, 2005, p. 1). In today's world, our youth are being taught to avoid nature, or at best, have indirect contact with it (Louv, 2005). Yet, their genetic makeup (their biophilia) is drawing them towards an affinity with all living things – the natural world (Buhner, 2002; Gardner, 1991). Louv (2005) believes the resulting conflict impacts young people in various ways as evidenced in the increase in mental disorders, behavioral issues, and decreased academic performance. To counter these negative effects and reestablish healthy biophilia, youth may be reconnected with the natural world through place-based education.

Place-based education provides an avenue for young people to reconnect with nature. Sobel (2004) defines place-based education as "the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science and other subjects across the curriculum" (p. 6). This is in contrast to today's standards-based approach to education, which presents outdoor places conceptually from the confines of the classroom (Gruenewald, 2003).

Place-based education is an approach to curriculum and instruction characteristic of "the Freirean tradition of critical pedagogy [promoting social agency and] …intergenerational learning" (Gruenewald, 2003, p. 7). A place-based pedagogy "embrace[s] the experience of being human in connection with the others and with the world of nature…" (Gruenewald, 2003, p. 6). There is a focus on place as a social paradigm that

can marginalize people as well as ecosystems.

According to Herzog and Pittman (1991), rural communities have a long history of marginalization from dominant culture. They go on to say high poverty rates and low levels of educational achievement are contributing factors. Rural communities are defined according to the United States government as "nonmetropolitan" and by the Census Bureau as having "less than 2,500 inhabitants or less than 1000 inhabitants per square mile" (Herzog & Pittman, 1991 p. 4). Understanding underrepresented students (for this study Native American and rural) in context of marginalization helps us to understand issues faced in rural education. Researchers believe marginalized students may have difficulty finding meaning in a one-size-fits-all decontextualized curriculum and instruction approach (Reyhner, 2010).

One of the main determinations of place-based education is it contextualizes experiences in place, complementing classroom curriculum and instruction (Woodhouse & Knapp, 2000). It is inherently experiential in nature, multidisciplinary, and it connects place with self and community. In deepening their connection to place, students form personal identity constructed from and in the places they live. Boundaries between home and school cultures become blurred, allowing students to find contextual meaning in curriculum.

Rural schools (those situated with in rural communities – as defined above) face a challenge of curriculum inequality. The literature suggests there are reduced curricular options for rural schools. For example, in the era of standardized testing, subjects like calculus, sociology, psychology, data processing, and offerings in advanced placement are being reduced or completely disappearing from rural schools' curricula (Edington & Koehler, 1987; Thomas, 2005).

Rural schools also face many challenges, ranging from underfunding to negative

stereotypes (Herzog & Pittman, 1995; Thomas, 2005). A popular stereotype is rural schools have higher community participation (Edington & Koehler, 1987; Herzog & Pittman, 1995). Herzog and Pittman's (1995) study supports the existence of this stereotype. They found when students describe rural they include discussions on people and community and imply connection to school and nature. It still needs to be determined to what extent rural students are connected to the community and if this connection is reflective of a connection to nature and some level of place meaning.

Incorporating the use of digital stories may be an effective way for integrating place meaning into the science curriculum when working with rural and other underrepresented students. According to Ohler (2006), when creating narratives, students cultivate their own voices and become heroic characters within their own learning stories. Sadik (2008) believes storytelling allows "students to make sense of the complex and unordered world of experience…" (p. 489). Using digital stories as a tool, students can engage in and give voice to their idea of place and what a specific place means to them.

Research Problem

As stated above, this study uses underrepresented students to encompass both Native American and rural students. Both of these groups have been marginalized by the dominant culture, and thus face similar challenges including low academic success in science, technology, engineering, and mathematics (STEM) (Aikenhead & Jegede, 1999; Aikenhead & Ogawa, 2007; Brown, 2007; Cajete, 1988; Herzog & Pittman, 1995; Thomas, 2005). Native American students continue to be underrepresented in science and engineering fields (Bang, Medin, Washinawatok, & Chapman, 2010; NSF, 2009; Pavel, Skinner, Cahalan, Tippeconnic, & Stein, 1998) with less than one percent receiving bachelor degrees in science

and engineering (Bang & Medin, 2010). Rural students are underrepresented in most sciences. For example, in Idaho (a mostly rural state) only 30% to 39% of the bachelor degrees awarded are in science and engineering (U.S. Census Bureau, 2009).

In 2000, over forty percent (37,548) of the "89,594 public schools in the U.S. …were located in rural areas or small towns" (Reeves, 2003, p. 2). Fifty-nine percent of the school consolidations that took place from 1986 to 1993 were in rural districts (Reeves, 2003). Issues faced by rural schools include declining enrollment, small populations, and geographic isolation.

As with other underrepresented groups, rural students must fight stereotypes and navigate difficult border crossings between home and school culture especially in science and technology (Aikenhead & Jegede, 1999; Brown, 2007; Cajete, 1988; Herzog & Pittman, 1995). Aikenhead & Jegede (1999) have described this border crossing in their work on Collateral Learning Theory (CLT). According to Jegede & Aikenhead (1999) CLT comprises multiple diverging schemata individuals hold in long-term memory. CLT consists of four types of schema development and processing. The types are: parallel, simultaneous, dependent, and secured (see figure 1.1). The different categories of collateral learning may not be independent or distinctly positioned from each other (Jegede, 1995, as cited in Sutherland, 2005).

Figure 1.1
Collateral Learning Theory Types

At one end of CLT is Parallel Collateral Learning where students create parallel

tracks of knowledge and the conflicting schemata are never resolved, as the diverging schemata do not come together at all (Fakudze, 2004). Parallel tracks of knowledge are built as students acquire new knowledge that opposes their existing worldview. Students compartmentalize the new information along these tracks of knowledge. They will access the different schema depending on the context (Jegede & Aikenhead, 1999) never integrating concepts. Students normally and periodically build bridges to cross between the types of schemata. This crossing, or transition, is considered impossible in parallel collateral learning (Aikenhead & Jegede, 1999).

There is little focus in the literature on simultaneous and dependent collateral learning. Simultaneous collateral learning "is a situation in which learning a concept in one domain of knowledge or culture can facilitate the learning of a similar or related concept in another milieu" (Fakudze, 2004, p. 271). The transition between the conflicting schemata is thought to be hazardous because it poses threats to the student's self-esteem (Aikenhead & Jegede, 1999). "In dependent collateral learning, the schema from one worldview or domain of knowledge challenges another from a different worldview or domain of knowledge…" (Fakudze, 2004, p. 271). This is evidenced when students can transform a schema without profoundly reconstructing their current worldview or sphere of knowledge (Fakudze, 2004).

Aikenhead & Jegede (1999) believe students can be guided from the beginning of the continuum; parallel collateral learning, to the other end of the continuum; secured collateral learning. In secured collateral learning students successfully merge existing and new knowledge and any schematic conflict is resolved (Fakudze, 2004). This is evidenced when students can exhibit some form of convergence of the two concepts (Sutherland, 2005). The transition between the two ideas, or tracks of knowledge, is smooth in secured collateral

learning (Aikenhead & Jegede, 1999).

After many years working as an outdoor STEM educator, I have discovered it is challenging to build conservation agency with young people who are disconnected from the place. Place meaning needs to be established first. However, it no longer works to take youth out into nature, into the field, with paper and pencil and ask them to articulate place meaning.

Today's youth are technology savvy. Technology is a familiar part of their everyday life. It provides them access to information and resources at a level never experienced by previous generations. Technology may lead to greater engagement (Liu, Horton, Kang, Kimmons, & Lee, 2013; Levin & Wadmany, 2005) and may give underrepresented youth a framework for decontextualizing standards-based curriculum. However, there is no evidence in the literature of sustained engagement due strictly to the integration of technology.

The Substitution Augmentation Modification Redefinition (SAMR) Model (Puentedura, 2015) does provide some evidence of student engagement in connection to technology use. This model offers a process for examining how technology use may affect student learning as well as teaching practices. Puentedura (2015) states, during the Augmentation level students begin to show increased engagement in the learning process.

In the current standards-based era, rural schools are faced with the increasing challenge of maintaining culturally relevant, place-based curriculum. In his study Thomas (2005) found teachers "expressed an awareness of some risk they entailed in straying from the tested curriculum to address local topics" (p. 22). Teachers are also required to reach out to the community when conducting place-based education. For many practitioners, this is outside their normal pedagogy. Despite these and other challenges, researchers believe place-based education and standard-based curriculum are complementary (Jennings, Swidler, &

Koliba, 2005).

When students create digital stories using images collected in the field, educators can incorporate place-based based education with standards-based curriculum and allow students a means to articulate place meaning. There is little research on the use of digital stories within the context of place meaning. Researchers have focused on the interdisciplinary component of digital stories as well as the ability to develop written, oral, and digital literacies (Hull, 2003; Kajder, Bull, & Albaugh, 2005; Ohler, 2006). However, there is a gap in the literature regarding the nexus of digital storytelling and place meaning.

Purpose

The purpose of this study was to examine the affordances and barriers for teaching underrepresented students who employ digital stories to articulate their interpretation of place meaning, as defined in Young (1999).

Definition of Terms

Biophilia – biophilia is the genetic predisposition of human beings to hold an affinity with all living things. People have an innate emotional desire to be part of the natural world on an arcane level.

Border Crossing – border crossing describes the navigation between microcultures.

Collateral Learning Theory – collateral learning theory comprises multiple diverging schemata being held in long-term memory. It encompasses four categories along a spectrum (parallel, simultaneous, dependent, and secured).

Conservation Agency – conservation is defined as the preservation, management, and care of natural and cultural resources. Agency is defined as the capacity, condition, or state of acting or of exerting power.

Curriculum – used to represent the concepts and content as part of a course of study. Curriculum includes learning standards, objectives and assessments, written materials and lessons created by the teacher, as well as products/materials created by students.

Digital stories – digital stories are short (three to five minute) narratives combining narration, still and moving images, and music. They merge problem solving and transformation in the authentic voice of the creator.

Place-based education – place-based education is using the local environment and community as a foundation for interdisciplinary curriculum and instruction. Subjects such as art, science, mathematics, or history are taught in the context of where the learning environment is located.

Place meaning – place meaning is a combination of the values and meaning ascribed to a particular place. The people who inhabit the place socially construct meaning.

Rural – rural is defined as geographically isolated communities with less than 2,500 inhabitants or 1,000 per square mile.

Underrepresented – is defined as insufficiently represented. It is used in this dissertation to describe the combined marginalization of Native American and rural students and their lack of representation in science fields.

Significance

A goal of this study was to add to the literature, addressing the gap vis-à-vis articulation of place meaning through the use of digital storytelling. This study was designed to be of theoretical importance in that it addresses the existing gap in the literature, providing evidence regarding the use of technology in establishment and articulation of place meaning by fifth grade students. If students who participate in technology-based place meaning

curriculum develop the ability to articulate deeper place meaning and establish a basis for future conservation agency, it could be argued this study's treatment played a role in enhancing conservation agency through deeper place meaning.

This study was constructed to be of practical consequence for the field of education by addressing the affordances or barriers of using technology to create and communicate place meaning for underrepresented students. In addition, this study may contribute to best practices in the field of education regarding use of technology, border-crossing, and decontextualizing curriculum. Significant results can add to teaching practice where digital stories and place meaning are concerned. This study may provide teachers working with predominately-underrepresented youth a strategy to facilitate border crossing, improving academic performance – especially in science.

Assumptions and Limitations

A fundamental assumption of this study is that all students participating will benefit equally from the curriculum. Students may gain or deepen place meaning and potentially develop conservation agency in the future depending on the affordances or barriers experienced during the treatment. Additionally, the curriculum may help underrepresented students cross cultural borders that exist between their home and school. There is also an assumption there is enough time built into this study to obtain significant results.

This study was conducted with fifth grade students. I designed and implemented this curriculum. By controlling the creation and development of the curriculum – not involving the teachers (at their request), trustworthiness is enhanced. My background as an outdoor educator may have impacted aspects of curriculum design. Other limitations are discussed in detail in chapter 3.

CHAPTER TWO: LITERATURE REVIEW

Technology is commonplace for many of today's youth. Young people are generally accustomed to unlimited access to information instantly. Information is at their fingertips. They surf the web, record and post videos, and engage in the realm of social media (Levin & Wadmany, 2005). Using recognizable portable devices, such as iPads or Chromebooks, may aid in student buy-in where relevancy issues exist (Cope & Ward, 2002), especially in science curriculum and the nexus of learning versus knowing; scientific versus traditional. This is particularly critical for underrepresented students who face challenges of border crossing and decontextualized curriculum (Aikenhead & Jegede, 1999; Sutherland, 2005).

Researchers (Aikenhead & Jegede, 1999; Sutherland, 2005) have argued there are differences in how knowledge is attained between Indigenous Knowledge and Western Science. Aikenhead and Jegede (1999) believe these differences can be understood through Collateral Learning Theory (CLT). CLT describes the conflict between different learning processes that create schematic conflict. CLT applies only to the conflicting schemata (Sutherland, 2005).

From the CLT framework, this literature review will look at rural students and place-meaning contexts. Culturally relevant place-based education will also be examined with an analysis of border crossing in the context of CLT. Finally, there will be a foray into digital storytelling, including how it is currently being used in education in the United States.

Theoretical Framework

Collateral Learning Theory is predominantly associated with the Learning Sciences. It is becoming increasingly popular in education, principally in the framework of underrepresented students and border crossing in science education. Collateral Learning

Theory grounds concepts such as "cognitive negotiations… [providing] …explanation for the cognitive strategies non-Western students may adopt to learn science" (Sutherland, 2005, p. 599). From this premise, CLT can be applied to other underrepresented students.

Collateral Learning Theory explains the levels of interaction and subsequent resolution of conflicting schemata (Fakudze, 2004). Jegede and Aikenhead, (1999) define CLT as involving "two or more conflicting schemata held simultaneously in long-term memory" (p. 51). Underrepresented students often find their worldview and school curricula in conflict. CLT is applicable when this conflict occurs – most often in science curriculum (Aikenhead & Jegde, 1999; Sutherland, 2005).

More than 4 million children start pre-school each year; however, only 4.5% will graduate with bachelor degrees in STEM fields (Stephens, 2010). Moreover, this number is excessively lower for underrepresented students. Native Americans are especially underrepresented (NSB, 2012; Babco, 2003). "By the time they reach junior high, many NA students avoid science" (Cajete, 1988, p. 2). While many children are losing interest in science around 7th or 8th grade, Native Americans face exceptional challenges, which contribute to their low participation and achievement in STEM. For example, NA students often experience difficult border crossings between the culture of home-life experiences and the culture of school science, particularly if taught with traditional Western paradigms (Aikenhead & Ogawa, 2007). Further barriers include poor student attendance, high teacher turnover rates on reservations (Lewthwaite, McMillan, Renaud, Hainnu, & MacDonald, 2010, p. 5), social institutions, which are authoritarian rather than group-focused (Cajete, 1998, p.2), and language and culture impairments (Cajete, 1998).

Several options for dealing with the barriers described above are discussed in the literature. One possibility is employing Culturally Congruent Instruction (CCI), which may mitigate the marginalization of NA students in STEM (Brown, 2007; Chinn, 2007; Ladson-Billings, 1995; Lee, 2003; Pewewardy & Hammer, 2003; Sievert, LaFrance, & Brod, 2011; Sorkness & Kelting-Gibson, 2006). CLT also provides a framework addressing the above stated barriers of underrepresented students.

CLT involves a spectrum of four categories of collateral learning practiced by a student (Fakudze). These are:

- Parallel
- Simultaneous
- Dependent
- Secured

Parallel collateral learning, sitting at one end of the spectrum, is considered the most extreme. Researchers believe schematic resolution is impossible during parallel collateral learning (Aikenhead & Jegede, 1999). Students may build bridges to cross between the conflict tacks of knowledge when engaged in other types of collateral learning; however, crossing between different tracks of knowledge is believed to be impossible during parallel collateral learning (Aikenhead & Jegede, 1999). Studies indicate students may "develop ways (school games) to pass their science courses without learning the content in a meaningful way…" (Jegede & Aikenhead, 1999, p. 49). There is no evidence of consequential learning or school culture assimilation during parallel collateral learning.

Following parallel collateral learning on the CLT continuum is simultaneous collateral learning. Here, transition between conflicting schemata is considered to be

hazardous due to negative impacts on self-esteem (Aikenhead & Jegede, 1999). During simultaneous collateral learning acquiring a concept in one culture or knowledge system can assist the learning of an associated concept in another sphere (Fakudze, 2004).

Dependent collateral learning follows simultaneous collateral learning on the CLT continuum. During dependent collateral learning resolving conflicts between differing schemata is believed to be manageable; meaning border crossing is more difficult and must be managed. Dependent collateral learning is evident when the home and school cultures are only somewhat different (Aikenhead & Jegede, 1999). The student is able to adjust a "schema without radically restructuring the existing worldview or domain of knowledge" (Fakudze, 2004, p. 271).

Anchoring the other end of the CLT continuum is secured collateral learning. Students exhibiting secured collateral learning have made smooth transitions with some modus of resolution of the conflicting schemata (Aikenhead & Jegede, 1999; Fakudze, 2004). They are able to converge two differing ideas or explain the maintenance of both ideas. These students will be able to articulate ideas and combine their home cultural knowledge system with the newly acquired Western science knowledge (Sutherland, 2005).

Collateral Learning Theory, while strong in its description of the four different types of learning student's experience, fails to describe "how the student acquires each one of them. It is not clear whether a student remains fixed in one type of collateral learning or he/she can move from one to the other, dependent on the concept being learned" (Fakudze, 2004, p. 271). Further studies framed in CLT will contribute to the literature and conceivably address the issue of movement within the four types of collateral learning.

Rural Student Contexts

There is a, "lack of a definitive understanding of the meaning of rural" (Herzog & Pittman, 1995, p. 4). The definitions provided in the literature come from an "urban perspective [which] seems to relate to a weak identity among… students…" (Herzog & Pittman, 1995, p. 4). It is argued that today's society does not favor ruralness; robust prejudices against rural places and people are prevalent (Herzog & Pittman, 1995). Today, in a time of political correctness, it is still acceptable to make fun of "hicks," "hillbillies," and "rednecks". "The Oxford English Dictionary provides references from the 16th and 17th centuries for the unflattering characterization of a rural person as a bumpkin" (Herzog & Pittman, 1995, p. 4). Rural students face the dichotomy of having cultural pride ingrained in them as part of their home and community environments and appearing to be apologetic for coming from nonurban areas (Herzog & Pittman, 1995). For these reasons I argue the categorizing of rural students as marginalized.

Rural communities differ from urban neighborhoods. Rural schools vary from urban schools (Bauch, 2000). However, in the era of one-size-fits-all standardized federal policies like No Child Left Behind, rural schools find themselves emulating urban schooling processes (Bauch, 2000). Students enrolled in rural schools face many challenges, for example, high teacher turnover, lack of funding, and meeting federal accountability requirements. In the midst of these prodigious challenges there are advantages – namely "that their schools are set in a community context that values a sense of place and offers a unique set of conditions for building social capital important for helping students succeed in school" (Bauch, 2000, p. 1). Edington & Koehler (1987) argue,

Smaller communities do tend to generate more community support for the school,

> with the school becoming a center for community activity. This, in turn, theoretically provides the students with a greater feeling of belonging to something in which they can participate, and thus enables them to develop a better self-concept (p. 3).

Like their students, rural teachers also face pronounced challenges. For example, the closed nature of small school environments means teachers should exploit opportunities to work across grade levels, communicating and strategizing together (Thomas, 2005). Other challenges rural teachers face include elements of No Child Left Behind – especially Annual Yearly Progress mandates, budget and student transportation issues, and student access to supplemental services (Reeves, 2003). Thomas (2005) also believes that the academic demands created by curricular standards may prohibit instruction connections with community.

Place Meaning Contexts

Semken and Freeman (2008) define sense of place as constituting place attachment and place meaning. Place meaning is the cognitive (effective) domain of sense of place. Young (1999) postulates place meaning is socially composed and conferred between producers (those who disseminate meaning) and consumers (those who receive meaning). It is a bidirectional process of exchange. The depth of place meaning is based on negotiations between the structures of place consumption and production within this bidirectional process (Young).

There is a gap in the literature concerning research on the effectiveness of place meaning, particularly in context of place-based education. The studies that do exist, while significant, fall short when indicating how profoundly students engaged with both their cultural and physical environments (Semken & Freeman, 2008). Young (1999) created the

Place Meaning Survey (PMS) instrument to measure individual construction of place meaning. He believes place meaning attributes are "influenced by pre-visitation variables, including existing knowledge, and environmental preferences and experience" (Young, p. 373). The PMS is designed to measure the range of meaning people attribute to places. It is devised to discern how and why people place importance on places. Young (1999) created survey items he believed would be relevant and meaningful to people.

The PMS consists of 26 place meaning items from Young's (1999) original 30 items, for example:

- Ancient
- Scenic
- Fragile
- Threatened

(See chapter three for the complete survey items). Young (1999) used four interview questions to identify and validate the 26-item survey (see chapter three). The interviews were conducted repeatedly. After 15 interview sessions were conducted, Young (1999) determined no additional themes occurred. He used the PMS in the context of tourism and tourist places.

Semken and Freeman (2008) used the PMS instrument in their study on the practice and assessment of place-based science education. They posit sense of place is a measurable paradigm of place-based instruction in science classrooms. From the premise of place as a social construct, Semken and Freeman believe,

> Many different meanings – for example, aesthetic, ceremonial, economic, familial, historical, political, and spiritual, as well as scientific – can accrue to the same place, evincing the spectrum of ways that individuals and communities know and

> experience [place]… Furthermore, to have little or no sense of local places is to be oblivious to their aesthetic value and their cultural and political significance, and possibly even to accede to their environmental or social degradation. This is a perilous path, in light of the increasing cultural diversity of our school population and mounting public concern over the sustainability of lifeways in the developed world" (p. 1043).

Semken and Freeman (2008) concluded that it is not only appropriate but, possible to create an assessment that is relevant to the specifics of place-based curriculum. They determined the PMS to be reliable and valid and propose the instrument is generalizable and perceptive in nature, making it suitable for use in the context of place-based education (Semken & Freeman).

Culturally Relevant Place-Based Education

Place-Based

Some researchers believe place-based education is the remedy to the lack of focus and attention on the Earth prevalent in many schools (Sobel, 2004). Place-based education is defined as:

> The process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science and other subjects across the curriculum. Emphasizing hands-on, real-world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens. Community vitality and environmental quality are improved through the

> active engagement of local citizens, community organizations, and environmental resources in the life of the school (Sobel, 2004, p. 6).

Descriptions of place-based education as an ever-increasing pedagogical phenomenon in both urban and rural schools in the United States are evident in the literature (Gruenewald, 2003; Penetito, 2009; Reyhner, 2010; Sobel, 2004).

Place-based curriculum may address issues underrepresented students have when it comes to decontextualized curriculum and instruction, which is in opposition to their home culture and worldview. Researchers (Penetito, 2009; Reyhner, 2010) believe the most effective way to contextualize education is to make it compatible with their culture, home life, and community. Penetito (2009) believes, from a practical perspective, place-based education can answer fundamental questions concerning what place is and what our relationship with it may be.

This leads to the issue of novelty space, which should be considered in relationship with place-based education. Riggs (2004) believes both curriculum designers and teachers must deliberately minimize Novelty Space (the collective effects of cognitive, psychological, and geographic novelty existing in a learning environment). The three components of Novelty Space are interconnected with no clear boundaries see Figure 2.1). The Novelty Space construct merely functions to identify the constantly interrelating features of a system, which if managed by educators, improve learning experiences in outdoor settings.

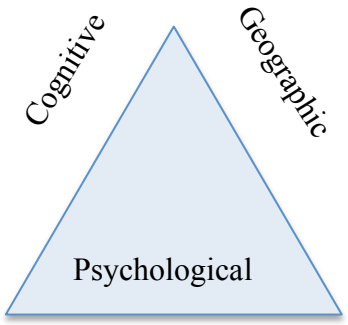

Figure 2.1
Novelty Space

"Only by minimizing the total space encompassed by all three elements of novelty space can students reach a point of optimum preparation, personal comfort, and maximum learning in the field" (Riggs, 2004, p. 6). Teachers can reduce Novelty Space by preparing students in advance. Preparation can include:

1. Thorough knowledge of the physical location of the field trip relative to more familiar landmarks from their daily life and all other geographic factors and features related to the field area and stops to be made (geographic preparation),
2. A briefing of the physical conditions they could expect, including weather, temperature, duration, time of arrival and departure, provisions for personal comfort (food, drink, etc.), and other personal factors so that they could minimize the separation between their personal expectations and the reality of the field environment as it actually occurred (psychological preparation),
3. A full suite of transferable, relevant, and necessary skills and prior knowledge from the content area in question that they could draw on to conduct meaningful investigations in the field environment, akin to scaffolding any other set of classroom exercises (cognitive preparation) (Riggs, 2004, p. 7).

Riggs (2004) found when the three factors of Novelty Space are addressed through the above

stated methods students will show enhanced attitudes toward field trips, quantifiable learning gains, and ideal educational experiences. Although Riggs (2004) focused on field trips, the Novelty Space issues are relevant to place-based outdoor education. I posit technology can be added as a fourth component of Novelty Space. This position will be supported or disputed with findings, which answer the research sub question in chapter three.

Brown (2008) suggests there should be a larger focus on how places factor into deeper understanding of both communal and personal identity for students. Teachers should then develop a pedagogy acknowledging the nexus of place, identity, and the manner in which we both take from and give meanings to the places where we learn and live (Brown, 2008). Places are not just abstract concepts, but they are locales of consequence and experience, which indicate pertinent ongoing activity. Identity is constructed through interactions with place. When engaging in outdoor education activities, teachers can learn who their students are in relation to the place. A decontextualized curriculum can unfold naturally, providing an environment for personal development of all students.

> Practice which is place-based and which seek to guide learners towards identification with their significant places, and therefore questions of who they are, may not only save us from a life of placelessness, but may go some way towards reviving and sustaining our places (Wattchow, 2005, as cited in Brown, 2008, p. 21).

Critical Pedagogy of Place

Everyone experiences place in a different way. Teachers should learn how to facilitate the personal understanding of knowledge developed in place (Gruenewald, 2003). In other words, teachers should develop a critical pedagogy of place.

> Critical pedagogy and place-based education… [converge] …into a critical pedagogy of place [offering] a much needed framework for educational theory, research, policy, and practice. Place-based pedagogies are needed so that the education of citizens might have some direct bearing on the wellbeing of the social and ecological places people actually inhabit (Gruenewald, 2003, p. 3).

Gruenewald (2003) believes that while place-based education may lack explicit theoretical convention, due in part to its naming, its purposes and practices connect to contextual, experiential, and problem-based learning as well as outdoor, environmental, democratic, multicultural, and community-based education, and constructivism and critical pedagogy, in addition to other approaches concerned with the perspective and significance of learning from specific communities and regions. Critical pedagogies of place should embrace human experience in connection with the natural world (Gruenewald, 2003). "Perhaps the most revolutionary characteristic of place-based education— one that connects it to the Freirean tradition of critical pedagogy—is that it emerges from the particular attributes of place" (Gruenewald, pp. 6-7). Researchers like Gruenewald (2003) posit the idea of people needing to connect with a place prior to acting on its behave is not a novel idea. Curriculum should be designed in a manner that facilitates this connection, taking the idea of outdoor places out of the abstract.

Cultural Relevance

Lee (2003) postulates establishing an equitable "knowledge base" and promoting academic success is crucial for all students. Researchers are calling for serious attention vis-à-vis the development of culturally relevant curriculum and instruction approaches (Aikenhead & Jegede, 1999). The literature calls for equity in science education. For

underrepresented students learning is improved – in fact possible – when happening in a culturally and linguistically consequential way (Lee, 2003). Underrepresented students are members of microcultures, which bring unique traditions and knowledge to the classroom.

There are microcultures within every dominant culture. These microcultures share distinctive expectations, beliefs, values, norms and established actions. Western science is described as a microculture (Aikenhead & Jegede, 1999). There is a premise Western science holds presuppositions concerning the nature of science understood through laws and theories. Indigenous people, however, may not endorse or understand the Western science paradigm (Sutherland, 2005).

Culturally Congruent Instruction offers a pedagogical approach to decontextualize curriculum for underrepresented students. CCI in STEM subjects includes an amalgamation of NA history, language, and culture with the traditional paradigms of the dominant culture (i.e. Western) and curriculum and instruction design (Brown, 2007; Ladson-Billings, 1995; Pewewardy & Hammer, 2003; Sorkness & Kelting-Gibson, 2006). CCI also supports the cultural crossing of rural community and Western science paradigms.

Border Crossing

Classrooms are ever-increasing milieus of diversity (Brand & Glasson, 2004). Jegede and Aikenhead (1999) believe all learning is facilitated by culture and has a social construct; therefore, teachers have become "cultural brokers" in the classroom. Teachers try to connect students' home and school cultures minimizing schemata conflict. "To acquire the culture of science, [underrepresented students] must travel from their everyday life-world to the world of science found in their science classroom" (Jegede & Aikenhead, p. 48). Teachers face the challenge of supporting bridge building between these microcultures.

Jegede and Aikenhead (1999) believe students will participate in some arrangement of collateral learning and experience success in science curriculum when teachers are able to help with mediation or negotiation of "cultural borders." A teacher working as a cultural broker will help students navigate between their home and science cultures, resolving any schemata conflicts (Jegede & Aikenhead). Successful border crossing will be evident by what degree underrepresented students find Western science accessible.

The literature provides a number of methodologies educators can use to facilitate cultural border crossing. For example, Bang and Medin (2010) advocate for the integration of the intellectual assets of students in the design and execution of learning milieus, which values and supports the worldviews of underrepresented students. This is especially critical in science education, which arguably has its own specific culture. Sutherland (2005) postulates a holistic approach to science border crossing. Bang et al. (2010) assume a community-based approach.

Environmental Science Curriculum

"Theorists and researchers have suggested several different definitions for curriculum" (Parkay, 2013, p. 358). Currently used definitions include vocabulary such as, "a course of study", "course content", "planned learning experiences" and "all the experiences that students have while at school" (Parkay, 2013, p. 358). Parkay (2013) believes these definitions are inaccurate or at minimum incomplete. More accurate is the definition, "…the experiences, both planned and unplanned, that enhance (and sometime impede) the education and growth of students" (Parkay, 2013, p. 358). This study uses the following definition of curriculum:

The concepts and content as part of a course of study. Curriculum includes learning

standards, objectives and assessments, written materials and lessons created by the teacher, as well as products/materials created by students.

Since the first national Earth Day in 1970, environmental science has become a part "of the school science curriculum" (McComas, 2002, p. 665). Environmental science education was furthered with the "Environmental Education Act of 1990" (McComas, 2002, p. 668). Environmental science curriculum is standard based. The standards "point out that science and technology should guide decision-making about environmental issues" (McComas, 2002, p. 670).

Researchers posit, "…one of the central questions facing science educators is not whether learners should be doing science but how best we can support and engage active learners in the process of scientific inquiry" (Barab & Luehmann, 2003, p. 455). According to Barab and Luehmann (2003), a primary challenge curriculum designers face is how to engage "learners in meaningful scientific inquiry" (p. 455) while maintaining a focus on important science education goals in the context of public schools. This challenge may be mitigated through the use of project-based (Barab & Luehmann, 2003) and place-based (Gruenewald, 2003) curriculum, which assists in student engagement while contextualizing environmental concepts in science.

Digital Stories

Digital storytelling provides a platform teachers can utilize to assist underrepresented students navigation and articulation of home and school cultural differences. This method of storytelling encompasses oral (recorded narratives) and visual (still and moving pictures) components bringing together conflicting home and school cultural constituents. Digital stories are short narratives, which incorporate narrative tension, problem-resolution,

authentic voice, and a transforming understanding (Ohler, 2006), and other components. They combine the author's voice, still and video images, and music (Hull, 2003).

In the literature digital storytelling is stated as a meaningful way to incorporate technology into the curriculum (Hull, 2003; Kajder et al., 2005; Kulla-Abbott & Polman, 2008; Ohler, 2006; Sadik, 2008). However, this is contingent on teachers having the appropriate skills and knowledge (Levin & Wadmany, 2005; Sadik, 2008). There are sequential steps teachers and students can use to create basic yet effective digital stories. First, students write a preliminary script. The script is a brief (less than one type-written page) text that represents the story. Secondly, plan and create a storyboard. During this step, students represent their story with "a series of sketches representing the still images and, in some instances, short video clips that comprise the story" (Kajder et al., 2005, p. 40). Then, students improve the script and sequence images using a digital video editor. Next, students will need to add narrative and music, transitions, and special effects (Kajder et al., 2005).

The survival of digital stories in education is based on the ability to tie them to the curriculum; strengthening students report writing and media literacy and critical thinking skills. Creating digital stories allows students to tap into skill and talents in project development, media production, storytelling, and art among others which may otherwise go undeveloped and which will assist them in academics and work (Ohler, 2006).

> The most obvious thing to say about digital stories and other kinds of signification that are mediated by new information technologies is that they offer distinctive contrasts to the primarily alphabetic texts and the forms of textual reasoning that predominate in schools and universities (Hull, 2003, p. 230).

Hull (2003) believes idiosyncratic affordances are related to different forms of representation in multi-media literacy versus those associated with handwritten script.

Sadik (2008) emphasizes the pedagogical and technical characteristics of digital stories. These characteristics are:

1. Point of view,
2. Content,
3. Resources,
4. Curriculum alignment,
5. Organization,
6. Student cooperation,
7. Camera and images,
8. Titles and credits,
9. Sound,
10. Language,
11. Pacing and narrative, and
12. Transitions and effects (Sadik, 2008, p. 496).

Sadik (2008) believes digital stories can be assessed and recommends using the following six trait-scoring rubric:

1. The criteria should be clearly aligned with the requirements of the task and stated objectives.
2. The criteria should be expressed in terms of observable product characteristics.
3. Scoring rubrics should be written in specific and clear language.
4. The number of points that are used in the scoring rubric should make sense.

5. The separation between score levels should be clear.

6. The statement of the criteria should be fair and free from bias (pp. 495-496).

The literature contains rhetoric concerning the affordances of technology in context of student engagement. Specifically, in regards to digital stories, technology is an educational tool students can make their own (Kulla-Abbott & Polman, 2008; Sadik, 2008). Digital storytelling personalizes the experience of learning (Sadik, 2008). There is a symbiosis between discovery, inquiry, and digital stories (Kajder et al., 2005). Digital storytelling is collaborative (Kulla-Abbott & Polman, 2008).

Russell (1999) discusses, the idea of interpreting experiences through our metanarratives, our stories. While she believes the relationship between story and experience is complicated, Russell supposes experiences play a role in the creation of a person's story. These same experiences can disrupt those stories. The idea that humans disconnect from nature is an essential problem leads to the premise of story and experience being interrelated. The stories we tell about our relationship with nature influence what experiences we pursue, and in turn, our understandings of such experiences. These experiences add to the creation, fortification, and sporadic interruption of our stories (Russell, 1999).

Summary

In this chapter I reviewed Collateral Learning Theory, rural student and place meaning contexts, culturally relevant place-based education, and digital stories. Each of these elements in the literature was relevant to the basis of this case study and thus required examination. Particularly relevant was the gap in the literature concerning the use of digital stories in relation to place meaning. This nexus was foundational to this study. With the groundwork in place, this study was constructed in a manner that included the above-

mentioned elements. The next chapter discusses the research design and methods of inquiry including detailed explanations and justifications for linking digital stories and place meaning to establish a basis for future conservation agency in underrepresented students.

CHAPTER THREE: RESEARCH DESIGN and METHODS

Study Context

According to Louv (2005) youth have a complex and conflicting understanding of nature. He also believes they are aware of current global environmental issues, yet their personal contact with nature is fading. The experiences they do have with nature tend to be limited at best. Yet, their genetic makeup draws them towards an affinity with all living things (Buhner, 2002; Gardner, 1991). The resulting conflict impacts young people in various ways including decreased academic performance (Louv, 2005).

Place-based education provides an avenue for young people to reconnect with nature. It uses the environment to teach concepts in mathematics, science, language arts, social studies, and other subjects. This is in sharp contrast to today's standards-based approach to education, which focuses on core content from the confines of the classroom (Gruenewald, 2003).

The literature presented in chapter two indicated a focus on the use of culturally relevant place-based education for underrepresented students. It is proposed underrepresented students can successfully negotiate cultural borders when teachers act as cultural brokers (Jegede & Aikenhead, 1999). There is a call in the literature for teachers to develop culturally congruent instructional practices, using tools that aid in border crossing and decontextualizing curriculum (Jegede & Aikenhead, 1999; Penetito, 2009; Reyhner, 2010).

The use of digital stories may assist the border crossing vis-à-vis conflicting schemata between students' home and school cultures. Digital stories are defined as short narratives combining narration, still and moving images, and music. Digital storytelling allows underrepresented students a vehicle to interpret their experiences while building content

knowledge, critical thinking skills, media literacy, and project development. According to Ohler (2006) creating narratives gives students the opportunity to express their own learning stories. Using digital stories as a tool, students can engage in and give voice to their idea of place and what a specific place means to them.

Pilot Study

I, as part of a team of researchers and tribal community members, conducted a study in 2013 piloting the instruments used in this study. This pilot study was part of *Back to the Earth* (BTTE), a larger National Science Foundation (NSF) Innovative Technology Experiences for Teachers and Students (ITEST) project. BTTE is a program designed to engage students in grades 4-6 on two neighboring Native American (NA) reservations in place-based STEM activities. Students participate in spring recruitment workshops and two non-consecutive weeks of summer camp. The program objective is to involve students in an integrated science, technology, engineering, and mathematics (STEM) experience that merges Indigenous Knowledge (IK), place, and historical significance with Western science building leadership and identity, as well as contributing to the STEM workforce in both communities. The place grounding this study is a regional watershed shared by both tribal communities connecting them culturally and physically.

During the final week of summer camp, participants created digital stories using digital media software. They incorporated digital media collected on hand-held devices by the participants during the first week of camp. Using this digital media, along with narratives, songs, and drawings, participants gave voice to their place-based STEM camp experience. These digital stories were coded by three independent raters using Young's (1999) *Place Meaning Survey*. The stories, along with the pre- and post-survey instruments created by the

BTTE team members, are the only parts of the BTTE program used as the pilot study. They are, therefore, relevant to this study. There was no inter-rater reliability during this pilot study. Inter-rater reliability is included in this study.

Participants for the pilot study were chosen from two neighboring NA reservations. One of the reservations is in Washington and the other is in Idaho. Selection was based on parameters of the *Back to the Earth* grant, which states participants must be Native Americans entering grades 4th through 6th and living on one of the reservations. Participants were recruited during STEM activity events held at their schools and within the communities. Participation was completely voluntary. For study purposes Idaho participants were labeled as *Community-1* and Washington participants as *Community-2*.

The results of the pilot study indicate a deeper place meaning for the participants after participation in the treatment. Participants were able to successfully complete the digital story activity, including place meaning elements (see curriculum in Appendix A). Key items on the survey (described below and in Table 3.1) showed increases in place meaning and place-based identity.

On the first weeks pre-survey, BTTE camp participants were asked to identify living environments. None of the youth from Community-1 identified the watershed as a living environment in comparison to 70% of the youth from Community-2 who were able to identify the watershed as a living environment. The post-survey did show an increase in Community-1 with 10% of the participants identifying the watershed as a living environment. There was no change in the Community-2 responses. After attending the third week of camp, which focused more on the attributes of the watershed, data (primarily from the digital stories the participants created) shows that 66% of the youth demonstrate a

complex understanding of the watershed. For example, they were able to include discussion describing how watersheds are formed and how they function, specifically discussing the convergence of waterways. All (100%) of Community-1 participants and most (75%) of Community-2 wrote rich descriptions on the final weeks post-survey in response to the question “What is a watershed?”

Results also support the claims made by researchers through literature that identity is formed through interactions with place. For example, when answering, “I am proud of my culture” on the pre-survey, 77% of Community-1 youth and 100% of Community-2 youth stated they strongly or very strongly agree. On the post-survey, 100% of both communities answered they strongly or very strongly agreed. When asked on the pre-survey to answer the following, “I believe I could be a scientist without giving up my culture”, 77% of Community-1 youth and 71% of Community-2 youth stated they strongly or very strongly agree. On the post-survey there was no change in Community-1 responses; however, there was a 4% increase in Community-2 with 75% of respondents answering the strongly or very strongly agree. When asked the same about being an engineer, 66% and 62% (Communities-1 and -2 respectively) strongly or very strongly agreed on the pre-survey and 75% of Community-1 answering they strongly or very strongly agree on the post-survey with no change in Community-2. Pilot study data is represented in Table 3.1.

Table 3.1

Pilot Study Summary of Findings

Sample Survey Items	Living Environments - Watershed	I am proud of my culture	I believe I can be a scientist w/out giving up my culture	I believe I can be a engineer w/out giving up my culture
Community-1				
Pre	0%	77%	77%	66%
Post	10%	100%	77%	75%
Community-2				
Pre	70%	100%	71%	62%
Post	70%	100%	75%	62%

After completing the two-week treatment, participants from both communities showed increased understanding of place as demonstrated in the pre- and post-surveys as well as the digital stories. Survey results show participants increased their cultural identity, scientific understanding of the place, and their ability to blend Indigenous identity with a STEM career. Community-1 showed the greatest increase in cultural connection to and identity with the place. Participants incorporated Indigenous Knowledge as well as newly acquired STEM knowledge in their digital stories.

The survey instrument is deemed valid; however, there are some trustworthiness issues. Primarily, the pilot study pre- and post-surveys were not identical. Also, all surveys were created by the BTTE team and used for the first time during the pilot study and this raises reliability concerns. As well, it was predicted the 5th grade population selected for this study would perform equally to the 4th-6th grade participants in the pilot study. This untested prediction adds to reliability and credibility concerns regarding the instrument and treatment used in this study.

Research Design

This mixed methods case study investigated the following question: What are the affordances and barriers for teaching underrepresented students who make digital stories to articulate place meaning as part of an environmental science curriculum? Three additional sub-questions were:

1. What key experiences will contribute to deeper place meaning?
2. What affect does digital storytelling have on border crossing?
3. How does the introduction of technologies positively or negatively impact novelty space?

The research question and secondary sub-questions directed all phases of this study.

A mixed methods design was used for this study. For comparison purposes, a control group and treatment group were randomly assigned within the group of participants. Quantitative data (pre- and post-surveys, paired and independent t-tests) supported with qualitative data (student and teacher interviews, researcher journal entries – including observation notes, participant reflections, participant storyboards, and treatment group digital stories) were collected on all participants. The mixed methods design incorporated a qualitative case study component. Creswell (2013) defines a case study as investigating "a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observation, interviews, audiovisual material, and documents and reports), and reports a case description and case themes" (p. 97). Three elements bound this case study. The first element was activity (digital storytelling). The digital storytelling is common to both the pilot study and this study. This activity is the basis for the curriculum (see Appendix A) that was

developed for this study. The second element was time. The treatment was implemented over a period of four weeks was chosen based on the idea that this was enough time to complete the digital story curriculum in its entirety. The third element was student reflection. These reflections were captured post-treatment. Participants evaluated other participant's digital stories and provided written reflections.

The design employed an observation, treatment, observation model (see Table 3.2). All participants were surveyed and observed during the environmental science curriculum activity. The treatment (digital stories) was then implemented in the classroom selected as the treatment group. Following the treatment all participants were surveyed and interviewed. The treatment group then participated in delayed post-treatment evaluations and reflections. The research design is presented in Table 3.2.

Table 3.2

Observational Research Design

	Observation	Treatment	Observation
O1	Demographic Review Pretest Survey Interviews	ES Activity with Treatment (DS)	Posttest Survey Interviews DS Observation Reflections
O2	Demographic Review Pretest Survey Interviews	ES Activity without Treatment (DS)	Posttest Survey Interviews Reflections

Population

This mixed methods study also employed a non-equivalent control design. The participants were fifth graders selected from one rural school in the Northwest United States. There were 44 total participants. Participant names used are pseudonyms to ensure anonymity. The median income of households in the rural town selected for this study was $28,854 with 20.3% of people under 18 years of age living below the poverty line. All participants were volunteers. To recruit these volunteers I: (a) selected a rural school based on the definition given in chapter one and travel distance, (b) met with the Superintendent and principal of the chosen rural school to introduce the proposed study and benefits expected for the school and students, and (c) at the invitation of the principal, met with the fifth grade teachers making a comparable presentation to them. The treatment and control groups were determined by random draw. No participants were compensated for involvement in this study; however, student participants received academic compensation (participation points) from their teachers for the storyboarding activity.

Data Collection

Data were collected in a variety of ways for this mixed methods case study. These included the following artifacts: student and teacher interviews, researcher journal entries – including observation notes, participant reflections, participant storyboards, and treatment group digital stories. For analysis purposes, the data were divided into primary and secondary sources. I categorized primary data as: storyboards and surveys and secondary data as all other data collected including digital stories, researcher journal entries, participant reflections, and all interview transcripts.

Community buy-in was an important aspect to this study as the environmental science pieces of the curriculum may have been viewed by some as conflicting with cultural and socioeconomic constructs of the region where my study took place. Therefore, prior to beginning the study, I co-authored (with the school principal) an informational letter to parents/caregivers about the study I would be conducting (see Appendix B). The principal edited the letter ensuring appropriate language and cultural relevance. The principal and participating teachers also provided feedback and approval of the parent/caregiver consent form (see Appendix C) before it was distributed. During the first week of the study, I conducted a training session with the teachers on the technology we would be using (iPads and iMovie). The basis of the training was to familiarize them with the technology in order to better assist their students during the implementation of the treatment.

Demographic information was obtained during the survey process. I distributed consent forms (Appendix C) to the parents/caregivers of the selected study population as well as the participating teachers. After receiving parent permission, I began a four-week study in two 5th grade classes. Participant assent was received orally from every student. Any participants who did not have parental permission did not appear on camera. A number of practices were employed to assure those participants were not captured on video or in photographs, including, but not limited to, having those participants work in a "no camera" zone, operate the video/photography devices, and sit next to or behind the interviewer so as not to appear in the video.

To establish a baseline of place meaning, I gave both the treatment and control group's pre-treatment surveys during the second week of the study period. I used Young's Place Meaning Survey (PMS) (See Appendix D). These surveys were read to each class, then

administered in groups (approximately half of the class at a time). Each survey item was discussed giving participants an opportunity to ask questions and a definition of terms page was given to the participants for their reference. The survey time was approximately 20 minutes per group. Circumstances around time limitations meant participants absent on the day the survey was administered did not take it.

I interviewed all study participants (treatment and comparison groups as well as teachers) during the first two weeks of the study. Teacher interviews lasted approximately 10 minutes and were conducted with both teachers at the same time (each responding to the questions in turn), while the student interviews, given in groups, lasted about 25 minutes each. Due to time constraints (mentioned below in the limitations section), only students present during the scheduled interview time were interviewed. I developed an interview protocol for both student and teacher interviews (see Appendix E). Protocols for the student interviews addressed environmental science understanding, digital storytelling utilization, and study site place meaning. Teacher interviews were conducted to support observations of student knowledge, experience and expression regarding the affordances or barriers of using technology as part of an environmental science curriculum in deepening place meaning, as well as to examine teacher attitudes and beliefs toward the digital storytelling curriculum.

During the first week, I conducted non-participatory observations of the treatment group participating in an art-based activity in their classrooms. Both groups participated in environmental science activities at the selected site. At the insistence of the teachers, both the treatment and control groups participated in the field activities on the same day; however, they were separated physically so they were unable to see each other. Only the treatment group was given iPads for the entire field experience (five environmental science activities

over the course of the day). During the third week of the study, both groups created storyboards. The treatment group created digital stories. I started the fourth week by giving all participants a post-treatment survey – which was of a similar duration time as the pre-treatment survey and administered using the same group format. I also conducted final interviews with all participants. Student reflections were collected post-treatment as part of the digital story presentations. Each group presented their digital story to the class and other participants evaluated the digital story presented providing feedback to the treatment groups. Participants were provided a grading rubric to guide the evaluation process (see Appendix G). Inter-rater reliability was established by having three separate raters code each digital story using the PMS. In an attempt to establish high inter-rater reliability each independent rater received the PMS item codes list and a definition of each item on the list (the same definition list provided to study participants mentioned above) and each rater participated in discussions on the understanding of the PMS items, their definitions, and procedure for coding the digital stories.

I kept a journal based on both classroom and field observations. Observations were held throughout the study, beginning in the classroom before the curriculum was implemented, during the treatment, and back in the classroom post-treatment. Anonymity was ensured through the use of identity codes. I created a list of alpha/numeric codes to replace student names. I assigned the codes to participants and used them on all study materials. Using these multiple forms of data collection are in keeping with Creswell's (2013) definition of a case study.

Digital stories, interview transcriptions, observations notes, and surveys (digital copies) were stored on my personal laptop and backed up on an external hard drive. No one

had access to the laptop or the external hard drive other than me. All hard copy material (researcher journal, surveys, and observation notes) was secured in a locked file cabinet. All data collected during this study was kept for a time in compliance with IRB protocol.

Data Analysis

The Huberman and Miles (1994, as cited in Creswell, 2013) approach was used during data analysis. Analysis strategies in this approach include making metaphors, writing codes, and noting themes and patterns among others. This approach allowed for thick, rich descriptions to be established grasping the spirit of the phenomenon (place meaning). Creswell's (2013) holistic analysis approach for case studies guided the evaluation of all data from this study. Holistic analysis allowed the entire case study to be examined. Analysis of the data followed Creswell's (2013) *Data Analysis and Representation by Case Study* techniques. This included creating data files, describing the case, establishment of themes, patterns and codes, direct interpretation of data, and presentation of the case through narrative, tables, and figures (Creswell, 2013).

Case study procedure requires the identification and use of codes. All qualitative data, both primary and secondary, was coded in NVivo. For example, all interviews were transcribed into a Word document then entered into NVivo, organized and analyzed using naturalistic/place codes, which were developed during the data analysis process. These included "…in vivo codes, names that are the exact words used by participants" (Creswell, 2013, p. 185). Findings were organized by these codes and subsequent themes were identified. Themes identified were: *Place Meaning*, *Engagement*, and *Science and Technology*. These themes, and any subsequent sub-themes (e.g *Active Leader*) were used to organize findings. Themes were organized in order of code discovery revealed during data

analysis. After analyzing and interpreting the qualitative data, excerpts supporting the themes were included in the findings of this study.

The PMS, used as the pre- and post-test survey, included 23 place-meaning themes. Using a 5-point Likert Scale, participants ranked each theme for a total possible score of 115. In response to the open-ended questions on the survey, one participant from the control group and four participants from the treatment group stated they had not been to the location the environmental science activities were held. Consequently, these participants' survey results were removed from the data due to vicarious impression. This is described in detail in chapter four. A t-test for independent groups was used to determine whether or not the survey data sets were significantly different. A paired t-test was used to compare control group pre- and post-test surveys as well as pre-and post-test surveys for the treatment group. During synthesis of the survey data, a "violation of homoscedasticity" (Statistics Solutions, 2003, n. p., retrieved online) was evident. This occurs "when the size of the error term differs across values of an independent variable" (Statistics Solutions, 2003, n. p., retrieved online). Outriders were removed from both the pre- and post-test surveys to correct for standard error bias (which leads to incorrect conclusions about significance) to move toward an assumption of homoscedasticity. After outriders were removed, additional paired and independent t-tests (as described above) were used to determine significant differences in participant surveys.

Three independent raters were engaged to code the storyboards and digital stories. They used the 23 place meaning themes from the PMS. In an attempt to achieve inter-rater reliability, the raters received and discussed the place meaning themes and definitions. During coding, each rater entered results into an Excel spreadsheet. Raters examined the storyboards and digital stories, awarding one point per theme identified. Those were

compiled into one spreadsheet for analysis. Themes were totaled, compared, analyzed, and reported as part of this study's findings.

During the digital story presentations, participants gave feedback to presenters via *Student Reflection Rubric* forms. Quantitative data was excluded from findings due to the inconsistent number of participants per group. Qualitative data from the reflections was analyzed, interpreted, and reaffirmed with primary data as described below.

In an attempt to establish reliability, I examined both student perception (surveys) and product (storyboards/digital stories) to assess whether or not they were the same. Data from participant reflections was reaffirmed with primary data described above (see Figure 3.1). Researcher notes were made and these findings will be reported in chapter four.

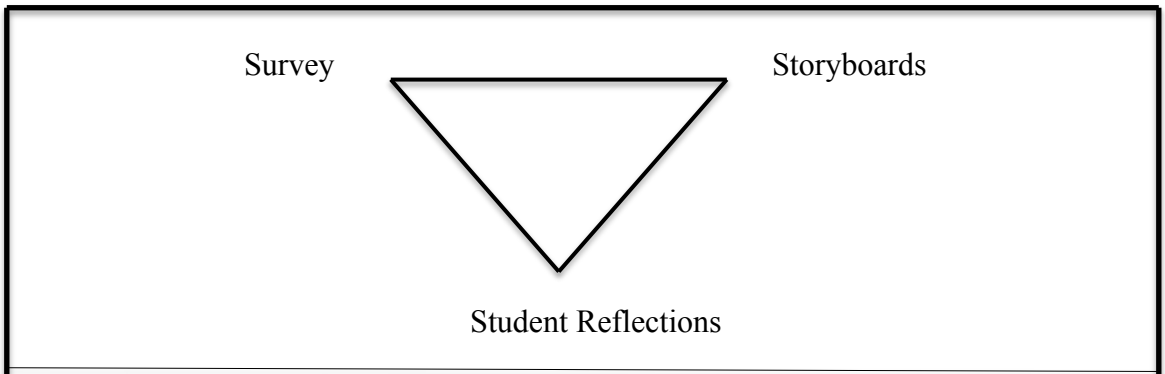

Figure 3.1
Data Reaffirmation

Validity

Validity was established by reaffirming data. The themes identified using NVivo were affirmed against other data sources (e.g. pre/post surveys) to establish or bring into question validity. Young's (1999) Place Meaning Survey was used to code the storyboards and digital stories as well as in a 5-point Likert Scale pre/post survey. As stated in chapter two, this is a survey instrument with established reliability and validity. I created the survey

using a point construct similar to the one used by Semken and Freeman (2008) in combination with the open-ended questions used by Young (1999). I used three of the four open-ended questions (intended to establish a baseline on place meaning) and 23 most applicable themes from Young's (1999) original 30 item PMS. I changed Young's *Important to Aboriginal Culture* to *Important to Rural Culture*. Each item in the survey was defined for participants and the independent raters. The point's formula the raters used to code both storyboards and digital stories will be explained in chapter four.

Researcher Background

My academic and professional background and experiences have afforded me unique understanding, which will help me as an educator, scholar, and researcher. Before pursuing a Ph.D., I spent over 20 years as an educator – the last 14 years as an outdoor environmental science educator. While working as the education curator at a natural history museum, I realized young people struggled to build conservation agency because they were disconnected from the place they lived. This disconnect made talking about conservation in a meaningful way challenging and promoting action on the part of the youth even more challenging. During this time I was pursuing a Master of Arts degree in Education, in the department of Curriculum and Instruction. I focused my thesis research on what I termed the human-nature disconnect (Richard Louv's Nature Deficit Disorder). This thesis work and experiences over the past 14 years as an outdoor environmental science educator have inspired my pursuit for a terminal degree and has guided my current research work.

Biases

It also leads to the biases I bring to this proposed study, including my view on student learning in an outdoor environment. As stated above, I believe the nature disconnect today's

young people experience has a negative impact on student engagement with and, ultimately their connection to, the places where they live and learn. I entered my dissertation research with this lens – developed during my career as an environmental science educator. I expected this lens would deepen as I went through this research process.

Limitations

I have addressed predicted limitations in this section, thus eliminating the need to address them in later chapters. There were five primary limitations. Each was important to contemplate due to their effect on how the study was conducted.

Novelty Space

The first predicted limitation was Novelty Space. There were three factors regarding novelty space: psychological, geographical, and cognitive (Riggs, 2004). Pre- site visit preparation mitigated these factors and countered this limitation. I prepared participants to visit the outdoor location through classroom presentations. Participants gained knowledge of the site during pre-visit class discussions. Reference was made to landmarks and cultural relevance familiar to participants' daily life and community.

Hawthorne Effect

The Hawthorne Effect was the second predictable limitation. This happens when participants' behavior is persuaded by the incidence of an experimental milieu and their perceptions of how they should react. Participants were informed of the nature and scope of this study and they were required to give assent. This limitation was not countered.

Diffusion

Diffusion was the third predicted limitation based on both the control and treatment groups being located in the same rural school. As part of the diffusion limitation, vicarious

impression was predicted. Meaning student participants gave answers most likely derived from their peers' impression of the place. Participants interacted with each other both during school hours and socially after school causing information about the treatment to be discussed with the control group. In anticipation of diffusion, both teachers requested the technology be utilized by all participants at the same time to avoid members of the control group feeling "left out" knowing that their friends "get to use the iPads and they don't." This limitation was not countered due to my attempt to address the teachers' request. This impacted the study's methodology and will be discussed in chapter five.

Proximity of Site

The fourth predicted limitation was the proximity of the outdoor site to the school. There were expected limitations in the use of an off campus location. First, transporting participants to and from the site and subsequent cost issues. Participants were able to walk to the site, eliminating any added expense. Another limitation is the time required when taking participants away from the school campus. Costs were eliminated by considering an outdoor education experience within walking distance to the school. The time limitation was not countered.

Study Time

Finally, study time was the fourth predicted limitation. The study was conducted under a truncated timetable. Initially, a six-week schedule was proposed to the teachers. However, the teachers, needing time to complete mandated testing, agreed to a four-week timeline at the end of the school year. This limitation was not countered due to political and territorial issues between the school, teachers, and researcher as well as teacher assumptions

about the curriculum. This impacted this study's methodology and it will be discussed in chapter five.

CHAPTER FOUR: FINDINGS

Today's youth interact with technology on a regular basis. They surf the web, record and post videos, and engage in the dominion of social media (Levin & Wadmany, 2005). Cope and Ward (2002) believe using recognizable portable devices, such as iPads or Chromebooks, may contribute to student buy-in where curricular relevancy concerns exist. The literature indicates a connection between culturally relevant place-based education and underrepresented students. The literature calls for teachers to cultivate culturally congruent instructional practices, using tools that aid in border crossing and decontextualizing curriculum (Jegede & Aikenhead, 1999; Penetito, 2009; Reyhner, 2010). The use of digital stories may assist the border crossing regarding conflicting schemata between students' home and school cultures.

From this premise I conducted a mixed methods case study. This study was guided by the main research question: "What are the affordances and barriers for teaching underrepresented students who make digital stories to articulate place meaning as part of an environmental science curriculum?" as well as three secondary sub-questions: 1) What key experiences will contribute to deeper place meaning? 2) What affect does digital storytelling have on border crossing? 3) How does the introduction of technologies positively or negatively impact novelty space? In this chapter, I present findings related to themes identified during data analysis. Those themes are: *Place Meaning*, *Engagement*, and *Science and Technology*.

Sample Population

All student participants were fifth graders enrolled in a rural school in the Northwest United States. To support anonymity the word "location" in brackets or parenthesis is used in

this chapter in place of the proper name of the site where this study was conducted. Student quotes were taken verbatim. I include [sic] in any quotes with grammatical errors to indicate they are presented as written or stated by the participant. A total of 44 students participated in this study (21 control group, 23 treatment group). Students ranged in age from 10 to 13 years old. The mean age of the control group was 11 years 2 months (134.6 months) and the mean age of the treatment group was 10 years 10 months (131.4 months). There was no statistically significant difference in age between the control and treatment groups ($p = 0.09$). Age distribution for student participants is represented in Table 4.1.

Table 4.1

Age Distribution of Student Participants

	Age			
Range	Control (N = 21)		Treatment (N = 23)	
in Months	N	% of Total	N	% of Total
120-131	2	9	6	26
132-143	14	66	13	57
144-155	4	20	4	17
156-167	1	5	0	0

Gender distribution was as follows: 30 males and 14 females. There were twice as many male participants as female. Possible implications of the gender distribution will be discussed in chapter five. Table 4.2 represents the gender distribution of study participants.

Table 4.2

Gender Distribution of Student Participants

	Gender			
	Control (N = 21)		Treatment (N = 23)	
	N	% of Total	N	% of Total
Male	14	67	16	70
Female	7	33	7	30

Fifty percent of the participants lived in the area for four years or more. One participant did not respond to this demographic question.

Place Meaning

According to Young (1999) place meaning is directly related to sense of place and is arranged socially between producers and consumers. The depth of place meaning is constructed on place utilization and production between producer and consumer in a bidirectional process. Place meaning was foundational to the research questions guiding this study and, therefore, was an important code.

A Place Meaning Survey (PMS) instrument (see Appendix D) was created to measure individual construction of place meaning. It investigates how and why people place importance on locales. Semken and Freeman (2008) used the PMS instrument in their study on the practice and assessment of place-based science education. I used the PMS, based on the Semken and Freeman model, as my pre- and post-test survey. It included three open-ended questions designed to determine respondent affect concerning the location used for the environmental science activities during the field portion of this study. The open-ended questions were:

1) What are your general impressions of the place (location)?

2) What is most important about (location) to you personally?

3) How do you personally feel about the place (location)?

Below are excerpts from the qualitative data, which are representative of participant responses to these open-ended survey questions and relate to the theme *Place Meaning*.

Both control and treatment group answers on the pre-test survey contained responses related to utilization of place when asked about their general impression of the place. For example, participants responded:

- It's a good place to hangout
- I would swim there
- …fun place to swim
- A place of fun swimming and [marshmallows]

The majority of responses concerning general impression included aesthetic traits (both positive and negative). For example, participants indicated:

- … a pretty park
- It is beautiful
- Don't like because of the geese poop
- I think it is nice …
- I think it looks ancient
- It is nice and beautiful …
- There is a lot of trash but it's nice when it's cleaned up
- The boat launch is [gross near] the land and water

When asked about general impressions on the post-test survey, 10% of the control group gave answers related to utilization of place. However, none of the treatment group

included utilization aspects in their responses. Seven participants in the treatment group mentioned having positive feelings about the location during the pre-test survey. One participant said, “I think I feel really good [sic].” Another stated, “I think it would be a very good place to go stay and run at [sic].” After participating in the treatment, 12 participants gave similar positive responses. One participant expressed having a negative feeling, describing it as “Boring.”

In response to the question “What is most important about (location) to you personally?” several participants mentioned utilization aspects of the location. They wrote, “That it is a good place to go fishing [sic]” and “You can do fun activities and be with your family.” Several participants mentioned naturalistic aspects of the place as being most important. One participant said, “The animals are most important.” Another stated, “Primarily, the water is most important.” Other participants declared cultural aspects of place as being most important. Jane, a participant in the control group, said, “It has lots of history.” Rose, a participant in the treatment group, stated, “What it was like with its logging history [sic].”

The PMS included 23 place meaning themes. Using a 5-point Likert Scale, participants ranked each theme - total possible score 115. One participant from the control group and four participants from the treatment group stated they had not been to the location the environmental science activities were held; however, they filled out the entire place meaning survey. These participants’ survey results were removed from the data due to vicarious impression and noted in Table 4.3. A one-tailed paired t-test was used to determine if there were significant differences between each group’s pre- and post-test surveys. There was a significant difference in the control groups pre-test ($M= 61.07$, $SD= 7.35$) and post-

test survey scores (M= 68.43, SD= 16.31) conditions; t = 1.8118, p = 0.045. There was not a significant difference in the treatment groups pre-test (M= 73, SD= 12.38) and post-test survey scores (M= 74.73, SD= 11.89) conditions; t = 0.4422, p = 0.33. A two-tailed independent t-test was used to determine if there was a significant difference between the groups' pre-test surveys. There was a significant difference in the pre-test survey scores for the control group (M= 61.07, SD= 7.63) and the treatment group (M= 72.57, SD= 12.34) conditions; t = 3.34, p = 0.002. This raised questions concerning instrument validity and reliability as well as sampling factors. These will be discussed in chapter five. A one-tailed independent t-test was used to determine if there was a significant difference between the groups' post-test surveys. There was not a significant difference in the post-test survey scores for the control group (M= 68.43, SD= 16.31) and the treatment group (M= 74.73, SD= 11.89) conditions; t = 1.45, p = 0.077.

During data analysis, a "violation of homoscedasticity" (Statistics Solutions, 2003, n. p., retrieved online) was discovered. There was no equal variance, a concern for survey validity and reliability. Outriders were removed from both the pre- and post-test surveys to correct for standard error bias and achieve equal variance. This process meant confounding themes with the highest *p* values (above 0.24) were removed. The themes removed were:

- Ancient
- Pristine
- Important to Preserve
- Important to Rural Culture
- Overdeveloped
- Unusual

- Scientifically Valuable

Results from a two-tailed independent t-test revealed a significant difference in the pre-test surveys between the control group (M= 61.07, SD= 7.63) and the treatment group (M= 72.57, SD= 12.34) conditions; t = 3.10, p = 0.004. The control and treatment groups' pre-test results for place meaning themes are represented in Table 4.3

Table 4.3
Place Meaning Theme Pre-test Survey Scores for Control and Treatment Groups

Range of Scores	Control (N = 21)		Treatment (N = 23)	
	N	% of Total	N	% of Total
29	0	0	1	4
30-34	0	0	0	0
35-39	3	14	1	4
40-44	3	14	1	4
45-49	5	24	3	13
50-54	4	19	3	13
55-59	0	0	9	39
60-64	0	0	1	4
65-69	0	0	1	4
70	0	0	2	9
Missing *	6	29	1	4
Participant results removed **	1		4	

Missing * means the student was absent from the day the survey was given.
Participants results removed** means these participants' results were removed from the survey data due to vicarious impression. These participants stated, in response to the open-ended questions, they had not been to the location yet they completed the entire survey.

Results from a one-tailed independent t-test revealed a significant difference in the post-test surveys between the control group (M= 48.9, SD= 5.79) and the treatment group (M= 55.27,

SD= 4.32) conditions; t = 1.85, p = 0.036. The control and treatment groups' post-test results for place meaning themes after I ensured equal variance are represented in Table 4.4.

Table 4.4
Place Meaning Theme Post-test Survey Scores for Control and Treatment Groups

Range of Scores	Control (N = 21)		Treatment (N = 23)	
	N	% of Total	N	% of Total
20-24	2	9	0	0
25-29	0	0	0	0
30-34	1	5	0	0
35-39	1	5	1	4
40-44	0	0	2	9
45-49	4	19	5	22
50-54	8	38	1	4
55-59	4	19	5	22
60-64	0	0	4	17
65-69	0	0	3	13
70-74	0	0	1	4
75-79	0	0	0	0
80	1	5	0	0
Missing *	0	-	1	4

Missing * means the student was absent from the day the survey was given.

Table 4.5 is a representation of the five place meaning themes in this survey with *p*-values < 0.05.

Table 4.5
P-values < .05

		Place Meaning Themes				
	N	Scenic	Remote	Relaxing	Fun	Tranquil
Treatment	22	83	60	87	97	77
* Missing response	1					
Control	21	64	43	59	74	93

The PMS was used to code the storyboards created by both participant groups as well as the digital stories created by the treatment group. Three independent raters were employed. The raters met to establish inter-rater reliability. In an attempt to strengthen reliability and consistency, all three raters received and discussed the place meaning themes and their definitions. Each theme was worth three points (one point per independent rater). The control group had 19* participants create storyboards for a total of 57 points per theme, while the treatment group had 23 participants create storyboards for a total of 69 points per theme. Total points were calculated by multiplying the number of participants (N) by the total number of points per theme (3). Both the control and treatment groups received a score totally 51% of the total for the theme Wilderness. With the exception of Wilderness and themes where both groups scored zero, treatment group storyboards scored higher in all themes barring two: Educational and Fragile. Storyboard place meaning theme total scores are represented in Table 4.6

Table 4.6
Place Meaning Theme Rater Code Scores for Storyboards

Place Meaning Theme	Control (Points = 57)		Treatment (Points = 69)	
	Points	% of Total	Points	% of Total
Ancient	0	0	0	0
Pristine	0	0	0	0
Scenic	11	19	25	35
Beautiful	2	4	12	17
Remote	0	0	2	3
Unique	0	0	0	0
Important to Preserve	5	9	23	32
Authentic	0	0	0	0
Privilege to Visit	0	0	1	1
Relaxing	1	2	2	3
Important to Rural Culture	7	12	33	48
Overdeveloped	0	0	0	0
Unusual	0	0	0	0
Scientifically Valuable	13	23	19	26
Ecologically Important	11	19	37	51
Fun	31	54	38	55
Threatened	7	12	10	14
Interesting	0	0	7	10
Educational	49	86	57	79
Tranquil	0	0	2	3
Spiritually Valuable	0	0	0	0
Fragile	1	2	0	0
Wilderness	29	51	35	51

* Two participants from the control group were absent the day storyboards were created.

The raters held a post-coding meeting to discuss each rater's codes and coding discrepancies. They determined there were significant concerns regarding the PMS as a coding instrument. One coder said, "I don't think it's reliable. Certain categories are harder, for example

'fragile'. It's highly subjective." Instrument subjectivity as well as reliability and validity will be discussed further in chapter five.

Examples of the *Place Meaning* theme were further evidenced in participant interviews. When asked, most students stated they had been to [location]. During the pre-test interviews, students expressed utilization concepts of place. I asked participants, "What does [location] mean to you?" Ian, control group participant, replied, "It's pretty. You get to go fishing. I caught Bluegill and some Sunfish over there…[sic]" Robert, treatment group participant, said, "I really like it. I like fishing there and I like to go there and hang out and stuff [sic]. It's really cool."

The following interview excerpt demonstrates an important finding from the data. Ian talks about the importance of [location] to rural culture.

Marcie: "What does [location] mean to you?"

Ian: "It's [location] means to me, it's pretty much like, like we don't have a lot of places you can go to, just do stuff. And, I can go there and do like whatever [sic]."

Other participants expressed similar cultural meaning. The following excerpts demonstrate how participants tied community and family culture to the place.

Jenny: "That place means a lot to me because when the [location] Lodge was there still, my sister and her friends used to play Heart and Soul and it's really sad about it [sic] because the owner has recently died."

Luke: "Yes, my mother used to work at the [location] Lodge when it was still there. She was a cook there and [I'd] swim when my mom was working, so [sic]."

Lance: "I like it because it's kind of like a generation thing, and my whole family goes there and we'll have a big picnic."

Important to Rural Culture was also evident in the storyboards and digital stories, as mentioned above. Treatment group participants made connections between the place they visited during the environmental science activities and their community in their storyboards. For example Anna wrote:

> "[Location] affects me and the community because the water has a lot of pollution in it and many animals live in there. Such as some cute ducklings with their mom passing through or by the dock… [sic]"

Another participant wrote, "[Location] sometimes provides fish. It also acts as a meeting place for me to swim." Heather wrote:

> "I think [location] affects [community] because people might litter and spill a lot of bad stuff in the lake and make the water not clean and healthy for the fish. It affects me because I might get very sick and I get others very sick to [sic] and I don't want that to happen at all."

In his storyboard, Bruce wrote, "I think that the [location] boat launch does effect [sic] our community because people can swim and play. Without the boat launch I think this town would be a bit boring." Other participants expressed similar sentiment through pictures – drawing people fishing and swimming.

As part of the post-test interview, I asked participants to tell me two things they learned about the environment through the environmental science activities at the field location. It was obvious students showed metacognitive strategies associated with place meaning, as exemplified in the following excerpt: "…you taught us how to look at the lake and think oh, what do I think that's in there? Like something that was there [sic]." Mrs. Carey, treatment group teacher, observed similar metacognition as evidenced in the

following excerpt from her post-test interview: "…I think that having the pictures and the experience has definitely made it more, like something more they would think about…"

As mentioned in chapter three, the treatment group presented their digital stories during the last week of this study. Their classmates provided feedback via the *Student Reflection Rubric* (see Appendix G). *Place Meaning* was one of three criteria on the rubric. Each criterion was worth a total of 3 points. For the treatment, participants were placed in groups of two or three by their teachers. One digital story was created and presented by each group. Reflections were given to the presenting group by one other group, therefore, not every group received the same total score as the group did not have the same number of participants. As a result, the quantitative data from the reflections was not included in the findings. Participants were asked to give written feedback in the *Comments* section of the reflection rubric. Place meaning was nuanced throughout these participant reflections as evidenced in the following excerpts: "Did not talk about the water muck [much] [sic]" and "It's peaceful and nice."

Engagement

The literature describes how technology may lead to greater student engagement (Liu, et al., 2013; Levin & Wadmany, 2005). However, there is a gap in the literature regarding evidence of sustained involvement due strictly to technology integration. The Substitution Augmentation Modification Redefinition (SAMR) Model (Puentedura, online 2015) does provide some evidence of student engagement through technology use. During data analysis, engagement emerged as a significant theme.

Both teachers believed their students would be engaged in the digital storytelling curriculum (see Appendix A). During the pre-test interview, Mrs. Carey said, "I think that

they'll really be engaged and excited about it." Mrs. Hudson replied, "I think it is going to be very engaging for the kids." In response to my question about which part of the digital storytelling curriculum they thought would have the largest impact on student engagement or interest, both teachers stated the technology (iPads) would be most engaging. Mrs. Hudson said, "Oh, definitely it's going to be the iPads. They are going to be so excited. I've got a student that he doesn't' even have access to the Internet, so he loves it when he can go to the library and use it." Mrs. Carey responded:

> "I think the iPads are going to be the thing that they're going to be super excited about. We don't actually, we have a lot of computers, but we don't have iPads so we don't get to do a lot with pictures just because taking them and trying to get them on computers. So, I think that quick action, they're really going to enjoy that part."

At the conclusion of this study, I asked both teachers if they noticed student engagement changing as a result of the digital storytelling curriculum activities. Mrs. Hudson responded, "Somewhat. They were really engaged with the hands-on…" Mrs. Carey also noticed changes in engagement, stating, "Well they were very engaged when they were creating their stories…"

The theme *Engagement* was evidenced throughout student participant data. During my first classroom observation, conducted with the treatment group, I noted students fully engaged during a hands-on art project. Although students expressed varied levels of confidence in their artistic ability, excitement and engagement were evident amongst all participants. This is in contrast to the language arts activity I observed during which several students were off task or wandering around the classroom. Mrs. Carey believes curriculum enjoyment and engagement have been negatively impacted by Common Core Skills

Standards. She said, “When I started teaching it was fun, for me and the students. Now it’s not.” The following student participant interview excerpts reveal a similar sentiment.

Ian: “I wish we did more fun stuff. Like we do some, but I wish we did more hands-on [sic].”

Eric: “…it’s boring.”

Fun was a recurring theme among participants. During the post-test interview I asked participants how the environmental science activities done at [location] were different from what they do at school. Participants consistently made reference to the environmental science activities at [location] being fun as evidenced in the following excerpts.

Ian: “And what was also even more fun at [location] because at [location] we got to do things that were actually fun [sic], not just read about things that we wish we could do.”

Luke: “They’re much more funner [sic].”

All three independent coders found the place meaning theme *Fun* nuanced throughout the storyboards and digital stories. Eighty-two percent of the control group’s storyboards conveyed the theme *Fun*, while 96% of treatment group’s storyboards expressed *Fun*. *Fun* was evident in 100% of digital stories.

I was interested in participant perception of their school science activities versus the digital storytelling curriculum, including both the environmental science and digital storytelling activities. Participants clearly and consistently articulated a preference for the format of the digital storytelling curriculum as demonstrated in the following pre-test interview excerpts.

Marcie: "What are two things about science activities that you do at school that you wish were different or that you may not like?"

Tim: "I wish we had like hands-on instead of reading books [sic]."

Jenny: "All we really do in our science centers is just like read… [sic]"

Bobby: "Like that we could do more experiments [sic]. We're just like talking about stuff that we do in science books – maybe more outside experiments."

When asked during the post-test interview a similar question, participants continued to express their preference for the format of the digital storytelling curriculum activities. For example, Noah said, "Compared to school, the activities we did at [location] were extremely exciting because when we were here the most exciting thing that happens is that we watch videos, maybe half an hour long, maybe [sic]." There was a common theme, beyond these examples, for school science to be more similar to the digital storytelling curriculum, specifically the hands-on and outdoor aspects.

Active Leaders

The sub-code *Active Leaders* described as: "Any student participant who was observed stepping forward and leading/assisting their peers during an activity." Data assigned to this code came exclusively from teacher interviews. Based on their existing knowledge of their students' personalities and capacities, both teachers articulated an expectation for certain students to step forward as active leaders because of their participation in the digital storytelling curriculum. Technology stood out as the main motivator to both teachers. In the following excerpt, Mrs. Hudson described her expectation for one of her students.

> "I have a few kids, well one little boy, I'm asking him politely to mark his book and pay attention to the lesson at hand. But, when it comes time to do something on the computers, he has learned how to do some pretty awesome things, you know through Google docs, and he's taught his peers. I can see him stepping up and you know wanting to put that book down and being a leader for his class."

Further evidence of active leadership was apparent in the following excerpt from Mrs. Carey. "Just doing more science recently, I have seen a couple of kids that seem to be kind of coming out of their shell that maybe weren't showing leadership before." Mrs. Hudson expected technology to be the foremost motivating factor for her students, while Mrs. Carey expected science would be the leading motivator. The following post-test interview excerpts reveal the authentic motivators each teacher observed during the digital storytelling curriculum.

> Marcie: "Have you observed any students emerging as authorities on environmental science? Digital Storytelling? [Location]?"
>
> Mrs. Hudson: "Yeah, Steve was stepping up and Jeffery. With John [adult leader of some of the environmental science activities] some kids with prior knowledge from last years afterschool program stepped up. A lot of kids were interested in going off on their own to collect bugs – extend learning."
>
> Mrs. Carey: "Um, not in the science concepts but some of the students really, 'cuz they really knew how to use the iPads, where other students didn't, and so they were able to lead in that regard."

The above excerpts represent participants' reaction to curriculum content, specifically science and technology.

Science and Technology

As mentioned in chapter three, participants were interviewed prior to beginning the digital storytelling curriculum and again at the conclusion of the study. During both interview sessions, participants were asked a variety of questions about science and technology. Therefore, both science and technology were important themes to investigate while coding the data.

Science

Science emerged as a prominent code. Both student and teacher participant data pieces contained references to science. To establish a baseline understanding of student perception concerning their school science, I asked participants to tell me two things about their school science activities they really like. The following excerpts provide an example of the general perception of participants in the control group.

> Student 1: "I like one of the things. I like to do this. I like to go outside. We like look at the watershed and how nature around us is working and which ways it can work [sic]."
>
> Student 3: "I kind of like reading from the book, but I kind of like more hands-on physical stuff. I like, actually not just reading, hands-on [sic]."

When asked the same question about school science, treatment group participants' responses were very similar to the examples above. The school science activities the participants stated they enjoyed most were either part of an afterschool program they participated in last year or activities from previous years in school. This is consistent with notes I made following my first classroom observation. Mrs. Carey stated her class "did almost no science" so far this

year because; with “teaching to the test” they did not have time. Mrs. Carey also said, “I’m sure we’ll fail that part of the test.”

I also asked participants to tell me two things about their school science activities they wish were different or may not like. Responses were consistent between both the control and treatment group: less textbook reading, more hands-on experiences. The following interview excerpts demonstrate

> Anna: “I wish we could do more like hands-on things, instead of just like reading a book [sic].”
>
> Will: “All we do in science is just, really we just read and we answer some questions [sic]. It’s boring.”
>
> Ian: “I was thinking that maybe we could have like more experiments. Like, as far as I know we haven’t done any of those. Like, the most exciting thing that I’ve seen is see how this plant grows [sic]…”

The following excerpt, from the post-test interview, demonstrates newly acquired understandings of science that can be ascribed to participating in the digital storytelling curriculum:

> Tim: “…hopefully you’re going to know about there is a little bit of pollution because [John], I think that was his name, he said you could tell by the bugs that were in it [the lake]. Most of them were able to stand a little bit of pollution. And, that um, actually as polluted as it is, um, and that there was actually, um, uh sorry, um animals that were live, more animals than I know actually live there and um stuff like that. You know, um, you know like how animals need water and all that stuff [sic].”

Throughout the student participant data were multiple examples of science understanding related to content and process directly resulting from participation in the digital storytelling curriculum. Participants used common scientific vocabulary related to content including: water cycle, water molecule, condensation, precipitation, oxygen, macro-invertebrate, and hypothesis. When asked about science, participants often referred to the environmental science activities segment of the digital storytelling curriculum. Many participants' references included direct correlation between the water testing activities and understanding of local water pollution problems. Some participants also mentioned connections between the human impact activities and their agency as members of a rural community. In her storyboard, Anna described how she and a friend picked up trash during the hike back to school. Josh said he learned, "When you're going camping and stuff, stay away from animals. Stuff like that [sic]." The following interview excerpts highlight the participants' ability to extend science process:

> Josh: "Science helps us in our everyday lives. Like, science is literally like it's everywhere. You can, if you want to, look at stars every night when you look up in the sky. That's millions of stars astronomers have named long ago. And, um, if you're building a house, see you might need to use science to make sure your house doesn't tip over on you like if it's on top of the hill [sic]."
>
> Robert: "You can use the information that you learned about the environment to save the environment from pollution and other bad things that might happen to it later on in your life. And, you can use it to pass it on to generations of, of like other people and a whole of a bunch of other stuff…[sic]."

Further analysis of participant artifacts exposed nuances of science content and process, providing interesting insight into student experiences during the digital storytelling curriculum. During the post-test interview, many participants stated the most memorable portions of the digital storytelling curriculum were the environmental science activities. Participants' storyboards depicted various activities from the environmental science phase of the curriculum. The following excerpts from the post-test digital storytelling reflections demonstrate the importance participants placed on science content and process: "I like the science" and "Did not talk about the water muck [much]. You did not put vocabulary [sic]."

I was interested in participants' perceptions of science competency. As part of both the pre- and post-test interviews, I asked participants if they believed they were good at science. Six students from the control group did not respond to this question during the post-test interview. The findings revealed a significant difference in perceived science competency following participation in the digital storytelling curriculum, $\chi 2$ (4, N = 50) = 5.89, $p = 0.02$. Figure 4.1 represents the responses participants gave concerning perceived science competency during the interviews. Table 4.7 represents the chi square results for Figure 4.1.

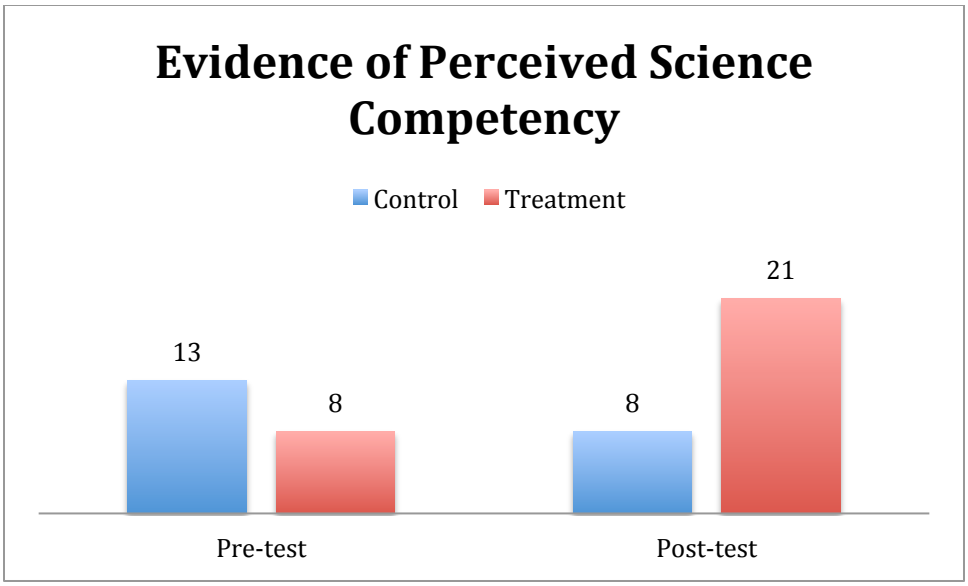

Figure 4.1 represents participant responses to the question; "Do you feel like you're good at science?"

Table 4.7

Science Competency Chi Square

	Results		
	Pre-test	Post-test	Row Totals
Control	13 (9.22) [1.55]	8 (12.73) [1.76]	21
Treatment	8 (11.78) [1.21]	21 (16.27) [1.38]	29
Column Totals	21	29	50

Technology

The literature discusses the possibility of technology leading to greater engagement (Liu et al., 2013; Levin & Wadmany, 2005). However, there is a gap in the literature concerning technology use regarding sustained engagement, especially concerning place-based curriculum. During data analysis, technology emerged as a prominent code and was guided by the following description: "Any reference, explicit or nuanced, made by participants to describe modern or ancient tools."

To establish a baseline for student knowledge of and access to technology, I asked participants the following questions: "Do you know how to use portable devices (i.e. smart

phones or tablets)? Do you have access to portable devices?" during the pre-test interview. Most participants indicated they do know how to use and have access to portable devices. The following interview excerpt is representative of participant responses: "Yes. I have two iPod's and iPhone and my mom and dad have that [sic]." One participant stated that although he does not have Internet at home he has an iPod and his mother has a smart phone.

Some participants displayed elevated self-efficacy while discussing technology use. In the pre-test interview Tim said, "I can figure out anything on technology [sic]." Another participant stated, "I think it's easy to use portable devices…" As I was conducting a discussion with the treatment group regarding use of iPads to create digital stories, Justin interjected, "Kids today know how to use technology." Male participants dominated the discussions on technology. This proved consistent with literature describing male students as more confident and frequent users of technology (Jackson, Zhao, Kolenic III, Fitzgerald, Harold, & Von Eye, 2008; Reinen, & Plomp, 1997).

To ascertain the impact of technology on participant experiences after the digital storytelling curriculum, I asked the following question: "Was making a digital story helpful to your thinking about environmental issues at [location]?" With one exception, participants responded positively stating yes - digital storytelling was helpful to their thinking about environmental issues. When asked to provide details in response to the above question, many participants were unable to articulate why it was helpful.

Tim: "Yes, because I saw a lot of… Yes, that's my answer – just yes [sic]."

Marcie: "Anyone else?"

Chase: "Yes."

Marcie: "Do you want to explain that?"

Chase: “No.”

While most participants were unable to provide specific examples of technological impact, the following interview excerpt demonstrates deeper understanding of both technology and environmental science, connecting the process of creating digital stories with observable environmental issues:

> “Yes, because I saw a lot of different pollution on the other side of the lake when we were taking pictures of different views. I saw like metal and garbage. People really don’t take care of our environment. We have a lot of trash and stuff in our front yard we always have to come around and pick it up [sic].”

The following interview excerpt represents the only response in which a participant stated digital storytelling did not have a positive impact on participant experience: “Um, so it’s not helpful because you can usually just remember it. Basically you’re just putting memories and adding text [sic].”

Technology was represented in participant storyboards and student reflection comments. Many of the storyboards depict participants using the iPads to take pictures. Participants also mentioned both iPads and picture taking in their storyboard text. Most of the participants were able to break down components of the digital story technology in their Student Reflection Rubric comments. Comments included: “Maybe more words”, “Nice job with the pics [sic]”, and “I like it. It had lot of colors but I would like it if it had more words [sic]. Good pictures.” Other comments included use of background music and length of digital stories.

Summary

In this chapter, I presented findings from the following data sources: pre- and post-

surveys, paired and independent t-tests, student and teacher interviews, researcher journal entries – including observation notes, participant reflections, participant storyboards, and treatment group digital stories. The chapter was organized by the three major themes that were evidenced in the findings: 1) place meaning, 2) engagement, and 3) science and technology. The quantitative findings were confounded by the PMS. However, the qualitative findings were unified. After completing the digital storytelling curriculum, participants in the treatment group demonstrated a connection to and articulation of place meaning. Chapter five will discuss the findings and highlight theories from the literature that are supported and contradicted by my study. It will also highlight educational practices that enhance student learning and some to avoid or think deeply about before using the digital stories curriculum (Appendix A). Chapter five will conclude with a discussion concerning the need for further research surrounding the use of PMS (Young, 1999) and digital stories associated with environmental science education.

CHAPTER FIVE: DISCUSSION

Overview

Discussions in the literature center on the phenomena of underrepresented and marginalized students who struggle to reconcile conflicts between school and home culture, particularly with regard for science curriculum (Aikenhead & Jegede, 1999; Brown, 2007; Cajete, 1988; Herzog & Pittman, 1995). Researchers argue culturally congruent curriculum and instruction may mitigate this conflict to some degree. Boundaries between home and school are blurred, allowing students to find contextual meaning in curriculum. According to the literature, rural schools often find themselves on the losing side of curriculum equality due to factors such as high teacher turnover, high percentages of school restructuring, as well as culturally irrelevant standard-based curriculum (Bauch, 2000).

Curriculum grounded in place uses the local community as the foundation for teaching concepts in science, math, social studies and other subjects (Sobel, 2004). Place-based curriculum opens the door to creating or deepening place meaning for students. Place-based curriculum (concepts and content as part of a course of study, including products created by teachers and students) emphasizes "hands-on, real-world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world…" (Sobel, 2004, p. 6). Digital storytelling can be an effective way to integrate place meaning into science curriculum, thus increasing cultural relevance for rural students. According to Ohler (2006), creating narratives allows students to cultivate their own voices and become the heroes of their own learning stories.

This mixed methods case study analyzed data to determine how integrating technology and digital storytelling into an environmental science curriculum may impact students' connection to and articulation of place. The main research question examined the affordances and barriers of teaching underrepresented students who use digital stories to articulate place meaning as part of an environmental science curriculum. Three sub-questions addressed: 1) the impact of student experiences on deepening place meaning, 2) digital storytelling as a pedagogical practice to aid in border crossing, and 3) the impact of technology use on novelty space.

Discussion of Findings

The sample population for my research study was made up of fifth graders, ranging in age from 10-13, from one rural school in the Northwestern United States. The treatment group was younger overall, with three times as many 10 year olds and zero 13 year olds. Although not statistically significant, the difference in age between the control and treatment groups may have impacted the findings. A large gender gap was also present in the sample population. Both the control and treatment group consisted of two-thirds male students, one-third female students. The findings of this study indicated the male participants were more engaged in discussions concerning technology. Male participants were also observed stepping up as active leaders more frequently than female participants when technology was involved. Current literature supports these gender-centered findings. Both the age and gender gap of the sample population can be considered as part of the discussion concerning confounding findings related to the PMS instrument.

During the pre-test interview, Mrs. Carey's expectation of her students was that they would, as a whole, be more comfortable with the technology pieces of the digital storytelling

curriculum due to the gender gap in her class. In the following excerpt she explains her preconception:

> "Um, in a class of 17 boys and 7 girls, when it comes to anything that requires artistic ability, like the drawing the storyboards, I think it'll be challenging for them [sic]. So, I think the digital one will increase their level of comfort, because a lot of them don't draw well and don't like to draw, so [sic]."

Findings from this study support Mrs. Carey's preconceived expectations. However, findings also indicate all participants created storyboards with richer detail than was evidenced in their digital stories raising questions about affordances of technology use in this rural school setting. These questions will be addressed later in this chapter, as data suggests technology may be a barrier, or at least a distraction, to learning during the environmental science unit.

The median income of households in the rural town selected for this study was $28,854 with 20.3% of people under 18 years of age living below the poverty line. It can be argued the low socio-economic status and level of poverty in the community selected for this research study correlates with the marginalization and underrepresentation of the sample population. The literature suggests various academic disadvantages faced by rural students, including minimal school funding and reduced curricular options (Edington & Koehler, 1987; Thomas, 2005). Socioeconomic status is a consideration in this discussion based on the arguments that rural students are marginalized by the larger society and underrepresented in the STEM fields.

In keeping with the mixed methods study design, I collected quantitative data (pre- and post-test surveys minus the open-ended questions, paired and independent t-tests) and supporting qualitative data (PMS open-ended questions, student and teacher interviews,

researcher journal/notes, participant reflections, participant storyboards, and treatment group digital stories). The data was divided into two categories: primary (pre- and post-test surveys and storyboards) and secondary (all other data – including digital stories, researcher journal/notes, student reflections, and participant interviews). The remainder of this discussion of findings will be presented by data type: quantitative first, then supporting qualitative. Responses to the main research question and three subsequent sub-questions are discussed within the findings of the collective data.

Quantitative Data

The *Place Meaning Survey (PMS)* instrument (see Appendix D) was developed by Young (1999) to investigate how and why people place importance on locales. Semken and Freeman (2008), working from the premise that place meaning is "a measurable learning outcome of place-based science teaching" (p. 1042) used the PMS instrument in their study on the practice and assessment of place-based science education. Their study was conducted as part of an introductory physical geology course they taught at the university level. Their study population was mainly, "…elementary or secondary education majors, but few of whom have chosen to major in geoscience" (Semken & Freeman, p. 1045). I used the PMS, based on Semken and Freeman's study, as my pre- and post-test survey as well as for the coding instrument for participants' storyboards and digital stories.

The *pre-* and *post-test surveys* were categorized as primary data. The pre- and post-test surveys were identical, consisting of three open-ended questions (discussed in the *qualitative data* section of this chapter) and 23 place meaning themes. Findings related to the quantitative data from the ranking of the 23 place meaning themes on the PMS raise many questions about the validity and reliability of the instrument when administered to fifth

graders in a rural setting. There was a significant difference between the control and treatment groups on both the pre-test surveys ($p = 0.004$) and the post-test surveys ($p = 0.036$). These survey results call into question the administration of the PMS, as well as issues surrounding sampling, and instrument validity and reliability for participants as young as ten years old. PMS validity and reliability will be discussed later in this chapter.

Both pre- and post-test surveys were administered in groups (approximately half of the class at a time). The large group environment was necessary due to time limitations (discussed later in this chapter). I administered all surveys with the exception of the control group post-test survey, which was administered by Mrs. Hudson, control group teacher, due to circumstances outside of my control (involving weather and time limitations). Potential issues surrounding two different survey administrators may be considered when interpreting a violation of homoscedasticity related to the pre- and post-test surveys, as reported in chapter four.

The control group did show significant growth concerning place meaning when comparing their pre-test survey to the post-test survey ($p = 0.045$). No significant growth was found between the pre-test and post-test surveys of the treatment group ($p = 0.33$). This raises the questions:

- Was the technology used to generate digital stories a barrier to deepening place meaning during an environmental science unit of study?
- And/or, was this the result of other factors, possibly the administration of the surveys?
- And/or, was the survey vocabulary appropriate for this sample population?

The validity and reliability of the PMS instruments come into question when examining the results of the pre-test surveys. There was a significant difference between the control and treatment groups' pre-test survey scores. However, there was not a significant difference between the groups' post-test surveys. While analyzing these results a violation of homoscedasticity was found. To address the instrument validity and reliability questions raised by the violation of homoscedasticity, outriders were removed to correct the standard error bias and achieve equal variance. The resulting data showed a significant difference between both groups' pre- and post-test surveys. The need to remove outriders from the survey raised additional questions and provided further support to suggest the PMS may not be appropriate for this study's sample population.

Further questions were raised when analyzing the results of three independent raters' coding's of storyboards and digital stories. The three independent raters used PMS themes as the coding instrument. The three independent raters were given the 23 place meaning codes used in the PMS, along with the PMS theme definitions. All three raters also participated in training on coding procedure in an attempt to achieve 80% or higher inter-rater reliability. Despite the training, 80% inter-rater reliability was not achieved. As a result, I used a point system that valued raters' adjudication of storyboards and digital stories. The raters awarded points to PMS themes that were evident in participants' work samples. The sum of raters' points were assigned to the 23 themes for each participant. When coding the storyboards, all three independent raters scored 10 of the place meaning themes higher than all others. Those themes were: *scenic*, *beautiful*, *important to preserve*, *important to rural culture*, *scientifically valuable*, *ecologically important*, *fun*, *threatened*, *educational*, and *wilderness*. The treatment group scored consistently higher in each place meaning theme category than

the control group. This finding supports the argument that there is an affordance to participation in the digital storytelling curriculum and that creating storyboards increased the connection to and articulation of place meaning. When coding the digital stories, all three independent raters scored six of the place meaning themes higher than all others. Those themes were: *scenic*, *beautiful*, *remote*, *fun*, *educational*, and *wilderness*. This finding supports an affordance to participants creating digital stories as a way to increase their connection to and articulation of place meaning.

After rating the storyboards and digital stories, the three raters met together and discussed the PMS themes as a coding instrument and their interpretations of the participants' work samples (storyboards and digital stories). There was a general consensus that the place meaning themes and the interpretation of participants' work samples were too subjective to garner 80% inter-rater reliability. The raters believed coding pictures created in the storyboards were difficult, because the raters were not sure what was meant by a full scene (wide shot) versus a couple of trees (Close-up Trees). Quality of pictures, especially where text was lacking, also constituted an issue for coding. It was stated the pictures that were mostly stick figures were harder to code. The three raters also agreed that digital story's lacking text posed a challenge when coding, as interpretation of the pictures was very subjective. They believed certain place meaning themes were also subjective – an example given by one of the coders with the theme *fragile*. Independent raters agreed the problem was not with the training they received, but that the place meaning themes were too subjective. Given the lack of inter-rater reliability and the statements made by each rater, it can be argued the PMS themes instrument was not appropriate for coding storyboards and digital

stories. This marginalizes the arguments above, that the digital story curriculum and the creation of digital stories increased the connection to and articulation of place meaning.

The results obtained through coding the storyboards and digital stories (adult interpretations of the codes and student artifacts) contradict the results of the pre- and post-test surveys taken by the participants. Semken and Freeman (2008) found the PMS instrument to be reliable and generalizable. However, they, like Young (1999), used it with adults. The findings of this research pose the following questions:

- Is the PMS instrument appropriate to use with fifth graders?
- Is the PMS instrument appropriate to use with rural students?
- Is the vocabulary used for the place meaning themes culturally relevant for rural fifth grade students?

As a result of these questions, I'll keep the question regarding PMS instrument generalizability, validity and reliability open to further research and I'll discuss findings from the qualitative data.

Qualitative Data

Place Meaning Survey - categorized as primary data. As mentioned earlier, I used PMS as my pre- and post-test survey. The surveys were identical and they included three open-ended questions. The open-ended questions were:

4) What are your general impressions of the place (location)?
5) What is most important about (location) to you personally?
6) How do you personally feel about the place (location)?

Writing responses to the open-ended questions allowed participants to articulate, in their own words, what the place meant to them. On the pre-test survey, participant responses were

generally tied to utilization and aesthetic themes. Seven participants in the treatment group communicated positive affective responses about (location). However, after participating in the digital storytelling curriculum, this number increased to 12. After participating in the digital storytelling curriculum, treatment group participants shifted their responses toward place meaning themes. They were able to include place meaning vocabulary and concepts in their written responses to the post-test survey and such vocabulary and concepts were markedly absent on pre-test surveys. This appears to support discussions in the literature concerning the close relationship between place-based curriculum and place meaning.

The ability for participants to articulate science, technology, and place meaning concepts beyond surface level understanding after participating in the digital storytelling curriculum was evident in the responses to the PMS open-ended questions. Growth by the treatment group was evident in the responses to the open-ended questions on the post-test survey; however, no growth was found in the quantitative data for the same group. The open-ended questions held relevancy for the participants that was lacking in the 23 place meaning themes. Using the three open-ended questions from the PMS eliminated the above-mentioned subjectivity issues related to the 23 PMS themes. Participants, when responding using personal narrative, demonstrated a deeper understanding of and connection to place. When considering the research questions guiding this study, the findings suggest that, while the 23 place meaning themes may not be appropriate for the sample population, the three open-ended questions are an effective means of measuring place meaning. Findings point to two key concepts: 1) that participation in the digital storytelling curriculum may have deepened an individual's connection to place and 2) that, as Semken and Freeman (2008) proposed, place meaning may be measurable as part of a science curriculum.

Pre- and Post-test Interviews – categorized as secondary data. While there is no definitive understanding of what it means to be rural, the literature discusses marginalization of rural students. Included in these descriptions are imposed stereotypes and academic disadvantages, including the lack of culturally relevant curriculum and instruction (Bauch, 2000; Herzog & Pittman, 1995). Rural students are also underrepresented in STEM fields. The majority of rural students who do seek degrees in science enter agricultural sciences.

Rural students are faced with the challenge of crossing borders between their home/community and school cultures. Opportunities to find cultural relevance, especially in science curriculum, aid in this border crossing. Collateral Learning Theory (CLT) posits that students move through different categories, or levels, of schematic conflict as they acquire new knowledge. Dependent collateral learning (one of four CLT categories) is evident when the home and school cultures are only somewhat different (Aikenhead & Jegede, 1999). Data from this study suggests many participants showed evidence of dependent collateral learning after participating in the digital storytelling curriculum. When asked about science during the post-test interview, participants often referred to the environmental science activities positioned within the digital storytelling curriculum. When considering the affordances and barriers for teaching underrepresented students who make digital stories to articulate place meaning as part of an environmental science curriculum, findings indicate these outdoor, hands-on, environmental science activities can be an affordance to participants' meaningful understanding of place meaning. This is particularly true when addressing the study question concerning what key experiences will contribute to deeper place meaning.

In both the pre- and post-test interviews, participants indicated their current school science curriculum was boring. Both teachers in this study predicted the highest student

engagement would be seen during the technology portion of the curriculum. Compared to other classroom activities, the data suggests this study's participants were more fully engaged during all portions of the digital storytelling curriculum than they had been with their current school science curriculum. The literature suggests when curriculum and instruction lack cultural relevance, students disengage and when using technology in classrooms, student engagement increases - male students in particular engage more frequently and for longer periods of time. The findings from this study differ somewhat from both the participating teachers' expectations of the study's participants and current literature. When asked during the post-test interview, participants consistently stated the environmental science activities held at (location) were the most memorable part of the digital storytelling curriculum. Educators should consider these findings when developing and implementing culturally relevant science curriculum.

The interviews further indicate participants were able to demonstrate a newly acquired understanding of environmental science. During post-test interviews participants were able to extend science concepts into their everyday lives and beyond their community or place in time (future connections). This shows evidence of managed border crossing related to dependent collateral learning. It can be argued the examples of environmental science understanding shared by the study's participants, which were related to content and process, are a direct result of their participation in the digital storytelling curriculum. This suggests that the digital storytelling curriculum may be a pedagogical practice that aids border crossing.

Like their students, rural teachers also face distinct challenges (Thomas, 2005) including student success in an era of standard-based curriculum. The teacher participants in

this study faced very specific challenges related to age and gender gap as well as limited, often irrelevant, resources. The interviews with the teachers indicated they are looking for a magic bullet – believing digital storytelling may be the one thing that will solve their engagement issues. However, the data does not support technology integration as a teaching strategy that provided for sustained engagement. This study found the planning pieces of the digital storytelling curriculum (environmental science activities and storyboards) were more of an affordance to students' engagement than actually making the digital stories.

Storyboards – categorized as primary data. The literature discusses the affordances of storytelling for marginalized students. Narrative allows students to express, through authentic voice, their own learning story (Ohler, 2006). It is a vehicle through which educators can help students cross the border between home and school cultures. From this premise, storyboards were an important artifact in the digital storytelling curriculum. After participating in the outdoor environmental science activities, all participants created storyboards. The teachers believed their students (predominately male) would struggle with this portion of the curriculum. Both teachers assumed the participants would not fully engage or produce work that was representative of their ability due mainly to a lack of participant self-efficacy. The data indicates the teachers' prejudices motivated their decision to truncate the time originally allowed for this activity. Instead of conducting this activity over two class periods of one hour each (per class), the activity was conducted in one session (per class) of one hour. Before participants created storyboards, the activity was introduced and connected to familiar lessons students had previously participated in (writing stories and creating comic strips).

All participants completed storyboards in the truncated frame of one hour. During that time, not only were participants fully engaged in creating their storyboards, they were fully engaged and showed concentrated effort. Some participants who seemed to have low self-efficacy employed a classmate to draw a particularly challenging element in their storyboard. It should be considered, both teachers provided participation points to the participants who were working on storyboards and this could have been a motivating factor.

When analyzing student scores from the three raters of storyboards, except on themes where both treatment and control groups scored zero, the control group participants scored lower on all place meaning themes except *educational* (control 85% of total versus treatment 82% of total) and *fragile* (control 2% of total versus treatment 0% of total). Evidence of place meaning was nuanced in the storyboards created by the control group. It was mainly through the use of pictures that the control group participants articulated some place meaning themes. They drew pictures of trees, the lake, grass, and the sky. They were able to demonstrate complex thinking about place, drawing different views; some close-ups of trees or plants or from a distance – what they saw from the hill above. Participants in the control group seemed to focus more on the environmental science activities rather than place meaning. In general the control group participants demonstrated a lack of ability to connect their experience at (location) with their community. One participant did demonstrate the ability to connect newly acquired place meaning with personal action, stating in his storyboard that during the hike back to school he, "Picked up trash of all kinds, plastic, food and dog poop," demonstrating a move toward conservation agency. He articulated a personal feeling, "It felt good to help," to his action. This personal affect is consistent with the individual construct of place meaning discussed in the literature.

Storyboards created by treatment group participants' contained clear examples of place meaning. Using drawn pictures and text, participants expressed specific place meaning themes including *fun*, *educational*, and *relaxing*. Participants in this group demonstrated a deeper connection to place. Their storyboards contained explicit evidence of place meaning themes such as important to preserve and important to rural culture. These and other connections between their experience and community demonstrate their ability to articulate place meaning based on their participation in the digital storytelling curriculum. In their storyboards, many of the treatment group participants were able to extend their experience at (location) to consider influences on the larger community. This is consistent with a move toward deeper place meaning and attachment. As with the control group, some treatment group participants expressed evidence of conservation agency, describing how they picked up trash on the hike back to school.

As predicted in the literature (Penetito, 2009; Semken & Freeman, 2008), all participants demonstrated an ability to articulate science concepts and processes in addition to place meaning. Using a combination of pictures and text participants described the environmental science activities they participated in at (location). They used scientific vocabulary and included drawings of scientific process such as use of field microscopes. Understanding of these scientific concepts and processes was noticeably absent in their pre-test findings.

Digital Stories –categorized as secondary data. The literature describes digital storytelling as a meaningful way to incorporate technology into the curriculum (Hull, 2003; Kajder et al., 2005; Kulla-Abbott & Polman, 2008; Ohler, 2006; Sadik, 2008). Digital storytelling allows underrepresented students a vehicle to interpret their experiences while

building content knowledge, critical thinking skills, media literacy, and project development. Digital stories combine the author's voice, still and video images, and music (Hull, 2003).

There are sequential steps teachers and students can use to create basic yet effective digital stories. First, students write a brief (less than one page) script that represents the story. Secondly, they plan and create a storyboard – a representation of their story with "a series of sketches representing the still images…" (Kajder et al., 2005, p. 40). Then, students create a digital story using one of the various hardware and software options available. Next, students improve the script and sequence images using a digital video editor. Finally, students add narrative and music, transitions, and special effects (Kajder et al., 2005). Due to time limitations (discussed below), some of these steps were skipped. This is a consideration when evaluating data results.

Treatment group participants, worked in small groups of two or three, and created and presented short digital stories. They were asked to create their digital stories from their storyboards. I observed less than half of the participants using their storyboards as part of the digital story creation process. Most participants focused exclusively on the technology (iPads). It can be argued this was a result of the time limitation and subsequently the novelty effect. In order to reduce or eliminate the novelty inherent in the use of new or novel technology, educators must integrate that technology into lessons regularly. This study's findings suggest the following questions:

- Can the novelty effect be reduced if the digital storytelling curriculum was presented as an eight-week unit?

- Would the novelty effect be reduced if participants in this study had used iPads throughout the course of the academic year (instead of during the last three weeks of school)?

Sixty percent of the digital stories exemplified the participants' best effort. They contained technological and scientific components as well as evidence of place meaning. As indicated in the findings, the digital stories depicted aesthetic place meaning themes, such as *scenic*, *beautiful*, *remote*, and *wilderness* as well as the *fun* and *educational* themes. However, in general they lacked the rich detail found in the storyboards. This raises the question, is the introduction of technology into environmental science a barrier to establishing or deepening place meaning? Novelty effect is also manifest in a couple of the digital stories. The time limitation meant the editing step was skipped during the digital storytelling curriculum implementation. This is evident in several of the digital stories that lacked continuity and suffered from poor editing.

Participant Reflections – categorized as secondary data. Participants in the treatment group filled out *Student Reflection Rubrics* (see Appendix F) during digital story presentations. The basis of these reflections was to ascertain whether participants could show understanding through evaluating and articulating place meaning themes, digital story components, and environmental science content. Participants were not prepared in advance for this part of the curriculum, although both teachers stated their students had previous experience with this type of activity. In her post-test interview, Mrs. Carey stated she would give her students a rubric if she did the digital storytelling curriculum in the future. At issue here is the impact on student voice. By giving participants a rubric instructing them on the specifics to be included in the digital story, Mrs. Carey may be reducing or eliminating

authentic voice. Everyone experiences place in a different way. Teachers should learn how to facilitate the personal understanding of knowledge developed in place (Gruenewald, 2003). In other words, teachers should develop a critical pedagogy of place. Curriculum should be developed that is not restrictive and provides opportunities for student voice.

One of the research questions was to explore what affect digital storytelling has on border crossing. The findings from this study suggested that, after participating in the digital storytelling curriculum, participants could show surface level understanding of science and technology concepts, and display connections to place as evidenced in their reflections. However, border crossing was not evident in the participant reflections. The reflections lacked the rich detail that was found in the storyboards.

Limitations – While conducting this research, issues related to study climate, including time limitations, and school politics and territory (teachers and principal) surfaced. During pre-study meetings, I sat down with the teachers to discuss research components and scheduling. I presented a six-week timeline, including amount of time needed to complete each section of the digital storytelling curriculum. Stating standardized testing time as a rationale, both teachers shortened the timeline for this study to three weeks with an additional two days to be scheduled before the study began for my non-participatory classroom observation and teacher pre-test interviews – total study time was four weeks. I complied with their requests. Both teachers had misconceptions about the digital storytelling curriculum and their students' engagement with that curriculum. The teachers told me their students did not have the attention span to participate in any activity lasting longer than an hour. They reduced the time for creation of the storyboards and digital stories to an hour each. After concluding the post-test interview, Mrs. Carey told me, "We should have let you

start sooner even though we were testing, so the students had more time." This statement revealed a shift in Mrs. Carey's original attitude concerning student engagement based on her association with and observation of the digital storytelling curriculum.

In addition to imposed time limitations, political and territorial issues emerged before and throughout the study. During my meeting with the principal, there were indications that I was viewed as an outsider coming from the university, and that I may not understand the culture of the community and the community may not understand why I was working with their children as participants in my study. The principal requested we co-author a letter to parents/guardians explaining my study (see appendix B). The principal also came to the field location during the environmental science activities. Her brief appearance at the site was unexplained. Both teachers were involved in the field trip portion of the curriculum, securing parent volunteers, handling distribution and collection of the parent consent forms, and leading one of the environmental science activities. However, a change was observed in one of the teacher's involvement as the digital storytelling curriculum continued into the storyboarding and the creation of digital storytelling phases. She was disengaged during both the storyboarding and digital storytelling activities, turning her class entirely over to me. I noted how she seemed either disinterested or intimidated by the technology. In contrast, the other teacher actively walked around her classroom interacting with participants during both activities and she joined in the question and answer part of the digital story presentations, asking her students questions about their stories. Both teachers exhibited control over all aspects of my study, but relinquished some, if not all, of that control as the study progressed. After observing their students enthusiastic engagement during the digital storytelling curriculum, both teachers stated in the post-test interviews they were going to pursue grants

to acquire iPads for their classrooms. Mrs. Carey described several ways she thought she could use digital storytelling in the future, for example in social studies units.

Participants showed evidence of the Hawthorne Effect. It can be argued this was due to the non-equivalent control group design of the study methodology and proximity of the two groups enabling diffusion and an expectation of the experiments' success. The time limitation and the teachers' misconceptions and prejudice can be considered as contributing factors as well. Participants also showed examples of vicarious impression during the pre-test survey process. For example, in response to the open-ended questions in the PMS, several participants stated they had never been to (location), yet they completed the entire survey ranking all 23 place meaning themes. Too, the Hawthorne Effect can explain participants' vicarious impressions and mimicked behaviors, such as picking up trash on the way back to school. Motivated by an expectation to perform for the study, participants may have used their classmate's impressions of the place as models for their own performance and practice.

Place Meaning Survey validity and reliability – Place meaning is generally defined as the values and meaning ascribed to a certain place. Those living in the place socially construct place meaning. Individual interpretation of and attachment to place are also a factor when constructing place meaning. This speaks to the subjectivity of interpreting and coding place meaning found in participant work samples. A nonmember who does not live in the place and lacks an aboriginal understanding of individual and social constructs of that place's meaning will likely not interpret place meaning the same way as an integrated member of the place.

While Semken and Freeman (2008) argue for the generalizability, validity and reliability of PMS, findings from this study raise questions concerning each of these.

Findings indicate the PMS instrument is not useable with rural elementary students in its' current form. While proven effective for adults, the PMS was not culturally relevant and it contained place meaning themes that were unfamiliar to the fifth graders in this study. The PMS instrument was deemed too subjective, raising further questions regarding validity and reliability in this study. Again, the concern is with the 23 place meaning themes. The open-ended questions are useable in this study, as they encouraged rural fifth graders to employ an authentic voice when responding to the open-ended questions. However, the place meaning themes are open to interpretation by the consumer (be they independent raters or survey participants).

Concluding Thoughts

It is the nature of mixed methods research to be complex and complicated. Quantitative data is collected, analyzed and supported by associated qualitative data sources. Quantitative results, such as t-tests, are reaffirmed against qualitative results, such as observation notes and interpretations of participant work samples. While complicated, mixed methods research allows for thick, rich discussion. The discussion laid out in this chapter is both thick and rich; even though this study's findings were confounded by the PMS and threats to validity and reliability of the quantitative data. All components of this study were guided by the main research question: What are the affordances and barriers for teaching underrepresented students who make digital stories to articulate place meaning as part of an environmental science curriculum? Three additional sub-questions were:

1. What key experiences will contribute to deeper place meaning?
2. What affect does digital storytelling have on border crossing?

3. How does the introduction of technologies positively or negatively impact novelty space?

When analyzing the quantitative data, the findings are confounding. There was a significant difference in both pre- and post-test surveys, and this raised questions about the PMS instrument validity and reliability with this study's sample population. The instrument has been described as too subjective in nature and this subjectivity further confounds the results of coding participants' work samples.

However, the qualitative data is less perplexing and more unified in their findings. While less explicit, the digital stories have nuances of place meaning. The novelty effect seems to have had a predominantly negative impact regarding technology use. And, the qualitative findings showed a relationship between generating digital stories and border crossing.

When examining key experiences to deeper place meaning, the qualitative data points to the planning phases of the digital storytelling curriculum as an affordance to academic learning via the environmental science activities and storyboards. Participant perceptions (presented in their interviews) align with findings from their work samples, with the exception being their digital stories. During the post-test interviews all but one participant stated creating digital stories helped them to think about local environmental issues. Yet, this was apparent in less than 50 percent of the digital stories.

The findings revealed a significant difference in perceived science competency following participation in the digital storytelling curriculum ($p = 0.02$). The treatment group displayed a significant improvement in their perceived science competency after participating in the treatment (creating digital stories). Conversely, control group participants displayed a

marked decline in perceived science competency at the conclusion of the study. Findings indicate there is a strong relationship between participation in the digital storytelling curriculum and creating digital stories and an increased perception of science competency, which is generalizable to the larger population. These findings indicate the digital storytelling curriculum and creating digital stories is an affordance to underrepresented students in the area of perceived science competency.

Recommendations and Future Research

Recommendations

Findings indicate the planning stages of the digital storytelling curriculum are an affordance to underrepresented students articulating place meaning. Questions remain around the affordances of technology for digital storytelling for underrepresented students' articulation of place meaning. Results are confounded by the quantitative results of the PMS. The work samples created by participants in this study (digital stories) do not demonstrate the place meaning articulated in other study artifacts, yet participants' perceptions (stated in post-test interviews) indicate digital stories had a positive impact on their perceptions of science competency. These confounding results may be negated in future replications of this study. Digital stories may be more effective as a capstone activity designed as a presentation for parents and/or relevant community members. Future research needs to consider how digital stories can have a positive affect that is comparable to the planning phases of digital storytelling in an environmental science curriculum.

Findings indicate the novelty effect of digital storytelling is a barrier to underrepresented students articulating place meaning as part of an environmental science curriculum. The literature supports the argument that novelty space associated with using

outdoor locations as well as the novelty effect of new or innovative technologies needs to be mitigated in order for students to be successful. This barrier may be removed by integrating technology into the overall curriculum consistently throughout the academic year.

A further recommendation is the creation of a generalizable instrument for measuring place meaning that is both culturally relevant and age-appropriate. The PMS instrument was found to be subjective and confounding when used with rural fifth graders. Participants in this study responded to the PMS whether they understood the survey or not. The literature calls for culturally congruent curriculum and instruction. Based on this research data a need also exists for culturally congruent survey instruments. In addition to relevancy issues, previously mentioned questions around the validity and reliability of the PMS exist.

Future Research

There are five areas of future research recommended based on the findings of this study. These five are: a longevity study to assess levels of conservation agency, a comparison study incorporating a modified PMS instrument, a comparison study addressing affordance or barrier of creating digital stories, a comparison study focused on mitigation of novelty effect from innovative technology use, and further research on theoretical and practical applications of environmental science curriculum in connection with place meaning. Each of these recommendations is listed below.

1. A follow-up longevity study involving the current sample population to assess levels of conservation agency attributable to the digital storytelling curriculum. Findings from this study indicate participants began to demonstrate conservation agency after participating in the digital storytelling curriculum. Further research may support the understanding of how conservation agency is formed.

2. Conduct a follow-up comparison study incorporating a modified PMS instrument. Compare a population with similar demographics who use the digital storytelling curriculum. However, place meaning would be assessed with an innovative relevant instrument. As mentioned previously, Young's (1999) *Place Meaning Survey* has been described as too subjective. Future research should look at the method to measure place meaning in a culturally relevant manner.
3. Conduct a comparison mixed methods case study that addresses how digital storytelling can be as effective in articulation of place meaning as storyboarding for marginalized and underrepresented students. A model or framework needs to be created that maximizes the effectiveness of creating digital stories to articulate place meaning as an integrated piece of environmental science curriculum. Research conducted with this focus can contribute to this study's findings along with existing literature concerning best practices for teaching marginalized and underrepresented students.
4. Conduct a comparison mixed methods case study that focuses on removing novelty effect from innovative technology integration in rural elementary classrooms. Findings in this study indicate the novelty effect is a barrier to technology use in environmental science curricula. Further research focused on the mitigation of the novelty effect may assist researchers in better understanding impacts of barriers when teaching marginalized and underrepresented students.
5. Further research needs to be conducted in regard to the connection between environmental science and place meaning. Theoretical and practical applications can

be further explored in an attempt to discover best practices, especially for educators working with marginalized and underrepresented students.

References

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

Aikenhead, G. S., & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Cultural Studies of Science Education*, *2*(3), 539-620.

Babco, E. (2003). Trends in African American and Native American participation in STEM higher education. *Commission on Professionals in Science and Technology, New York, NY*.

Bang, M., & Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science Education*, *94*(6), 1008-1026.

Bang, M., Medin, D., Washinawatok, K., & Chapman, S. (2010). Innovations in culturally-based science education through partnerships and community. In M. Khine & I. Saleh (Eds.) *New Science of Learning : Cognition, Computers, and Collaboration in Education.* New York: Springer.

Barab, S. A., & Luehmann, A. L. (2003). Building sustainable science curriculum: Acknowledging and accommodating local adaptation. *Science Education*, *87*(4), 454-467.

Bauch, P.A. *School-Community Partnerships in Rural Schools: Leadership, Renewal and a Sense of Place*. A paper presented at the Annual Meeting of the American Educational Research Association (NewOrleans, LA, April 24-27, 2000).

Brown, M.R. (2007). Educating all students: Creating culturally responsive teachers, classroom, and schools. *Intervention in School and Clinic*, *43*(1), 57-62.

Brand, B.R. & Glasson, G. E. (2004). Crossing cultural borders into science teaching: Early life experiences, racial and ethnic identities, and beliefs about diversity. *Journal of Research in Science Teaching. 41*(2), 119-141.

Brown, M. (2008). Outdoor education: Opportunities provided by a place based approach.

Buhner, S.H. (2002). *The Lost Language of Plants: The Ecological Importance of Plant Medicines to Life on Earth.* White River Junction, VT. Chelsea Green Publishing.

Cajete, G.A. (1988). Motivating American Indian students in science and math. *ERIC Clearinghouse on Rural Education and Small Schools,* 1-7.

Chinn, P.W.U. (2007). Decolonizing methodologies and Indigenous knowledge: The role of culture, place and personal experience in professional development. *Journal of Research in Science Teaching*, *44*(9), 1247-1268.

Cope, C., & Ward, P. (2002). Integrating learning technology into classrooms: The importance of teachers' perceptions. *Educational Technology & Society*, *5*(1), 67-74.

Creswell, J.W. (2013). *Qualitative Inquiry & Research Design: Choosing Among Five Approaches (3rd ed.)*. Los Angeles. Sage Publishing

Edington, E.D. & Koehler, L. (1987). Rural student achievement: Elements for consideration. *ERIC Clearinghouse on Rural Education and Small Schools Las Cruces NM*

Fakudze, C.G. (2004). Learning of science concepts with a traditional socio-cultural environment. *Sout African Journal of Education*, *24*(4), 270-277.

Gardner, H. (2011). *The unschooled mind: How children think and how schools should teach*. Basic books.

Gruenewald, D.A. (2003). The best of both worlds: A critical pedagogy of place. *Educational Researcher, 32*(4), 3-12.

Herzog, M.J.R. & Pittman, R.B. (1995). Home, family, and community: Ingredients in the rural education equation. *ERIC* Retrieved from http://eric.ed.gov/?id=ED388463 1-24.

Hull, G.A. (2003). At last: Youth culture and digital media; New literacies for new times. *Research in the Teaching of English,* 38(2), 229-233.

Jackson, L. A., Zhao, Y., Qiu, W., Kolenic, A., Fitzgerald, H. E., Harold, R., & von Eye, A. (2008). Culture, gender and information technology use: A comparison of Chinese and US children. *Computers in Human Behavior*, *24*(6), 2817-2829.

Jegede, O.J. & Aikenhead, G.S. (1999). Transcending cultural borders: Implications for science teaching. *Journal for Science & Technology Education, 17*(1), 45-66.

Jennings, N., Swidler, S., & Koliba, C. (2005). Place-based education in the standards-based reform era-Conflict or complement? *American Journal of Education, 112*, 44-65.

Kajder, S., Bull, G., & Albaugh, S. (2005). Constructing digital stories. *Learning and Leading with Technology, 32*(5), 40-42.

Kokkelenberg, E. C., & Sinha, E. (2010). Who succeeds in STEM studies? An analysis of Binghamton University undergraduate students. *Economics of Education Review*, *29*(6), 935-946.

Kulla-Abbott, T., & Polman, J. (2008). Engaging student voice and fulfilling curriculum goals with digital stories. *Technology, Humanities, Education and Narrative (THEN Journal)*, *5*, 38-60.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, *32*(3), 465-491.

Lee, O. (2003). Equity for linguistically and culturally diverse students in science education: A research agenda. *Teachers College Record*, *105*(3), 465-489.

Levin, T., & Wadmany, R. (2005). Changes in educational beliefs and classroom practices of teachers and students in rich technology-based classrooms [1]. *Technology, Pedagogy and Education, 14*(3), 281-307.

Lewthwaite, B., McMillan, B., Renaud, R., Hainnu, R., & MacDonald, C. (2010). Combining the views of "Both Worlds": Science education in Nunavut Piqusiit Tamainik Katisugit. *Canadian Journal of Educational Administration and Policy*, (98), 1-71

Liu, M., Horton, L., Kang, J., Kimmons, R., & Lee, J. (2013). Using a ludic simulation to make learning of middle school space science fun. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS)*, *5*(1), 66-86.

Louv, R. (2005). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder.* Chaple Hill. Algonquin Books.

McComas, W. F. (2002). The ideal environmental science curriculum: I. history, rationales, misconceptions & standards. *The American Biology Teacher*, *64*(9), 665-672.

National Science Foundation (2009) *Science and Engineering degrees, by Race/Ethnicity: 1997-2002* (NSF Publication, No. 10-300) (NSF 41. Division of Science Resources Statistics, Arlington, VA.)

NSB. (2012). Higher Education in Science and Engineering. In *Science and Engineering Indicators 2012.* Arlington, VA: National Science Foundation.

Ohler, J. (2006). The world of digital storytelling. *Educational Leadership, 63*(4), 44-47.

Parkay, F. W. (2013). *Curriculum and instruction for becoming a teacher*. Boston. Pearson Education Inc.

Pavel, D., Skinner, R., Cahalan, M., Tippeconic, J., & Stein, W. (1998). *American Indians and Alaska Natives in postsecondary education*. Washington, DC: National Center for Educational Statistics.

Penetito, W. (2009). Place-based education: Catering for curriculum, culture and community. *Culture and Community*. *18,* 5-29.

Pewewardy, C. & Hammer, P.C. (2003). Culturally responsive teaching for American Indian students. *ERIC Clearinghouse on Rural Education and Small Schools*.

Puentedura, R. (2015, January). SAMR Model, *Technology is Learning,* retrieved from https://sites.google.com/a/msad60.org/technology-is-learning/samr-model

Reeves, C. (2003). Implementing the No Child Left Behind act: Implications for rural schools and districts. *Naperville, IL: North Central Regional Educational Laboratory*.

Reyhner, J. (2010). Place-based education. *Indigenous Bilingual Education,* June/July, 16-17.

Riggs, E.M. (2004). Field-based education and indigenous knowledge: Essential components of geoscience education for Native American communities. *Science Education, 89*(2), 296- 313.

Russell, C.L. (1999). Problematizing nature experience in environmental education: The interrelationship of experience and story. *Journal of Experiential Education,* 22(3), 123-128.

Sadik, A. (2008). Digital storytelling: A meaningful technology-integrated approach for engaged student learning. *Educational Tech Research Dev,* 56, 487-506. DOI 10.1007/s11423-008-9091-8

Semken, S. & Butler Freeman, C. (2008). Sense of place in the practice and assessment of place-based science teaching. *Published online 27 March 2008 in Wiley InterScience* DOI 10.1002/sce..20279

Sievert, R., LaFrance, J., & Brod, R. (2011). Development, validation, and preliminary use of culturally congruent instruction survey. *National Association of Research in Science Teaching,* Orlando, FL.

Sobel, D. (2004). Place-based education: Connecting classroom and community. *Nature and Listening*, 4, 1-7.

Sorkness, H.L. & Kelting-Gibson, L. (2006). *Effective teaching strategies for engaging Native American students*. Paper presented at National Association of Native American Studies Conference, Baton Rouge, Louisiana.

Statistics Solutionss. (2013). Homoscedasticity [WWW Document] Retrieved from website. http://www.statisticssolutions.com/homoscedasticity/

Stephens, R. (2010, February 4). FDCH Congressional Testimony. *Science, Technology, Engineering, and Math Education*. Committee on House Science and Technology Subcommittee on Research and Science Education.

Sutherland, D. (2005). Resiliency and collateral learning in science in some students of Cree ancestry. *Wliey InterScience,* DOI 10.1002/sce.20066

Thomas, T. G. (2005). Teachers' Decision-Making about Place-Based Education and State Testing. *Rural Educator*, *26*(3), 19-24.

U.S. Census Bureau (2009) retrieved from http://www.census.gov/prod/2012pubs/acs-18.pdf

Woodhouse, J., & Knapp, C. E. (2001). Place-based curriculum and instruction: Outdoor and environmental education approaches. *Thresholds in Education*, *27*(3/4), 31-35.

Young, M. (1999). The social construction of tourist places. *Australian Geographer*, *30*(3), 373-389.

APPENDIX A: CURRICULUM

STANDARDS:
5-LS2 Ecosystems: Interactions, Energy, and Dynamics
Common Core ELA: RI.5.7

Part 1: Environment Science Activities
Anticipated time: 3-4 hours over 1 class period

Preparation: Choose 4 to 5 environmental science activities that can be conducted in the outdoor location you have chosen. Recruit volunteers to help you implement the activities. Gather any materials needed to conduct the activities and transport those materials to the location on the day of the field trip.

Procedure:
Introduce the environmental science activities to be conducted at the outdoor site. This can be done just before leaving the classroom and traveling to the outdoor location. Say: *we will be (walking, taking the bus, etc.) to [location]. Once there we will participate in the following activities: (name them).* Conduct the environmental science activities at location. Have (treatment group students) capture their experience on iPads (or other handheld devices).

Train students in how to use the iPads before taking them into the field.

Part 2: Storyboard Activity
Anticipated time: 1 hour over 1 class period

Preparation: Gather materials: large drawing paper, colored pencils, and rulers. Draw 6 boxes on a paper and/or the whiteboard as an example for students.

Procedure:

Back in the classroom after spending time doing an environmental science activity at [location] all participants will create storyboards. Students will be trained in how to create storyboards. Explain to students they will be creating a story based on their experience doing the environmental science activities and how (location) impacts the community. Connect the activity to something familiar to students (e.g. comics). Ask students to give you the parts of a story. Say, for example: *what parts are in a story? (Beginning, Middle, End). What else is in a story? (dialog)*. After connecting storyboarding to storytelling, say: *now, using the ruler, each of you divide your paper into six boxes*. Have students tell their story in the six boxes.

Part 3: Digital Storytelling Activity
Anticipated time: 1-2 hours over 1 class period

Preparation: Load iMovie (or other movie making software) onto each iPad (or other handheld device). Front-load the activity by giving students access to the technology and teaching them how to use the camera and iMovie software.

Procedure:
The participants will be told that they have to make a short story (about 3 to 5 min long) on their experience at [location]. The story has to have two important elements:

a. It should be a story that is about their experience at [location] and
b. how [location] affects them and their community.

Have students, working in small groups of 2 or 3, use their storyboards as the basis for their digital stories. Say: *using the storyboards you created, make a short digital story (3-5 minutes) using iMovie. Include pictures you took at (location), text, and background music.* Remind students where to find their pictures, how to add text and background music. Go around the room, assisting students as they create their stories.

Part 4: Delayed (post-treatment) Activity

Students/groups share their digital stories with the other students/groups. They can act out their stories using the images and videos or they can tell the story as they have constructed it. After the story presentation other students/groups will fill out student reflection rubrics providing feedback to the presenting students/groups. Post-activity discussion can be had during which we can have conversations about land use, ethics, and values surrounding the stories (or other relevant place meaning constructs).

e.g. teachers and researcher can ask questions such as:

- If one community is causing the pollution how do you deal with that community as people from your community go there to work?
- Do you think the your current land use practice is causing some of the pollution in the water?
- Do you have a say in the matter if the government decides to use the land for certain things that might affect your communities.

APPENDIX B: LETTER TO PARENTS

April 17, 2015

Marcie Galbreath
University of Idaho
Coeur d'Alene, ID

Dear Parents/Guardians

My name is Marcie Galbreath. I am a Ph.D. Candidate with the University of Idaho. I have spent over 14 years as an outdoor educator. I have conducted many formal and informal outdoor education programs for children and adults in the Desert Southwest as well as the Pacific Northwest.

Your child is invited to participate in a research study I am creating, which will identify successful strategies for implementing and using technology (*Digital Stories)* in outdoor science education as a practical instructional tool. Your child was selected as a possible participant in this study because s/he is a 5th grade student at [school name here].

During this study your child will have the opportunity to use handheld devices (i.e. iPads) to take pictures and videos while participating in an outdoor science activity. Your child will then create a digital story (alone or in a small group) about their experience doing outdoor science and present the story to their classmates. I will be interviewing your child as part of my data collection.

You will have the opportunity to give separate consent to your child's participation in the study and whether or not you want your child interviewed on camera. There are steps in place that allow your child to participate fully in the study without ever appearing on camera.

In addition to the interviews, I will be asking each student to fill out a short survey before and after the activities. This survey is designed to assess each child's connection to the place the activity will be held. For example, questions include: What is most important about [location] to you personally? And, How do you personally feel about this place?

During the entire study, I will be working closely with your child's teacher and the school principal.

Data collected during this study, including the digital stories, will be written about and presented at professional conferences and to teachers across the country. This is in an effort to provide teachers and other education professionals information about a practical tool (digital storytelling) they can use with their students. Your child's identity will be kept anonymous through the use of codes. I will create a list of alpha/numeric codes to replace student names.

I ask that you consider this opportunity and discuss it with your child. I am available to answer any questions you may have. My contact information is included below.

I am excited to work with your child's teacher to provide a fun opportunity to use technology within nature!

Thank you,

Marcie Galbreath
[email address here]

APPENDIX C: PARENT CONSENT FORM

Voices of Place Case Study Research

Your child is invited to participate in a research study, which will identify successful strategies for implementing and using technology (*Digital Stories)* in outdoor science education as a practical instructional tool. Your child was selected as a possible participant in this study because s/he is a 5th grade student in a rural school.

If you decide to allow your child to participate, the child will be asked to answer questions and provide information about doing environmental science at an outdoor location and, if your child is in the class selected to use the technology, how the use of that technology impacted their learning experience. Conversations with your child will be videotaped.

There are some possible risks involved for participants. There is a field trip involved in this study and thus participants will be exposed to risks associated with field trips. Teachers will take the lead on any incidents where a child is involved. All Lakeland School District policies will be followed. First aid kits will be onsite during the field trip. Videotaped interviews will be shared with people interested in the findings of the study and your child may be identified and your child's words and image used in a report of the study's findings. To create anonymity your child's name will not be used. There are also some benefits. These include the sharing of successful implementation strategies with other educators and promoting the use of technology in other classrooms to aid in place meaning and science content understanding.

The University of Idaho assumes responsibility for lost or damaged technological equipment used by students participating in this study.

Information from this study will be released to as wide an audience as possible. The information will be in the form of videotaped interviews and a written report documenting successful strategies for implementing and using *Digital Stories* in the school and classroom. The purpose for sharing this information will be to empower other teachers with the skills and knowledge to use and implement *Digital Stories* in their classrooms.

Your child's participation is entirely voluntary and your decision whether or not to allow him or her to participate will involve no penalty or loss of benefits to which you or your child are otherwise entitled. If you decide to allow your child to participate, your child is free to discontinue participation at any time without penalty or loss of benefits to which you or you child are otherwise entitled.

If you have any questions about the research at any time, please contact, Marcie Galbreath, PhD Candidate, University of Idaho, (208) 620-1447 or marcieg@uidaho.edu. Ms. Galbreath will be supervised in this study by Dr. Paul Gathercoal, Professor & Chair Curriculum & Instruction Dept., University of Idaho, gatherco@uidaho.edu. You will be offered a copy of this form to keep.

Your signature below indicates that you have read and understand the information provided above and discussed it with your child, that you willingly agree to allow your child to participate, that you may withdraw your consent at any time and discontinue your child's participation at any time without penalty or loss of benefits to which you and your child are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Signature _____ Date _____

Your signature below indicates, that you willingly agree to allow your child to be video taped and photographed, and that you may withdraw your consent at any time and discontinue your child's participation at any time without penalty or loss of benefits to which you and your child are otherwise entitled.

Signature _____ Date _____

APPENDIX D: PLACE MEANING SURVEY

Place Meaning Survey					
Read each of the following questions and answer completely.					
What are your general impressions of the place?					
What is most important about [location] to you personally?					
How do you personally feel about the place?					
Read each theme below. Circle the number that represents how well each theme describes [location] to you personally.					
Place Meaning Themes	Not at All		Neutral		Extremely
Ancient	1	2	3	4	5
Pristine	1	2	3	4	5
Scenic	1	2	3	4	5
Beautiful	1	2	3	4	5
Remote	1	2	3	4	5
Unique	1	2	3	4	5
Important to Preserve	1	2	3	4	5
Authentic	1	2	3	4	5
Privilege to Visit	1	2	3	4	5
Relaxing	1	2	3	4	5
Important to Rural Culture	1	2	3	4	5
Overdeveloped	1	2	3	4	5
Unusual	1	2	3	4	5
Scientifically Valuable	1	2	3	4	5
Ecologically Important	1	2	3	4	5
Fun	1	2	3	4	5
Threatened	1	2	3	4	5
Interesting	1	2	3	4	5

Educational	1	2	3	4	5
Tranquil	1	2	3	4	5
Spiritually Valuable	1	2	3	4	5
Fragile	1	2	3	4	5
Wilderness	1	2	3	4	5

Table 3.2
Definition of Survey Item Themes

Item	Definition
Ancient	Early, prehistoric, primeval, and primitive
Pristine	Unspoiled, spotless, flawless, impeccable, clean, fresh, new, virgin, pure, and unused
Scenic	Picturesque, pretty, attractive, lovely, and beautiful
Beautiful	Attractive, pretty, handsome, and alluring
Remote	Faraway, distant, and far
Unique	Distinctive, distinct, individual, and special
Important to Preserve	To preserve, protect, or maintain
Authentic	Genuine, real, true, and veritable
Privilege to Visit	A special right to visit
Relaxing	Slacking, tempering, and not anxious, not tense
Important to Rural Communities	Important for economic and/or cultural reasons
Culture	Beliefs, customs, arts, etc. of a group, place, or time
Overdeveloped	Too large, too strong, and too many buildings
Unusual	Uncommon, abnormal, atypical, unfamiliar, and different
Scientifically Valuable	Systematic, technical, non-emotional value
Ecologically Important	Physical environment importance
Fun	Enjoyable, entertaining, fun, and pleasurable
Threatened	Imperil or endangered
Interesting	Absorbing, engrossing, fascinating, and captivating
Educational	Academic, scholastic, teaching, and learning

Tranquil	Peaceful, calm, serene, quiet, and undisturbed
Spiritually Valuable	Nonmaterial, divine value
Fragile	Vulnerable and delicate
Wilderness	Uninhabited and uncultivated

APPENDIX E: INTERVIEW PROTOCOLS

Student Pre-test
Interviewer - "I am interested in your thoughts about your school science activities and [location]"

1. What are two things about science activities that you do at school that you really like?

2. What are two things about science activities that you do at school that you wish were different, or that you may not like?

3. What is your favorite subject/class?

4. What is your least favorite subject/class?

5. Do you think science can help you in your life? Do you think science can help your community?

6. Do you feel like you're good at science?

7. Do you know how to use portable devices (i.e. smart phones or tablets)? Do you have access to portable devices?

8. Do you enjoy telling stories? Have you ever written a story? Have you ever created a video or movie?

9. Have you ever visited [location]?

10. What does [location] mean to you?

Student Post-test
1. How were the environmental science activities you did at [location] similar to science activities you do at school?

2. How were the environmental science activities at the park different from school science

activities?

3. Were you more interested in the environmental activities at [location] compared to school science activities?

4. What part of the science activities from [location] do you remember most?

5. Can the things that you learned through all these activities be used in other parts of your life?

6. Can you tell me two things you learned about science through the activities at [location]?

7. How did you learn these things?

8. Can you tell me how you might use science in your life?

9. Can you tell me two things you learned about technology through using the *iPads* at [location]?

10. How did you learn these things?

11. Can you tell me about how you might use technology in your life?

12. Can you tell me two things you learned about digital storytelling now that you have created a story?

13. How did you learn these things about digital storytelling?

14. Can you tell me about how you might use digital storytelling in your life?

15. Can you tell me two things you learned about the environment through the activities at [location]?

16. How did you learn these things?

17. Can you tell me about how you could use what you learned about the environment in your life?

18. Was making a digital story helpful to your thinking about environmental issues at [location]?

19. Do you feel like you are good at science?

Teacher Pre-test
Okay, It's [date]. If you could just state your name.

1. What are some overall thoughts you have about the digital story curriculum?

2. What are some of the highpoints you expect?

3. Do you foresee any difficulties?

4. Do you expect changes in student engagement as a result of the digital story curriculum activity and specifically do you expect you'll see any students emerging as leaders, maybe specifically in the environmental science or the digital story part? Do you think when we're on the field trip some leaders will appear?

5. From your perspective, what features of the curriculum will have the largest impact on student engagement?

6. Can you share any concerns or comments you have concerning students' responses to the curriculum and activities they're going to do?

7. Are there any issues related to this curriculum you would like to share at this time?

Teacher Post-test
1. What are some overall thoughts you have about the digital storytelling curriculum now that we have concluded the activity?

2. What are some of the highpoints?

3. Did you observe student engagement changing as a result of digital storytelling curriculum? Did you observe student feelings toward environmental science changing as a result of the digital storytelling curriculum?

4. Did you observed any students emerging as authorities/leaders on environmental science? Digital storytelling? [Location]?

5. What are some of your overall thoughts about the digital storytelling activity now that we have completed it?

6. Do you have any final thoughts on the digital storytelling activity and/or curriculum? Connection to place?

APPENDIX F: INTERVIEW TRANSCRIPTS

Control Group 1 Pre-test Interview

Marcie: Okay. So, I am really interested in what you guys think about science. I'm interested in what you think about the science you do at school and I'm also interested in what you guys think about [location], kind of like I was asking on the survey yesterday, okay? Alright, so, first question is, what are two things about science activities that you do at school that you really like?

Student 1: I like, one of the things I like to do is, I like to go outside. We like look at the watershed and how nature around us is working and which ways it can work.

Marcie: Okay. Great. Yes?

Student 2: Um, I like how we read in the book about all the stuff then, how the body and how nature, nature and how nature grows.

Student 3: I kind of like reading from the book, but I kind of like more hands-on physical stuff. I like, actually like not just reading, hands on.

Student 4: Um, I like the, I forgot.

Marcie: Okay. So, I'll ask the next question. What are two things about science activities that you do at school that you wish were different or that you may not like?

Student 2: Reading.

Student 3: I wish we had like hands-on instead of reading books.

Student 5: I wish that like, that we also read the books, but that we also do experiments.

Student 1: I wish we did more fun stuff, like we do some, but I wish we did more hands-on.

Marcie: Alright. So, question three: What is your favorite subject in school?

Student 1: I like to do spelling because I'm pretty much an A+ student and spelling.

Student 2: I like doing um, science.

Student 4: I like reading our book, Tuck Everlasting.

Student 5: Recess.

Student 3: I like, like social studies and history. I like learning about stuff that happened now and like before.

Student 6: Math and history.

Student 7: I like science because it just makes me feel like a worthy earthling, like I actually get to know what's happening around me so I can actually have something to do later.

Student 8: Math.

Marcie: Okay. Great. Alright. So, what is your least favorite subject? Okay, let's start over here again.

Student 1: Social studies.

Student 2: Math.

Student 3: I'm not really a big fan of math.

Student 4: Science. I don't get very good grades.

Student 6: Social studies.

Student 7: Um, I don't really know. I kind of enjoy little bit of everything.

Marcie: Okay. Alright. So, alright here's another question, do you feel like you're good at science?

Student 1: No.

Student 3: No.

Student 2: Yes.

Student 4: Not really.

Student 5: No.

Student 6: Not at all.

Student 7: I'm not really sure if I'm good at it or not.

Student 8: Halfway.

Student 9: I'm pretty good.

Student 10: Yes.

Student 11: Yes. I'm good at science.

Marcie: Okay, do you think that science can help you in your life? Do you think that it can help your community too?

Student 1: Yes. I can't think of a reason why, I'm just thinking yes.

Student 3: Yes, because like if you don't know like, if somebody doesn't know how to take care of stuff like you can help them.

Student 4: Yes, if animals are going extinct you can actually collect their DNA and bring them back.

Student 5: Right, yes.

Student 6: Yeah, because like when you're growing like a garden, like Isaac said about the animals, or if you find an animal you can have like the DNA and is like science to help it.

Student 7: Yes, because like people are still trying to find a cure for cancer and without science we wouldn't be able to even if we want, we wouldn't even have a chance to try.

Student 8: [unintelligible] would help the community because if we had a virus outbreak we would need, we would need scientist find, to find a cure so we would not be wiped out so mankind can stay on earth as long as possible.

Student 10: For cancer.

Marcie: Okay, so next question, do you enjoy telling stories?

Student 1: No.

Marcie: Have you ever created one of your own?

Student 1: Yes, but I still don't like to tell them.

Marcie: Okay and have you ever created a video or movie?

Student 1: Video.

Student 2: Yes.

Marcie: So you enjoy telling stories?

Student 2: Sometimes.

Marcie: Have you ever created one of your own?

Student 2: Yes.

Marcie: Have you ever created a video or movie?

Student 2: Video.

Marcie: Okay, same questions.

Student 3: Um, yeah, and I created one of my own. But, I make videos, but I don't put them on YouTube and stuff.

Student 4: Yes, I like to tell stories.

Marcie: Okay, and have you created your own?

Student 4: Um, I'm working on one.

Marcie: And have you ever made a video or movie?

Student 4: I'm actually working on that as well.

Student 5: Yes, sometimes I tell stories, and school, there's like a story out, there's like slides and you can put pictures and like write a story.

Student 6: Um, I kind of like telling stories. For videos and movies my brother, like I videotaped him and he is like dancing or something. I'm at [unintelligible] character.

Student 7: Yes. I love making videos on my mom's iPhone. It's great especially when you get [unintelligible] but I've never made a story.

Student 8: Yes. I tell stories to all of my cousins, and I have like 14 so usually tell like monster stories to the little kids. I make up stories about storybooks. And, yes I've made videos on my YouTube channel and I'm working on a movie right now.

Marcie: Okay, so next, have you ever visited [location]?

Student1: Um, yes.

Student2: Yes.

Marcie: Mm hmm.

Student 4: Yes.

Student 6: Yes.

Student 7: Yes.

Student 8: Nope.

Student 9: Yes ma'am.

Marcie: Okay, um, last question. So, what does [location] mean to you?

Student 1: It's [location] means to me, it's pretty much like, like, we don't have a lot of places you can go to just do stuff and I can go there and do, do like whatever.

Student 2: The waters really shallow. It is, it's like he stepped into it and it's up to your knees.

Student 3: It's pretty. You get to go fishing. I caught bluegill and some sunfish over there. But, they got to get rid of the geese.

Student 5: That place means a lot to me because when the fireside lodge was there, there still, my sister and her friends used to play heart and soul, and it's really sad about it because the owner has recently died.

Student 7: I usually swim at the dock, but like last time it was Fourth of July and I didn't really like it because I got stung by a bee twice and I'm allergic to bees so it wasn't the best experience.

Student 8: I haven't really been to the [location], so I don't really know what it means to me.

Student 9: Talking about the geese, they need to get rid of them. But, the water was pretty warm. They need an actual playground at the park.

Student 10: It's kind of messy with all the geese poop, but I had a great experience there, like catching snake and canoeing.

Student 11: Yes, my mother used to work at the fireside lodge when it was still there. She was a cook so there. I'd swim when my mom was working so.

Control Group 2 Pre-test Interview

Marcie: So I'm really interested in what you guys think about your school science and about [location] that's where were going to be going, right?

Student 9: We don't know about [location].

Marcie: Well you can just say that if I ask a question about that, okay? Some people might and some people might not. Okay, so let's go ahead and get started here okay so are there two things about science activities that you do at school that you really like?

Student 1: Well sometimes we having this afterschool activity called iSTEM and like we get to do experiments in that, go places, like to the lake.

Student 2: This. I like doing this and that's it.

Student 3: I like all science things.

Student 5: I like to know about the electronics that we are going to use on this trip to our destination and basically that's it.

Marcie: Okay, so the next question is, what are two things about science activities that you do at school that you wish were different or that maybe you don't like?

Student 1: Well sometimes we have like the science class and we go to different class, like Mrs. Clark's, and sometimes we just learn about like, grass and how it grows. I like the water cycle. And, sometimes we learn like, chemicals and that. And, I wish that we had more science things to do.

Student 3: I was thinking that maybe we could have like more experiments. Like, as far as I know we haven't done any of those. Like, the most exciting thing that I've seen is see how this plant grows. Something that I've actually wanted to do for a really long time, since I first bought this one video was, um, some experiments relating to dry ice and it's super cold so you should handle it with care. So, maybe we could do some of those. They're really fun.

Student 6: Um all we really do in our science centers is just like read except for [unintelligible].

Marcie: Okay, so the next question is, and I'm just going to go around and ask each of you, what is your favorite subject in school?

Student 1: Science.

Student 2: Recess.

Student 4: Even though we almost never do it my favorite would have to be art.

Student 5: PE.

Student 6: Math.

Student 7: Mine would be PE and math.

Student 8: Math.

Student 9: I like PE, math and recess.

Marcie: Okay, so now I'm going to go around again and ask you, what is your least favorite subject in school?

Student 1: Math.

Student 2: Everything else.

Student 4: I have no idea.

Student 3: Everything else.

Student 8: Everything except spelling.

Student 6: I like everything.

Student 7: Spelling.

Student 5: Math, science, social studies.

Student 9: Math, recess, lunch and snack.

Marcie: Okay, so here's another question. You can just raise your hand for this one. Do you feel like you're good at science?

Student 1: I do.

Student 2: Yeah I feel good in science. I feel like I'm doing good because every time I do a test I usually get a perfect score, or miss like one question.

Student 4: It's awesome to get to do experiments.

Student 5: All we do in the class that I am in for science is read, and sometimes we do PowerPoints, only sometimes, because we basically… they're boring.

Marcie: Okay, anybody else? Okay, so here's another one, do you think science can help you in your life and do you think it can help your community?

Student 1: Yes.

Student 2: Yes, it can help people because it helps the earth and you can help other things.

Student 3: Yes, because you can make stuff to help your community or something like that.

Student 5: No, because I don't like to do science.

Student 6: Yes, because science can cure cancer or other disease.

Student 7: Yes. I think yes.

Student 8: Yes.

Student 9: Yes, because it can help [unintelligible].

Marcie: Okay. So, here's another question. If you could just raise your hands, do you enjoy telling stories and have you ever written a story or created a movie or video?

Student 1: Yes, yes, yes and yes.

Student 2: Yes, because I have written a story, but I just lost my train of thought.

Student 4: Sometimes. I like sometimes, I don't, don't do that. And, I do like telling stories but it's just not that fun unless there's like a sleepover or something.

Student 5: Also yes, yes and yes.

Student 6: Yes [unintelligible].

Student 8: I don't mind making movies and telling stories, but I don't tell stories. I read all the stories.

Student 9: I don't really like telling stories and I have made a video

Marcie: Okay. So, I'm going to ask another question. This time I'm just going to go around and get each of you to answer, okay? Have you ever visited [location]?

Student 1: No.

Student 2: Yeah.

Student 3: No.

Student 4: I have, but I'm not sure.

Student 5: I'm not sure if I have because when I go to [location], the lake, usually all I do is swim at it.

Student 6: I don't exactly know because we went fishing at a park and its called [location] and I went there. I also saw a [location] campfire lodge on the road.

Student 6: I have no clue.

Student 7: No.

Student 9: No.

Student 10: Yes.

Student 11: No.

Marcie: Alright. So, one more for those of you that have, okay? So, you're going to have to raise your hand. What does [location] mean to you if you've been there?

Student 1: Swimming.

Student 2: Swimming and it's boring.

Student 4: Bore myself to death.

Student 5: Wet and alive.

Student 6: I haven't gone.

Student 7: Fishing swimming and sometimes [unintelligible].

Student 8: Fishing.

Student 9: I haven't gone there.

Treatment Group 1 Pre-test Interview

Marcie: Okay so kind of like I talked about before. I'm really interested in your guys' thoughts on both your school science and on [location]. So that's what my questions are going to be about. Okay? Alright, so you can kind of raise your hand, and it's not that important because I'm not going to be getting you on video. I just want to make sure I get your answers clear, so just try to answer one at a time. Okay?

Student 1: Wait, so you're recording us?

Marcie: Uh huh. Just on the audio. Okay? Not on video. Alright, so my first question is: What are two things about science activities that you do at school that you really like? Go ahead.

Student 1: Uh, I forgot….. Oh yeah, reading, and then tests. Science tests.

Marcie: You like Reading about science and doing science tests?
Student 1: Yeah.

Marcie: Okay, you have to make sure that you guys speak up okay so that I can get it recorded. Okay, anybody else?

Student 1: Oh I have another one. We were doing science games today and that's my favorite activity.

Student 1: You like science games too.

Student 2: I do?

Student 1: Remember last year you said you did?

Student 2: When?

Student 1: Last year when we were playing it.

Marcie: Okay so let me ask the next question. What are two things about science activities that you do at school that you wish were different or that you may not like?

Student 2: Ummm….ummmm….

Student 1: I kind of don't like reading and I kind of don't like tests.

Student 2: But you said you liked them.

Student 1: I sorta like it.

Marcie: Okay, but you'd still like them to be different right?

Student 1: Yeah

Marcie: Anything else? Anybody else? If you could change them, if you could make them different, your science activities, what would you do?

Student 1: Make them harder.

Student 2: More movies about science.

Marcie: So you like movies? Okay. Alright, so next question is, what is your favorite subject in school?

Student 1: I know. That would have to be reading, and spelling and math and social studies.

Student 2: Is recess a subject?

Student 1: And recess, and lunch, and snack.

Student 2: I like math and social studies.

Marcie: What about you?

Student 3: Nothing

Student 4: I like recess. I like science and social studies. And my other favorite first subject, and that's soccer.

Marcie: Alright so, what is your least favorite subject?

Student 5: Pass!

Student 1: Social studies

Student 2: Writing

Student 3: Yeah I… writing!

Student 4: Reading.

Student 3: It's too much work, and so many words.

Marcie: Okay. Alright, so next do you feel like you're good at science?

Student 1: No

Student 2: Well kind of.

Marcie: Okay.

Student 4: Not at all.

Marcie: Alright, so do you think Science can help you in your life and do you think it can help your community?

Student 4: Uh huh.

Marcie: Can you explain?

Student 1: You can do it Dustin, you can do it!

Student 4: I can't really explain it.

Marcie: Okay.

Student 2: Is farming kind of science?

Marcie: Whatever you can think of.

Student 2: So what was the question again?

Marcie: Do you think science can help you in your life and do you think it can help your community?

Student 2: Uh huh, Because farming gets big farmers that pick food for people.

Marcie: Anything else?

Student 2: Uh… no.

Marcie: So I'll let you each answer this question. Do you know how to use portable devices like smartphones and iPads, and do you have access to portable devices? So just kind of like um, one at a time.

Student 1: Yes and yes

Student 2: Yes and yes. Because my brother has a portable DVD player, so yes.

Student 3: Yes and yes

Student 4: Yes

Marcie: Okay, and this next one has a couple different parts. So, do you enjoy telling stories? Have you ever written a story, and have you ever created a video or a movie?

Student 1: No

Student 2: No

Student 3: No…yes and, I've created a story but… I don't know.

Student 5: Uh yes and yes, because I've created a story and it's called When Bananas Go Bad.

Student 4: No. Yes. No.

Marcie: So you created a story, but you don't really like to tell it?

Student 4: Uh uh

Student ?: Yes. No. No.

Student 4: So that's yes. Yes. Yes.

Student 2: No. No. No.

Marcie: Okay. Alright, so now we'll just go around again. Have you ever visited [location]?

Student 1: I don't know. Where his [location]?

Marcie: It's where we're going to. It's down across the…

Student 2: Isn't that a camping place? Like a camping place near [location]?

Student 3: Is it clear down by [location]?

Marcie: Yes, right on the edge.

Student 1: Oh, I think I've been there.

Marcie: There's a boat launch on one side, and a park on the other.

Student 2: Oh yeah I've been there. Yes

Student 5: No

Marcie: Okay. Alright, so for those of you that it been there, um what does [location] mean to you?

Student 2: I think I've been there. It means a lot to me because there's a lot of butterflies there.

Student 3: Uh, I don't know. It means a lot because there's a lot of animals and stuff.
Treatment group 2 pre-test interview

Marcie: Kind of like I was telling you guys yesterday. I am interested in what you guys think about your school science activities and what you think about [location]. So those are what the questions are going to be about. Okay. Alright, so the first one, and again just raise your hand, the first one is what are two things about science activities that you do at school that you really like?

Student 1: I like what we study about in Science and what we do.

Student 2: I like how we had little science projects so we have our science books and we get to talk about things like what we might do for an experiment.

Student 3: I really like Science experiments especially ones where we get to use a candle …[unintelligible]

Marcie: Okay. Did you guys hear that?

Student 4: I like how we like going here and like look at different rocks with those like magnifying glasses

Marcie: Anybody else? Okay. Alright, so the next question is, what are some things about science activities that you do at school that you wish were different or that maybe you don't like?

Student 1: Like that we could do more experiments we're just like talking about stuff that we do in science books. Maybe more outside experiments.

Student 2: We could do you like, we coming here and like those experiments where you bring a bunch of stuff together.

Student 3: I think a fun experiment is where like stuff to blow up. Like less reading more experiments. Stuff like that.

Marcie: Anybody else?

Student 4: I think we're good

Marcie: So this one I want everybody to answer. I'm just going to go around okay? We'll start right here. So, what is your favorite subject in school?

Student 1: Science

Student 2: Math

Student 3: Science, social studies and math. I can't tell.

Student 4: Math.

Student 5: Um math.

Student 6: I think probably Reading and probably social studies.

Student 7: Spelling, math and….

Student 8: Spelling, math, social studies and recess and lunch.

Student 9: I like reading too.

Marcie: So I'm going to go around again. Everybody is going to answer this one. This time is your least favorite subject in school.

Student 1: Math.

Student 3: You just did math just now.

Student 2: Social studies.

Student 4: Science.

Student 5: Social studies.

Student 6: Uh, uh, uh, math.

Student 7: Social studies and reading.

Student 8: Reading and social studies.

Marcie: Okay. Alright, so this when you guys can just raise your hand if you want to answer okay? Do you feel like you're good at science?

Student 1: Yes I feel like I'm really really good at science. Because I might the best at science.

Student 2: [unintelligible] the science club.

Student 3: I'm kind of good at math, I mean science but kind of not.

Student 4: I think I'm pretty good at science.

Student 5: I'm kind of mellow with science. I might just burn off an eyebrow or two.

Student 6: If it has math in it I'm good.

Student 7: Um, I have good grades but in science I have kind a low.

Student 8: I have, hold on. I'm kind of good at science. I can do you like math in it and uh, um I forgot that six times five is 30. So I'm not that good at math.

Student 9: I'm okay at it.

Marcie: Okay. Alright, so again raise your hands. This one has a couple parts. Do you think Science can help you in your life and do you think it can help your community?

Student 1: I think science can help us in our life and our community because science is everywhere and it helps our environment.

Student 2: I think it can help our community like it could help clean the water in the [location], Lake, and like it could also be used at Ponderay.

Marcie: Down here?

Student 3: I think that Science is actually pretty good because it tells what concoctions to put together to make stuff blow up, like I really like doing. And, um yeah so I guess it really is good for the environment like what we should do [unintelligible]

Student 5: Um, what was the question again?

Marcie: Do you think that science can help you in your life and in your community?

Student 5: Oh, yeah because like you could like make… you could learn about like the insides of animals and and you could help yourself bye helping the community by like not making the air dirty and stuff

Student 6: You can help me become a millionaire like a chemical reaction it's like what's a lot. Into my community [unintelligible]

Student 7: Yes because um I think the community helps someone, it sounds really bad I can't take another piece and pick it apart and see what it is.

Student 8: I think it can help in the community but not as much as in life.

Student 9: I think it helps the community because you can like if someone isn't healthy you can like make some like water and [unintelligible]. Like take away all the water and like, yeah.

Marcie: Okay. Alright, so I want every one to answer again so we'll just go around. Okay? Alright, so do you know how to use portable devices, Smart phone and those iPads and do you have access portable devices?

Student 1: Would the tablet be considered something like an iPad?

Marcie: Yes.

Student 1: My aunt has a tablet and I do know how to use it.

Student 2: I do have the Kindle fire, which counts as a tablet and I know how to use it and I have access to it.

Student 3: I have four different smart devices and I have access to all of them.

Student 5: What was the question?

Marcie: Do you know how to use portable devices like smartphones and iPads and do you have access to them?

Student 5: No I don't have access to them but I know how to use one.

Student 6: I have a smart phone and I know how to use it and I have access to it. And I'll play with one touch.

Student 7: I know how to use pretty much all the systems basically every single electronic [unintelligible]. Because I've been using them since I was four years old.

Student 8: I don't have access to them everyday but I know how to use them.

Student 9: I have access to them and I know how to use like everything that's smart so like Home computers and stuff.

Student 4: I have to Kindles so yes and I have access to them. On my laptop I have a very, very good password. I forget what it is sometimes so I have to get a new password.

Marcie: Alright, so next question. In a going to have everybody answer this one too so we'll just go around. Do you enjoy telling stories have you ever written a story, creative story and have you ever created a video or movie?

Student 1: I've written a story and I've never created created one.

Student 2: I like telling stories I like making stories [unintelligible]…the most dangerous animal in the world yes a puppy

Student 3: I like to make stories I do it all the time and pictures to but I don't make movies out of them.

Student 4: I like to write stories I have one that might get published

Student 5: I personally have wrote many stories. At night normally. I just get my book and I start writing in it I have about two series it's kind of weird. And I've made movies.

Student 6: I've been using YouTube for two years.

Student 7: I haven't made a movie that I write lots of stories.

Student 8: I write stories and I write stories and I like funny videos.

Student 9: I like to write stories about [unintelligible]

Marcie: We have two questions left. The second one I want everyone to answer again. Or just got to go around okay? Are we ready? Have you ever visited [location]?

Student 1: Yes I have

Student 2: No I haven't

Student 4: Well, no but I really want to see it and see where it is.

Student 3: Yeah I've been there A couple times.

Student 5: I have been there once for only about a minute.

Student 7: I've been there plenty of times.

Marcie: Have you been to Fireside?

Student 8: I have not.

Marcie: Alright, so this last question is for those of you, so raise your hand so I know who you are, but have been to [location]. I'd like to know what it means to you.

Student 1: It means like it's a good place to go fishing. Cuz there are a lot of fish there and that's about it.

Student 3: I like it because it's kind of like a generation thing and my whole family goes there and will have a big picnic.

Marcie: Okay. Have you gone?

Student 9: No.

Student 7: I really like it. I like fishing there and I like to go there and hang out and stuff it's really cool.

Student 5: It really doesn't mean anything I was only there for a minute.

Student 2: It's pretty and I like it.

Student 6: It's like, I guess I like it.

Treatment Group 3 Pre-test Interview

Marcie: So, kind of like I talked about yesterday there's a couple things I'm really interested in what you guys think about your school science activities and also [location]. So those are what the questions are going to be about, mainly, okay? Alright, so first question, again raise your hand if you want to answer. What are two things about science activities that you do at school that you really like?

Student 1: Um, in fourth, last year we had A experiment where we um did projects on like how to melt ice and stuff. Like we put dye in it and put it in the bag and this little plastic container over it and it like melted in an hour or two.

Student 2: Last year we did like these plants that we made. Like we did these beans and I did the biggest.

Student 4: Yeah right.

Student 2: I did. You know I did.

Student 5: I did a couple times some science experiments those are [unintelligible].

Marcie: Anybody else?

Student 6: No.

Marcie: The next question is what are two things about Science activities that you do at school that you wish were different or that you don't really like?

Student 7: I wish we could do more like hands on things, instead of just like reading a book.

Marcie: Okay.

Student 8: Yeah I wish we could do like more projects and stuff like that. Instead of reading about it.

Student 9: All we do in science is just is really we just read and we answer some questions. It's boring.

Marcie: Anybody else? Okay. So this one everybody's going to answer so I'm just to go around the group okay? So I'd like to know what is your favorite subject in school?

Student 2: Art,

Student 3: Art

Student 4: Reading. Reading things.

Student 5: Recess.

Student 6: Either art or math.

Marcie: Okay. So, this one is for everybody as well. What is your least favorite subject in school?

Student 1: I would have to say social studies.

Student 2: Spelling.

Student 3: Social studies.

Student 4: Social studies I have like all bees and 1A and social studies.

Student 5: I have a C in science.

Student 6: Math.

Student 7: Social studies.

Student 8: Science.

Marcie: You can just answer. So raise your hand to answer do you feel like you're good at science?

Student 1: Yeah

Student 2: Yeah

Student 3: Yeah

Student 4: Yeah I have an A

Student 5: Yeah I have an A+

Student 6: I have an A+

Student 7: No I have a C. it's my lowest grade.
(kids talking to quiet, can't hear)

Marcie: Okay. Did you want to answer? No?

Student 9: Yes, I've got like a B+

Marcie: Okay so do you think that science can help you in your life and do you think science can help your community?

Student 1: Yeah, because like what if you made a like something that can clean the lake.

Student 2: Because everyone knows that the lake at [location] is kind of dirty. Like yeah.

Student 3: That we could make like a machine where the fumes from the cars don't affect the air so much.

Marcie: Anybody else?

Student 5: Yes, because sometimes it gets really dark and we don't have lights then, it flights were never made then it would be a lot harder to get light at night.

Student 6: We took a field trip. Our whole science group took a field trip to the lake where we took this this white bottom and we put it down into the lake with a rope on it. And, we had to see if the water was dirty or not and how dirty it was, was how like how healthy or clean the water was.

Student 8: How dirty was it?

Student 9: Pretty dirty. Well at least you could see the white.

Marcie: Okay anybody else? Alright, so this question is for everybody again so were just to go around. Do you know how to use portable devices like the iPad's and smart phones and do you have access to them?

Student 1: Yes

Marcie: Yes on both? You know how to use them and you have access?

Student 2: Yes

Student 3: Yes on both.

Student 4: Yes

Student 5: I can figure out anything on technology and yes.

Student 6: I want to answer but I barely get to???????

Marcie: So, next question. And this is for everybody too it has three questions in it. Do you enjoy telling stories? Have you ever written a story, created it, and have you ever made a video or movie?

Student 1: The first one. Wait can you say the question again?

Marcie: Do you like telling stories?

Student 2: No.

Marcie: Have you ever written a story?

Student 2: Yes.

Marcie: Have you ever made a video or movie?

Student 2: Yes.

Student 3: I have, I do like telling stories, and I'd like told some stories.

Student 4: I haven't made any.

Student 5: I don't like telling stories but I think I have made a video.

Student 6: Yes. Yes. Yes.

Student 7: I tell stories to people I just like make them up as I go and people say they're very good stories and one day I want to make movie with my ideas.

Student 8: I like telling stories and I've made a movie and I've been on the commercial and it made a movie and I posted on Facebook.

Student 9: I do not like telling stories. And I have not made a movie and I have written a story.

Marcie: The next question is for everyone. I'll start over here. Have you ever visited [location]?

Student 1: Yes

Student 2: Yes

Student 3: Yes

Student 4: I'm pretty sure I have.

Student 5: I think so.

Student 6: Yeah.

Student 7: Nope.

Marcie: Okay so for all of the rest of you that answered yes I want to know what [location], what it means to you.

Student 1: Nothing

Marcie: Okay.

Student 2: It's fun to go there. The water and the beaches are pretty dirty there. A lot of trash there but it's fun.

Student 3: I like jumping off the docks.

Student 4: Um, It’s just a place.

Student 8: I don’t really know because I don’t think I’ve been.

Student 6: It’s fun and sometimes relaxing.

Marcie: Okay. Perfect.

Control Group 1 Post-test Interviews

Marcie: How were the environmental science activities we did at [location] similar to science activities you do at school?

Student 1: We do some water testing, like, stuff we can do in classrooms so we don't necessarily have to get messy but when we do go outside, down to [location], we did some different experiments down there to test the water quality and the oxygen’s. So we know, you can also do that indoors.

Student 4: Um, I’m fairly sure that we don’t do science classes.

Marcie: Anybody else?

Student 2: We did a water cycle near the river, and we did a water cycle game that was kind of like dancing and then we like, watched a movie about water cycles and play a game about water cycles at [location].

Student 3: We don't really, we didn't really do any experiments, we just read up on what to do.

Marcie: Okay, anybody else? So, how were the environmental science, and we touched on this a little, how were the environmental science activities at the park different from what you do at school?

Student 1: We read all books at school, and at Fireside we did stuff on paper.

Student 2: Kind of like when we really do, like, reading our books in class but when we were at [location] we did only activities.

Student 3: And, what was also even more fun at [location], because at [location] we got to do things that were actually fun, not just read about things, that we wish we could do.

Student 4: Yeah, we watch TV about science and we read, and down there we played like, games like, some magnifying glasses to see my, to see how the insects are and stuff.

Student 5: [location] was more like, hands on and not just reading books and watching a video or whatever.

Marcie: Were you more interested in the environmental actives at [location] compared to school science activities?

Student 1: The activities at [location] were a lot more fun than ones in class.

Student 2: Same. Its like Jacob said, its funner at [location] because we don't just, we, do hands on stuff.

Student 3: Compared to school, the activities we did at [location] were extremely exciting because when we were here the most exciting thing that happens is that we watch videos, maybe, half an hour long. Maybe.

Student 4: I think that it was funner at [location] because all we do here is read books and watch video tapes. But, when we are at [location] we get to do experiments.

Student 7: Cause like, we did all kinds of different stuff that's hands on.

Marcie: Okay, what else? What part of the science activities from [location] do you remember most?

Student 1: Like, drawing, what we, like, bird views, bird eye views and street view and bug view.

Student 2: The activity I remember most is when we were going around doing, um, rolling the dice and the water cycle with the beads.

Student 3: The activity I remember most is when we were running down by the, like [unintelligible] that's what I remember the most, cause like we just sat and looked at stuff. Writing.

Student 4: My favorite part, well the most memorable part for me was, um, the part where we would roll the dice in the water cycle and I actually got a pretty interesting story from that, my, my molecule of water.

Student 5: My most memorable part was when we were taking pictures for, for the um, movie so we could, so we could find interesting things around [location] that we could put in movies, so people would like.

Student 6: My most memorable part of it was how we were testing to see how much oxygen was in that little cup of water that we had.

Student 7: My most memorable part is when we looked in like, these microscopes looking at insect larva.

Student 8: My most memorable part was the water cycle game. And was looking at larva and bugs and stuff in these microscopes.

Student 9: My most memorable part was when some kids got to test how the water would be, if there was oxygen under in that.

Student 1: Um, I have one more. Um, at [location] the thing I can most remember is the, uh, bugs . Like we got to looks at bugs and everything.

Marcie: Ok, so can the things that you learned through all these activities be used in other parts of your life?

Student 1: Yes they can, because then you can actually make a career discovering more species, like the ones that you may discover like, when doing, like Nathan over there said with the larva in the water. You could discover new species.

Student 2: I say yes and it, the reason what like Jacob said.

Student 3: [unintelligible] You might want to be, like a scientist when you grow up, and you can tell them, like, what you did.

Marcie: So can you tell me two things that you learned about science through the activities at [location]?

Student 1: How bugs, uh, live and uh, how you can take, how you can draw the bird eye view and everything.

Student 3: The two things that I learned were, one, about like all the bugs I really didn't know and about the green ooze and how you can make it.

Student 4: Um, the two things that I learned was the green ooze and how the water cycle works.

Marcie: Okay, so those of you who answered, so how did you learn these two things?

Student 1: They showed us everything, and like, with the bugs, they showed us everything, and um, uh, the uh, when you did the bird eye view and everything, you guys taught us how to do that and think what we think was down on the ground if we were like a bird.

Student 2: Same with Jayden. That's really all that you guys taught us.

Marcie: So, how you might use science in your life?

Student 1: You can use, um, to teach, like, your kids everything and at the bird eye view, if you want to do that for an activity you can do that instead of just sitting there doing something lame. Doing something funner. And, with the bugs you could teach them like what they eat, what they do, what they look like.

Student 2: Uh, a way you could use science is that , like you could have science like, kind of like, with the computers and online you could look up like all those things with technology.

Student 5: There are pretty much a lot of stuff we do in normal everyday life has something to do with science. Turning on the lights means the lights are science, electricity is science [unintelligible] is science, pretty much everything we make is science.

Student 6: Science is fun.

Student 7: Science helps us in our everyday lives. Like, science is literally like, it everywhere you can, if you want to look at stars, every night when you look up in the sky that's millions of stars astronomers have named long ago and um, if you're building a house see you might need to use science to make sure your house doesn't tip over on you like if it's on top of the hill.

Marcie: Absolutely. Okay. Okay, so now can you tell me two things that you learned about the environment through the activities you did at [location]?

Student 1: Like you taught us how to um, you taught us how to look at the lake and think oh, what do I think that's in there like something that was there.

Student 5: You taught us about the water and how it's not that the water in [location] is clean compared to some of the other waters there are.

Student 6: It's not clean anymore.

Student 7: You taught us that like, animals get uncomfortable when, like, humans get like, [unintelligible]. We also learned the environment depends on us humans not to litter not to pollute because an entire ecosystem depends on the clean fresh environment.

Marcie: And, so how did you learn these things?

Student 1: You taught us.

Student 2: Yeah you taught us and you showed us you like showed us how to do it, instead of just saying, oh here you go do this, you can make us figure it out on ourselves, by ourselves.

Student 5: We learn this stuff because, for one, someone found out about it and they just kept trying new things and eventually got to you teaching us, and that's education.

Student 7: Because you taught us how to do it and you showed us, instead of just giving it to us, yeah.

Marcie: Okay. So, can you tell me how you might use what you learned about the environment in your life?

Student 5: You can use it to, wait, if you homeschool your kids you can use it to take it, take them down to your lake that's like right there, and like if you're not, you could probably have a field trip at your school and go down to the lake and look around like we did.

Student 7: You can use the information that you learned about the environment to save the environment from pollution and other bad things that might happen to it later on in your life and you can use it to pass it on to generations of, of like, other people and a whole of a bunch of other stuff like maybe if you were asked to like, right [unintelligible] there's so many ways to use the environment to help.

Student 2: When you're going camping and stuff, stay away from animals. Stuff like that.

Marcie: Last question. Do you feel like you're good at science?

Student 1: Yes I do because I always get A+'s.

Student 2: I'm alright I get an A or A minuses.

Student 4: I don't know how good I am compared to other people, but I'm good myself and I learn things.

Student 5: Yes, I do well in science. I try as hard as I can and it's actually pretty easy for me, so I usually get good grades like A's or A+'s.

Student 6: I'm not really get at it, but most of the time I either get a C or an A.

Student 7: I think I'm pretty good at science because I usually get an A or a B.

Student 8: Yeah, I think I'm going to science.

Control Group 2 Post-test Interviews

Marcie: This is a post interview. It is like the other one that we did before all the activities we've done, but obviously it's at the end. Some of the questions will be a little bit different but it'll be pretty much the same. Are we ready? How are the environmental science activities you did at [location] similar to science activities you do at school?

Student 1: Like looking at the bugs. We don't really do that but we talk about pollution and we talk about like insects and invertebrates and macros and things like that.

Student 2: We kind of talk about it, but we don't really do it.

Student 4: Um, we kind of learn about stuff like, in school, but when we went to [location] we had it like shown to us, like hands-on.

Marcie: Okay. And, so that kind of leads into the next question, how are the environmental science activities at [location] different from what you do at school?

Student 1: We usually don't do it, hands-on; we do some hands-on but not very much. That was really hands-on, not reading.

Student 2: Um, at school we usually just read the science book and then at [location] we were like actually doing it and not just reading about it and experiencing what would happen.

Student 4: It's like basically, like we usually do outdoor activities whenever we go to field trips, but mostly we stay inside but I think that, and I forgot what I was going to say. Okay, pass on.

Student 5: Like Faith said, usually we read our science books. We got to actually do like something different; we got to use an iPad instead, yeah.

Marcie: Okay. Anybody else?

Student 6: We also, instead of doing a game, I mean instead of reading, we do a game, we did a game at [location], the water cycle game.

Student 7: And, we also talked about pollution.

Student 8: And then, when we did like the bird's eye view, that kind of like helped us see stuff, know stuff.

Marcie: Okay. So, were you more interested in the environmental science activities at [location] compared to school science activities?

Student 1: Yeah.

Student 2: Yeah.

Student 3: Yes.

Student 4: Yeah, because I like hands-on. I like the outdoors and I like to do hands-on stuff, but I don't like the book we're reading, so.

Student 5: Yes. I liked it more, [location], because we were outside and not reading from the book.

Student 6: Yeah, I like [location] more because of three things: one, we were outside. Two, it could've been anywhere outside it didn't have to be [location] because I like the outdoors. It could've been anywhere. It would've been better than in class, and we got to do hands-on stuff outside.

Student 7: Um, I like doing the [location] thing because we got to, like, in your group and the other group we got to look at the bugs.

Marcie: Alright. So, what part of the science activities from [location] do you remember most?

Student 1: Um, I remember the bird's eye view type thing.

Student 2: I remember the map. That was really fun. And, also the necklace that we connected with the things, the molecules.

Student 3: I remember, like Tristan, the necklace too.

Student 4: I remember the necklace thing because like me and [unintelligible], we were in a group and we, we worked together and we kept on, like getting red beads and most of the time we would get stay after plays instead of move on.

Student 5: Same thing as her. She was in my group.

Student 6: Same thing as her.

Student 7: I remember, I remember the animals that we thought could live there.

Marcie: Anybody else? So, can the things that you learned, the activities that you mentioned, be used in other parts of your life?

Student 8: Kind of like the mapping, if you want to become like a geologist, or the water cycle if you want to, like if you came to school to teach like the water cycle, you could do that little game, or you could bring the bugs in, or have them go outside and map, or something.

Student 9: You can use the bug thing because he kind of told us, we got there…

[School announcement happening in loud speaker – announcing scheduling changed in afternoon activities – they will begin sooner. *This did have some impact on my data collection: I was unable to give the comparison group their posttest surveys so the teacher took them from me and administered them*]

Marcie: Okay, did you have anything else?

Student 9: No.

Marcie: Anybody else?

Student 10: No.

Marcie: Okay. So, can you tell me two things that you learned about science through the activities at [location]?

Student 1: Hmm, you can actually use iPads. You don't usually think about iPads and science, making the videos and stuff about science with the iPads. I learned quite a bit from them.

Student 2: I didn't really know, yeah, what Christian said, I didn't really know that science and making movies and iPad things were part of science.

Student 4: Technology.

Student 5: Technology is science.

Marcie: Anything else you learned about science through the activities?

Student 6: We learned about how, we learned about how not all water is like pure water, it's not pure.

Marcie: It's not clean water, it's not pure.

Student 8: We also learned that some of the water can look clean, it could look like crystal-clear but it can still have pollution in it, if it's still not be good for you and it could [unintelligible] come out of a faucet.

Marcie: So, how did you learn these things?

Student 3: We learned them from the field trip, the [location] one.

Student 9: We learned them because you said, like you said the movie's going to be about science. And, the pollution, I think the guys name was Mark, he told us about, that he took like this green food dye that represented green ooze, which is pollution and poured it in and then took that cup and poured it in into another one and just kept doing it. And, he put it in to a water bottle full of water and he said it looks pure but it still has pollution in it, it might look like water pure water but it's not okay to drink.

Marcie: Okay. So, can you tell me how you might use science in your life?

Student 1: Uh, like for your job, or like pretty much anything. If we needed to like, figure something out like, if you were lost, or you might want to try to map it out. I did a circle because I put that tree on my map or stuff like that.

Student 2: If you're learning something you know, you could [unintelligible] out or everything.

Marcie: Anybody else? How you might use science in your life?

Student 3: No.

Student 4: I use it all the time, so.

Marcie: You use science all the time?

Student 4: Yeah, basically everything is science. There's science everywhere.

Student 5: Science is like computers and TV, iPads are science because they're like, technology and I use the computer and TV almost everyday.

Student 6: Yeah, most people do, so they're using science every day.

Student 8: I have an iPod and I use it for my alarm clock, and I have a couple games on there. I watch TV pretty much every time after school [unintelligibile] the activities at [location] obviously had to be tested and stuff right?

Marcie: Right. Yeah.

Student 9: I use technology to keep in contact with family that's not near, like to call them or Facebook or stuff.

Student 10: Like Tristan and them, I have a couple of games, the TV, the computer.

Marcie: Okay. So, can you tell me two things you learned about the environment through the activities at [location]?

Student 1: I learned that we need to protect the environment because it could look clear but honestly there could be some pollution in it [uninteliigible].

Marcie: Okay. Anybody else?

Student 3: Like you could like take a picture of something and then like, maybe zoom it in; that would be kind of like a microscope and you can make it bigger.

Student 4: Some things I learned, we need to clean up the environment in the water and even on land, we should clean it up too.

Marcie: Okay. And, so these things that you learned, how did you learn them?

Student 1: I learned them like through the field trip and through you.

Student 2: I learned them by the guy Jim telling me water can look clear but sometimes it's not. I learned to keep like the land safe.

Marcie: Anybody else?

Student 7: No.

Marcie: Alright. Last one. Do you feel like you're good at science?

Student 1: No.

Student 2: No.

Student 3: No.

Student 5: Yes.

Student 6: Yes.

Student 7: No.

Student 8: No.

Treatment Group 1 Post-test Interviews

Marcie: alright so again this is the post interview it's a lot like the one that we did before the activity some of the questions might be a little different K alright, in your mind how are the environmental Science activities that you did a [location] similar to science activities that you've done at school?

Student 1: Uhh, Oh we learn about water molecules.

Student 2: Learning about water molecules, that's similar?

Student 3: Yeah.

Marcie: Okay.

Student 4: Yeah what he said.

Student 3: Yeah what he said.

Marcie: Okay, well how were the science activities different from science activities you do at school?

Student 1: They're much more funner.

Marcie: Okay they were more fun what else?

Student 3: We looked at dead bugs.

Student 4: And we went outside.

Marcie: And, you went outside?

Student 4: And we did activities.

Marcie: You did activities and that's different?

Student 4: Yeah.

Marcie: Okay. So, are you more interested in environmental science activities' at [location] compared to school science activities?

Student 1: Yes.

Student 2: I don't know.

Marcie: Okay what part of the science activities from [location] do you remember most?

Student 2: Oooo, I know the beads and the water bugs yeah just the beads.

Student 3: My ant.

Student 4: Oh yeah my pincher bug.

Marcie: Okay can the things you learn through those activities be used in other parts of your life?

Student 1: Yes.

Student 2: Yeah.

Student 3: Yeah.

Marcie: Can you explain?

Student 1: No.

Student 2: No.

Student 3: No.

Marcie: Okay, so, you think you can but you're not sure how?

Student 1: Yeah.

Marcie: Okay so can you tell me two things you learned about science through the activities that you did at [location]?

Student 1: Wait what was the question?

Marcie: Can you tell me two things you learned about science from the activities you did at [location]? Is there anything that you learned that you remember?

Student 2: Oh water stays in the sea a lot.

Marcie: K.

Student 1: Uh I forgot.

Student 3: We learned about condensation, precipitation and other stuff and we also learned about water molecules.

Marcie: Okay anything else? How did you learn most things?

Student 1: By talking about it.

Marcie: By talking about?

Student 2: And a game.

Marcie: And a game. Can you tell me how you might use science in your life?

Student 1: By being a scientist.

Marcie: By being a scientist okay what else?

Student 3: Uh.

Student 4: Yeah what Cole said.

Marcie: Alright, can you tell me two things you learned about technology through using the iPads at [location]?

Student 1: I don't know.

Student 2: What was the question.

Marcie: Can you tell me two things you learned about technology from using the iPads at [location]?

Student 2: Making movies, yeah, making movies and that's it.

Student 3: Yeah, making movies.

Student 4: Pictures yeah.

Marcie: Mm hmm What about pictures did you learn?

Student 1: That it was fun.

Marcie: That it was fun okay. Okay so how did you learn those things?

Student 1: By applying them.

Marcie: By applying them, okay. So, using the technology?

Student 1: I said playing.

Marcie: Oh playing sorry I did not hear that. So can you tell me how you might use technology in your life?

Student 1: When you call people and take pictures and stuff

Student 2: When you fix stuff.

Marcie: Fix stuff?

Student 2: Fix stuff with computers.

Student 3: You can do that?

Marcie: I don't know, you tell me, how can you use it in your life? What you think?

Student 3: I don't know but my dad use this technology for his job he has computers and stuff.

Marcie: Okay anybody else? Okay can you tell me two things you learned about Digital storytelling now that you've created a story?

Student 3: What was the question again?

Marcie: Can you tell me two things you learned about digital storytelling now that you created a story?

Student 4: Ooo, that you can make a slideshow.

Marcie: That you can make a slideshow?

Student 4: You can make [unintelligible] slideshow and you can turn on music.

Marcie: Yeah anything else?

Student 4: Those are two things

Marcie: Those are two. So how did you learn those two things?

Student 4: By listening.

Marcie: By listening.

Student 2: By actually trying to do it.

Student 1: By messing around on it.

Marcie: Anybody else? Okay can you tell me how you might use digital storytelling in your life?

Student 1: Making movies.

Student 3: Yeah what he said .

Marcie: Anybody else?

Student 4: I got nothing.

Marcie: Okay. Can you tell me two things you learned about the environment from the activities you did at [location]?

Student 1: We saw lots of weird looking bugs.

Marcie: Just lots of weird looking bugs?

Student 3: Yeah same as him.

Marcie: What else?

Student 4: There's a lot of animals.

Student 1: And there were three graves.

Marcie: Hmmm?

Student 1: There were three graves.

Marcie: Yeah there were three graves in that environment, huh? Anybody else learn anything about the environment from those activities?

Student 1: A lot of water.

Student 2: Water molecules.

Student 3: Studying water bugs.

Marcie: Okay. What did you learn studying water bugs?

Student 3: That they're big.

Marcie: That they're big.

Student 4: Some are teeny tiny.

Marcie: Okay. Can you tell me how you learned those things? Besides studying the bugs could you give me that one. How else did you learn most things?

Student 1: I don't know by looking around and stuff.

Student 2: Taking pictures.

Marcie: Taking pictures. What else?

Student 4: Studying stuff.

Marcie: Studying stuff okay. Can you tell me how you might use what you've learned about the environment in your life?

Student 1: By being scientists.

Marcie: Being a scientist, you could use it. How else could use it?

Student 2: By fixing stuff.

Marcie: How could you use what you learned about the environment in your life?

Student 3: By fixing stuff.

Marcie: Can you explain that?

Student 3: Not really.

Marcie: What kind of stuff?

Student 3: Computers and technology.

Marcie: Okay. So, using computers and technology you can fix environmental stuff is that what you said?

Student 3: Yes.

Marcie: Okay. So, was making a digital story helpful to your thinking about environmental issues at [location]?

Student 1: Yes it was.

Student 2: Yeah.

Marcie: Can you guys explain how?

Student 2: Because, I don't know.

Student 1: Me either.

Student 3: Yeah because we think about the animals and stuff.

Marcie: Okay you think about the animals and stuff. Okay what was the best part about visiting [location] for you?

Student 1: We got to do the bead game.

Student 2: Pictures.

Marcie: Pictures. Taking pictures?

Student 3: Discovering different bugs and [unintelligible].

Marcie: Discovering different bugs and what?

Student 3: Learning what they are.

Student 4: I don't know.

Marcie: Okay one more question. Do you feel like you're good at science?

Student 1: No.

Student 2: A little bit.

Marcie: A little bit?

Student 2: Yeah a little bit.

Marcie: Anybody want to explain?

Student 1: Because I got a D in science.

Student 3: No, because I keep getting F's.

Marcie: Okay well those are all of my questions for you.

Treatment Group 2 Post-test Interviews

Marcie: I'm going to go ahead and record and let's see here okay [murmuring about technical issues…] Alright. So, I'm going to ask you guy's questions. This is what's called the post interview so we do it after. The questions are similar but not exactly the same as the ones that I asked you before we did this. Alright see you guys are going to have to speak up okay? Okay so are we ready?

Student 1: Yeah.

Marcie: Okay this is the post-study interview. Make sure you raise your hand since there are so many of you in here so I can make sure I hear what everyone is saying. That we were not talking over each other. Okay, how are the environmental science activities you did at [location] similar to science activities you do at school?

Student 1: Well…

Student 2: You gotta like mixup formulas and stuff.

Student 3: Um we got to do hands on things.

Marcie: And that's similar to what you do at school? Alright.

Student 4: One is cause they're both science and two is what she said.

Student 5: It's kind of similar because we learn about science stuff and the second one is we don't really do stuff at school experiments that I know of.

Marcie: Okay so that's my next question how were the environmental science activities at the park different than ones you do at school?

Student 2: Um we get to look at bugs instead of being in school

Marcie: Okay. Anybody else? Somebody down here?

Student 6: We were at the lake.

Marcie: We were at the lake. Anything else?

Student 7: We got to use the tablets to take pictures

Marcie: Uh huh you used the iPad to take pictures.

Student 8: I saw duck.

Marcie: That would be different than at school?

Student 8: Yeah.

Marcie: Anything else? Okay where you more interested in the environmental Science activities at [location] compared to science activities at school?

Student 1: Mm hmm

Student 2: Mm hmm

Student 3: Yes.

Student 4: Yes.

Student 5: It, it we actually got to do stuff instead of read.

Marcie: Okay. Anybody else want to explain why you preferred it?

Student 7: Yes.

Marcie: Do you want to say why?

Student 7: No

Marcie: Okay. So what part of the science activities from [location] do you remember the most?

Student 2: Me and Cody took pictures. We were like taking pictures. We were throwing rocks in the water. We were taking pictures of the splash and we're trying to make it look like a fishes point of view, kind of yeah.

Marcie: Yes?

Student 4: I remember making like the beads and maps and [unintelligible].

Marcie: Okay.

Student 5: Yeah a lot of stuff.

Student 6: Playing the game.

Marcie: Okay so can the things you learned from these activities be used in other parts of your life?

Student 1: Yes.

Student 2: Yes.

Marcie: Okay, now explain how you can use it.

Student 4: Like were talking about like the Atlas and in real life when you grow up and you want to travel somewhere you have to know where that place is so you need to understand how to use that map.

Marcie: Right, right. Yes, we do need to understand how to use maps. Anything else?

Student 6: Well um if you see dark clouds you know it's going to rain.

Student 4: That's not always true.

Student 7: It looks like it's going to rain.

Student 5: If you like see and I learned if you like see the green clouds of tornado's coming.

Student 4: Green?

Student 5: I'm telling you that's true.

Marcie: But is there anything you learned at the park can you use that in your lives?

Student 8: The fish can die and that'd be a bad way to catch fish, they'd just be floating on top of the water.

Marcie: Anybody else? Okay. So can you tell me two things that you learned about science through the activities at [location]?

Student 1: I've only got one and that's the direction north is.

Student 3: What's a direction? Which way's north?

Student 1: Um It's that way.

Marcie: Hold on.

Student 1: It's that way.

Marcie: How do we know that?

Student 1: Um Look at the North star.

[lots of silly background chatter]

Marcie: Okay anything else? What'd we learn about science through these activities?

Student 1: Using the northern star or the small dipper on north.

Marcie: K. Anything else? So how did you learn these things?

Student 1: By the people that told us.

Student 2: The people that were talking to us and he had his hand on his [unintelligible].

Marcie: Okay so can you tell me how you might use science in your life? Raise your hand. Yes?

Student 4: Um on a map.

Student 6: If you want to be a scientist.

Student 3: You can do science like to see like where you are and look at marks because like some marks that can be like cemeteries.

Marcie: Okay. Good. Anybody else?

Student 5: To apply some things like you can apply it to things [unintelligible] maybe. That's what he said.

Marcie: Yes science can help you with that anybody else.

Student 7: I don't know.

Student 8: It can help you do magic.

Student 2: Not really.

Marcie: Science can help you do magic in your life? Do you want to explain how?

Student 8: Yes it's not the magic, it's actually the magic tricks are basically science sometimes cuz yeah.

Marcie: Okay. Okay, I have another question can you tell me two things that you learned about technology through using the iPads at [location]? Raise your hand. Hold on. Yes?

Student 2: I learned how like to turn it on and and then I learned how to go to the movies section and see where the pictures are and make a movie.

Student 3: And make a movie.

Marcie: Okay, yes, you.

Student 6: Okay so I learned they're expensive and they're very [unintelligible] another thing I learned was that how to make movies but I knew everything else.

Marcie: Okay. Who else? What'd you learn about technology? Yes.

Student 7: I learned about how to make movies on it because I didn't know how to make them.

Marcie: Anything else? So, how did you learn these things? Yes.

Student 1: We learned them by a bunch of grown-ups teaching us how to learn them.

Student 3: By reading our orange science books.

Marcie: About technology?

Student 1: Are you sure?

Student 3: Yes I'm sure.

Marcie: Anybody else? Yes.

Student 6: By using hands-on activities.

Marcie: Uh huh. By using hands on activities. Anybody else? Raise your hand if you answer. Okay so can you tell me how you might use technology in your life?

Student 1: I actually am going to become a computer tech person that knows how to fix them and make them, yeah.

Marcie: Yes. Yes, you.

Student 5: Um you could use them for like traveling.

Student 6: You can use them like for finding geo-caches like where they are.

Marcie: Yes, anybody else? How you might use technology?

Student 8: I don't know for recording our voices.

Marcie: Yeah, for recording voices. Okay can you tell me two things you learned about digital storytelling now that you've created a story?

Student 1: Like sound and text?

Marcie: Just digital storytelling that we did last week. What did you learn now that you've created a digital story?

Student 3: I learned how to make a movie A video and like a um a slideshow and I know how to.

Marcie: How to what?

Student 3: I know how to… I know how to…

Student 5: I learned how to make the movies because I didn't know how to do that and I already know how to make the slideshows and other stuff.

Marcie: Okay.

Student 6: I learned how to make movies and how to put in sound effects and music on it

Marcie: Okay, anybody else? Okay. And so how did you learn those things?

Student 1: You showed us

Student 2: By following directions we paid atten… you, we we learned by paying attention not goofing around during the lesson or and paying attention.

Student 3: You already said paying attention.

Student 2: Oh.

Marcie: Anybody else? Can you tell me how you might use digital storytelling in your life?

Student 2: You can use it for like a family night. You can like put on the story on the wall are the, on the wall are, at like my grandpa's house downstairs, we have a huge theater.

Student 4: You can write a story.

Student 3: Excuse me; um you could use to, use it to tell a story.

Marcie: Okay so can you tell me two things that you learned about the environment through the activities at [location]? Yes.

Student 1: That um it would take a lot to get the pollution out of the water.

Marcie: Okay.

Student 3: Um I only learned one our waters been around for a very long time

Student 5: I learned that um you can you can like if you were like a, like a, little teeny tiny little bunny rabbit you can pretty much eat is like, grass or, if you like a bird you can see pretty much water land rocks people but you can't see too much because you're so far in the air.

Student 6: I think that um I learned that you don't just randomly kill an animal. It's bad unless you're hungry. That's a whole different reason for it.

Marcie: Anybody else? And, so these things about the environment how did you learn them?

Student 1: By you.

Student 3: By using the hands on activities.

Marcie: The hands on activities okay. Anybody else? Okay so can you tell me how you might use what you learned about the environment in your life? How could you use that in your life?

Student 1: You could tell your kids not to chase animals or else they might kill you.

Student 2: [unintelligible]… There was a deer and I was at school.

Marcie: How could you learn use what you learned in your life? How else?

Student 3: Find out what to do.

Marcie: Find out what to do, uh huh.

Student 1: If you're trying to run away then you would have to know, know if you're camping then you have to know the way animals learn, animals prey and how they learn, how they would react to different place to them they'd kill you.

Marcie: Absolutely. Okay, was making a digital story helpful to your thinking about environmental issues at [location]?

Student 1: Yeah.

Student 2: Yeah.

Student 4: Yeah, cuz you could like, like learn like you could take pictures at [location] and come home and you could get like, or you could like download that movie. Like, you could take pictures at [location] then go back to your house and make a movie of it. That's pretty cool.

Marcie: You said yes.

Student 6: Um, because like the same thing you could download the app and you can show if you have a tablet or phone or iPod you can do it on that and then you can make like movies and show it.

Marcie: Anybody else? How does it help with your thinking about environmental issues?

Student 8: You, you took part of my answer.

Marcie: What's your answer?

Student 8: Maybe, um… say the question.

Marcie: Was making a digital story helpful to thinking about environmental issues at [location]?

Student 8: Oh, still yes.

Student 9: Um so it's not helpful because you can usually just remember it basically you're just putting your memories and adding text.

Marcie: Okay, anybody else? Okay. I have one more question. Do you feel like you're good at science?

Student 1: Yeah.

Student 3: Yeah.

Student 4: Yeah.

[Everybody saying yeah together]

Student 5: Yes.

Student 6: No.

Student 7: Yes.

Student 8: No.

Student 9: I feel like I'm good at it because, because, like, because if your assignment is like to make something [unintelligible].

Marcie: Do you feel like you're good at science?

Student 2: No if Science is just like learning how to like how to set something on fire I'm good at it.

Treatment Group 3 Post-test Interviews

Marcie: Alright, so I'm going to record this. Okay and so this is called the post interview it's a lot like the one we did before the activity but it's after the activity so the questions will be just a little bit different but it'll be similar to what we all ready did. Okay, and so I'll need you to again raise your hands so we're not talking over each other and I can get the answers and that you speak up. Okay, perfect. So, first question, in your mind how were environmental science activities you did a [location] similar to school science activities you've done? Yes?

Student 1: Um, they're pretty similar because we draw maps sometimes in science and do a bunch of science activities during class sometimes.

Student 2: Um, it's similar because we had bugs come up here from the lake and we observed them and um we also have we also, have took a hike down there and did some stuff but I was in Science Corp. so.

Marcie: Okay so that was Science Corp. Anybody else?

Student 3: It's all science.

Marcie: Okay. So, how were the environmental science activities that we did at the park different from school science activities?

Student 2: Um sometimes we don't go outside, normally, and we're doing things inside

Student 4: Um normally we don't go, normally we don't walk down to the lake. Normally we don't walk down to a different location.

Student 5: We um, we did hands on things and we usually just read a book; reading science.

Marcie: Okay.

Student 6: And, actually just like she said we read a book and answer questions and just put down on papers and whenever we did have an activity it wouldn't be something cool; we wouldn't get to use bugs. It would be something like, um, because we only did one this year but it was only with candy bars so we didn't actually do hands on things.

Marcie: Okay what else? Okay, so, were you more interested in the environmental science activities that we did at [location] compared to school ones?

Student 1: Yeah I was more interested in it because we did a lot more hands-on things instead of just reading out of a book.

Student 2: Yes because we actually get to walk around instead of just sitting down in the classroom the entire time.

Student 3: Yeah because we were actually like being with other people and we were just reading out of a book.

Student 5: I agree with everyone. Like, I think it was a lot more hands-on and it, a lot more fun.

Student 6: I think it was, wait, what was the question again?

Marcie: Were you more interested in the environmental science activities…

Student 6: Oh, I thought it was a lot more interesting because it was a lot more funner and we don't actually get to do hands-on things and there was a lot of that. And, we don't actually move. There was no books we all got, we all can experiment or our thoughts instead of having to sit there and read and so I thought it was a lot more interesting and better.

Student 3: I already went but yeah I think it was more interesting because we didn't do a lot of things with books but, Trevor said we all got to do at least one activity with friends and we got to run around and find out things that we never knew before.

Marcie: Okay, yes. Okay, so what part of the activities from [location] do you remember most?

Student 1: Um the game that we played.

Student 2: The water cycle game.

Student 5: Uh, the water cycle game and the [unintelligible] I have a mental picture that I took in my head. And, the bugs because I'm afraid of the bugs.

Student 6: Um looking at the bugs.

Student 7: The water molecule game And the [unintelligible].

Marcie: Yes?

Student 8: Taking the pictures.

Student 9: Everything.

Student 4: It was really, really fun.

Student 3: The games.

Marcie: Okay, so can the things that you've learned from those activities be used in other parts of your life?

Student 1: Yeah the things that we learned in our activities they can be used in different parts of our life because maybe your scientist and your studying water molecules and you remember the game that you played while you were in fifth grade.

Student 2: I think it will be really helpful because we'll know how, now we'll know how to check the oxygen it was really good practice because if you decided to become a mapper and you're making maps that would be really good practice for making maps to have like a satellite picture and you can copy out of that.

Student 3: Well even if you aren't a scientist or you're mapper or anything it will be useful on your own when you're a parent and your kids need help with their science homework.

Student 9: Um, kind of like, not really I guess because like, yeah, you can do the maps and stuff, otherwise like the water cycle game you know more about the water cycle but you wouldn't really like use that as an adult in your life to like move on.

Marcie: Anyone else?

Student 7: Um, yes and no like McKenna said the water cycle game was, I don't know, we were just grabbing beads from the kit and putting it on the necklace. It wasn't very, we weren't really learning anything.

Marcie: Okay, so can you tell me two things that you learned about science through the activities at [location]?

Student 4: Yes cause the water molecule game we got to see how, how far water molecules have to travel to get to different parts places and maps. I didn't know some of the names of the maps. Now I know that satellite view maps would know then a ground view map would be called the street map. I didn't know that and that a satellite map would be called a birds view map. I didn't know you, I didn't know what the actual name would be.

Marcie: Okay anyone else? Okay. Alright, so since you're the only one that answered how did you learn that?

Student 4: How did I learn that? Um, because we got to study, we got to take pictures, we got to move around, we got to we got to move around, exercise.

Marcie: Okay, so can you tell me how you might use science in your life?

Student 1: But if you become a scientist and you can make all kinds of stuff.

Student 2: Well pretty much, um, or like when you're cooking food and stuff and like cake and stuff that would like put, water and powder and make [unintelligible] bread and stuff.

Student 4: Science would be really helpful in life because um so you can know things and you wouldn't get confused to be laughed at because you don't know, like, even one of the parts of the plant or something or you don't know it and it's very simple. So, science, and it can also help with jobs and cooking and helping your kids. You would learn like, my friend over here said so, yeah, that would be really helpful thing in life.

Student 5: It would be really helpful and kind of good because science is usually used in cooking and other things and it would help you help your kids with homework and stuff like that and then you might have like, a fire or something and you know not to try and blow it out because oxygen actually makes the fire go.

Marcie: Okay, so can you tell me two things that you learned about technology through using the iPads at [location]?

Student 6: Um, well I learned how to make a movie. And, I also learned how to, um, design things.

Student 7: I worked hard to make this [unintelligible] movie and put text in and basically how the iPad work because I have a tablet so it's different, yeah. But, I actually learned how to do some things.

Student 8: I learned how to use iMovie and how to do the music in the background.

Student 9: I learned how to um make a new movie on the iMovie section I didn't know that plus [unintelligible].

Marcie: Okay anybody else? No? Okay, so how did you learn those things?

Student 1: Uh, by taking pictures and exploring different themes on the app.

Student 3: By interacting with the iPad and having you kind of tell us directions um oh and you know messing around with it. Mainly interacting with it cause, and you helping us, that was a really big help too.

Marcie: Okay so can you tell me how you might use technology in your life?

Student 1: You might use technology in your life, in your, if your a scientist and you look it up on the computer or you can watch videos about it.

Student 4: If you're a computer engineer, then you would have to learn how to use it.

Student 6: You literally use it, would help you a lot because, I mean we use phones, we use computers, we use tablets, we use almost every job there is you have to use something or some technology. I have, you learn to [unintelligible] technology [unintelligible].

Marcie: Yes.

Student 1: Well you would need to know how to use technology for like being an engineer on cars and making any type of automotive or making construction vehicles.

Marcie: Anybody else? Okay, so can you tell me two things about digital storytelling now that you've created the story?

Student 11: I was actually in testing when they were doing that.

Student 3: Uh, what about it?

Marcie: Yeah, what did you learn about…

Student 3: Oh

Marcie: … Digital storytelling now that you've created a story?

Student 3: Oh, I learned that you can make it sound really fun and put little noises in like barking and [imitates a sound] put music in and make it sound like really cool, for cool text and cool creations; just make it awesome.

Student 4: What was the question again?

Marcie: What did you learn about digital storytelling now that you've created a story?

Student 4: Oh, um, that you can stretch out the pictures to make it longer, you can put in different types of music and cut it off at one point, you can separate them, you can put different music in different parts.

Student 6: Um, you can use it to present something like a presentation.

Student 7: Um, well you could… well he took all my ideas.

Marcie: Okay, anybody else? Okay and so, how did you learn these things?

Student 1: By exploring different parts, like tapping and putting, you are [school buzzer going off] on it spacing them out.

Student 6: Just basically experiencing it hearing, it from your friends, from you and um, remembering and.

Student 7: Well using the iPad.

Marcie: Can you tell me how you might use digital storytelling in your life?

Student 1: Whenever you're doing a presentation.

Student 4: When you're making movies.

Student 6: When you are actually maybe making a book.

Student 7: School.

Student 8: Uh, when you like, Billy said, make a book, an audiobook, you can record what you're saying you can read a book, record it, play it again to other people.

Student 9: Um, actual moviemaking like, um, something like Jurassic Park or something like that.

Marcie: Okay, anybody else? Okay, can you tell me two things you learned about the environment from the activities at [location]?

Student 2: Um, that how the water molecule, when we played the bead game over on the other side of the boat launch, that you have to go through different areas and different parts of the world like glaciers oceans and rivers.

Student 6: Uh, that there's a lot more oxygen than I thought in the lake. Or, how actually it doesn't look as polluted as it does. Um, and um, the, the um, sorry you know the, this things that water molecules can do and stay for very long time.

Marcie: Okay, and so how did you learn these things?

Student 1: Uh, when I said by, and the bead game by rolling the dice and moving to different areas to different sections of the boat launch over by trails looking at the sky, looking at pictures.

Marcie: So can you tell me how you might use what you learned in your life?

Student 6: Uh, teaching your kids, being a scientist, or just um, doing it for fun, or um, um, doing experiements [unintelligible] the lake and stuff, and yeah, just doing stuff that involves a lot of things.

Student 7: Purifying, or, you can use it for like purifying the earth or cleaning the lake.

Marcie: Yes?

Student 8: When you're a science teacher in high school or college you can teach the kids what you learned from when you were in school when you went on that one particular field trip where you learned about water molecules and different types of maps.

Marcie: Okay. Alright, so we're almost done. Was making a digital story helpful to your thinking about environmental issues at [location]?

Student 3: Yes, because I saw a lot of, yes, that's my answer, just yes, yes.

Marcie: Anyone else? Was a helpful to your thinking?

Student 1: Yes.

Student 3: What was the question?

Marcie: Was making a digital story helpful to your thinking about environmental issues at [location]?

Student 5: Yes.

Marcie: Do you want to explain that?

Student 5: No.

Student 9: Yes, because hopefully you're going to know about there is a little bit of pollution because Mark, I think that's what his name was? He said you could tell by the bugs that were in it. Most of them were able to stand a little bit of pollution and, that, um, actually as polluted as it is, um, and that there was actually, um, uh, sorry, um, animals that were live, more animals than I know actually live there and, um, stuff like that you know, um, you know like how animals need water and all that stuff.

Student 8: Yes, because I saw a lot of different pollution on the other side of the lake when we were taking pictures of different views. I saw like metal and garbage. People really don't take care of our environment we have a lot of trash and stuff in our front yard. We always have to come around and pick it up.

Marcie: Okay, so what was the best part about creating a digital story for you?

Student 1: It was fun.

Student 10: I wasn't there.

Student 3: Being able to do it with somebody else.

Student 4: Like not having to work by yourself.

Student 5: Doing it with your friends and learning how it works.

Student 6: Making a movie, funny sounding and fun. Doing it with friends and finding out what works.

Student 11: I was doing testing.

Marcie: Oh, that's right.

Student 8: Doing it with friends.

Marcie: What was the best part?

Student 8: He fell asleep.

Marcie: Um, What was the best part about making a digital story to you?

Student 9: The best part of making a digital story because it's fun making a digital story because you can watch it over as many times as you can possibly, you can watch it over as many times as you want.

Student 8: You just said that.

Student 9: I know.

Student 7: Yeah because you can you can make it really funny using different pictures. Um, you can use different themes, you can use different music, like we said four questions ago you can tell your friends to watch it over you can show it to your teacher you can present it.

Marcie: Okay. Alright, I have one more question; do you feel like you're good at science?

Student 1: Yes.

Student 2: Yes.

Student 3: Yes.

Student 4: Yes.

Student 5: Yeah.

Student 6: Absolutely.

Student 7: Yes.

Student 8: Yes.

Student 9: Yes

Teacher Pre-test Interviews

Marcie: Okay. So, it's May 12. Okay. So, I can start with you. If you could just state your name?

Kim: My name is Kim [Hudson].

Marcie: And, how long have you been teaching?

Kim: I've been teaching for nine years.

Marcie: And, how long have you been teaching at [location] Elementary?

Kim: Nine years.

Marcie: Okay. So, what are some of your overall thoughts about the digital storytelling curriculum, of what you know about it?

Kim: From what you've presented to us I think that it is going to be very engaging for the kids. I think there is going to be some kids that actually like storyboarding, drawing more believe it or not in this techy day and age.

Marcie: Okay. That is a highpoint that you expect then. Do you foresee any difficulties or problems?

Kim: Um, maybe in the group work. Just they're um, they're such an active group and they really like to have their hand in everything, so we're really going to have to make sure we set our standards. Like I have my rules for group work, so we'll have to go over them ahead of time to make sure everyone gets their fair share in creating. So, that might be one problem that comes up, but we can overcome that by addressing it first

Marcie: Right, right, yeah, yeah. So, we'll need to deal with that. And, I can help you with that. Okay. So, I'm going to ask the same questions with you. So, if you could state your name.

Lori: Lori [Carey].

Marcie: And, then how long you've been teaching?

Lori: 19 years.

Marcie: And, how long have you been at [location] Elementary?

Lori: 10 years.

Marcie: Okay, and so, same thing for you. Do you have, um, can you share your overall thoughts of the digital story curriculum so far?

Lori: Oh I think it will increase engagement. I think the kids will be really excited. Um, I think that they will want to play a bit before they want to get serious … it's something new and so we'll have to work with the time frame that way, but I think that they'll really be engaged and excited about it.

Marcie: Great. Okay. Um, okay next question. Do you expect changes in student engagement as a result of the activity and, um, specifically do you expect you'll see any students emerging as leaders – maybe specifically in the environmental science or the digital story part? Do you think when we're on the field trip some leaders will appear?

Kim: I do. I have a few kids, well one little boy, I'm asking him politely to mark his book and pay attention to the lesson at hand but when it comes time to do something on the computers, he has learned how to do some pretty awesome things you know through Google

docs and he's taught his peers. I can see him stepping up and you know wanting to put that book down and being a leader for his class.

Marcie: And so, same question for you. Do you expect changes in student engagement specifically in leaders stepping forward?

Lori: Just in doing more science recently, I have seen a couple of kids that seem to be kind of coming out of their shell that maybe weren't showing leadership before. Um, I still think that I'll have some that will let other people do it for them. Um, in a class of 17 boys and 7 girls, when it comes to anything that requires artistic ability, like the drawing storyboards, I think it'll be challenging for them, so I think the digital one will increase their level of comfort because a lot of them don't draw well and don't like to draw so.

Marcie: Okay. Um, so from your perspective, what part of the curriculum will have the largest impact on student engagement, on interest?

Kim: Oh definitely it's going to be the iPads. They are going to be so excited. I've got a student that he doesn't even have access to the Internet, so he loves it when he can go to the library and use it.

Marcie: Same question.

Lori: I think the iPads are going to be the thing that they're going to be super excited about. We don't actually, we have a lot of computers, but we don't have iPads, so we don't get to do a lot with pictures just because taking them and trying to get them on the computers, so I think that quick action, they're really going to enjoy that part.

Marcie: Okay. Um, so can you share any concerns or just comments that you have concerning students expected responses to the curriculum and activities they're gonna do?

Kim: I think that they're going to be even more excited as they get going with this activity than, I think they're perceiving it differently. Like right now they're like "ooohh" [moan], but they're going to get into and they're going to be super excited.

Marcie: Mm hmm. So, same thing, any concerns, comments with their expected responses?

Lori: Um, I think that there will be a couple that will try to give you really, possibly bizarre answers, but I think overall they're going to do well and enjoy it.

Marcie: Okay. And, um, final question. Are there any issues related to this curriculum that you'd like to just share at this time? And I'm aware that you haven't jumped into it yet.

Kim: I'm just hoping that I get all the parental consent back. I would love it for everyone to be able to participate.

Marcie: Okay. Same for you.

Lori: Same. Yeah, I think the experience will be enriching for them and I'd like them all to participate as well.

Marcie: Okay, Great. Well I appreciate you guys letting me interview you…

Teacher Post-test Interview – Lori [Carey]

Marcie: So, this is the post-study interview. I'm just going to ask you a few questions. So, um, the first one is, what are some overall thoughts you have about the digital storytelling curriculum? Now that we're done with it?

Lori: Um, I was impressed with what the kids were able to do in a short amount of time. Um, I wish we had I pads, so that we could do more with that cuz I see lots of possibilities to different things with them.

Marcie: Okay. So, is there a highpoint that jumped out at you?

Lori: Well, just overall I thought the kids had really tried, really got the science documented in there and some were just kinda more interested in the whole experience and didn't really put a lot of science, but I think overall I just thought it was really cool, that they were able to do that and have that kind of presentation in a short amount of time.

Marcie: Um, okay. So, did you see student engagement changing as a result of the digital storytelling curriculum activity?

Lori: Like, what do you mean? Like, at that moment or overall?

Marcie: Yeah, whatever your thoughts are on that.

Lori: Well, they were very engaged when they were creating their stories, but I don't know that they connected it to the science. So, having it more connect to the science would be my goal. You know if I were to do it again, I would have some sort of rubric that they had to document you know certain things or something.

Marcie: Right. Okay. So, did you observe any students emerge as authorities on digital storytelling or the concepts, the concepts in science or anything as they were going through it?

Lori: Um, not in the science concepts, but some of the students really, cuz they really knew how to use the iPads where other students didn't and so they were really able to lead in that regard, so.

Marcie: K. So, what are some of your overall thoughts of the digital story activity? Just the activity itself since we already talked about the curriculum, but that specific activity.

Lori: So, the activity of what they did at the lake and then creating the digital stories?

Marcie: Yeah, just not the whole curriculum that included the lake and the storyboarding and stuff, but just the digital storytelling. I know that you had briefly mentioned in the previous one that you saw other places that you could maybe use that activity.

Lori: I would really like to be able to use that for um, I wrote a proposal a while back but I didn't get it, for social studies. I think you could use, do some really cool things for that with the social studies curriculum – having iPads and you know acting out points in history and making little movies. I think that would increase the engagement in social studies a lot, so. There's a lot of applications here, it could really get their interests.

Marcie: Okay. And then the last question has two parts to it, do you have any final thoughts on the digital story activity? Or, the curriculum and especially specific to, not specific to, but in addition to general thoughts and how it worked in connecting them to that place, to the park, and the area they live in?

Lori: I guess time will tell on that one. You know it's kind of hard to say how they're connected to their place at this moment. But you know I think that having the pictures and the experience has definitely made it more, like something more they would think about then just like some of the kids, I don't think they had even been down there before, so.

Marcie: Okay. Great...

Teacher Post-test Interview – Kim [Hudson]

Marcie: What are some overall thoughts you have about the digital storytelling curriculum now that we have concluded the activity?

Kim: The kids really engaged with digital storytelling, as I thought they would be. I was dismayed that group work didn't go better. We had practiced that and done some of that. I was surprised some of the kids had never been to [location]. They really liked the water testing and all that.

Marcie: What are some of the highpoints?

Kim: Highlights – Some of the kids did a great job. One of the shy kids stands out in my mind. He used the vocabulary "macro-invertebrates". Some of the kids just wanted to put selfies up. Josiah and Breanne really took their time with the prep work [storyboards].

Marcie: Did you see student engagement changing as a result of digital storytelling curriculum activity? Did you see student feelings toward environmental science changing as a result of the digital story activity?

Kim: Somewhat, they were really engaged with the hands-on. In this day and age they're so hooked up to electronics that that does excite them.

Marcie: Have you observed any students emerging as authorities on environmental science? Digital storytelling? [Location]?

Kim: Yes, especially I liked that my kids went first with Jim and Marie. Then, going next to taking pictures. How they looked at it after being with him [Jim]. Yeah, Shane was stepping up and Josiah. With Jim some kids with prior knowledge from last years afterschool program

stepped up. A lot of the kids were interested in going off on their own to collect bugs – extend learning.

Marcie: What are some of your overall thoughts about the digital storytelling activity now that we have completed it? Do you have any final thoughts on the digital storytelling activity and/or curriculum? Connection to place?

Kim: I am trying to get iPads to piggyback on what you did or something else, cuz they were so engaged. That's what I took away from it.

APPENDIX G: STUDENT REFLECTION RUBRIC

Name: Teacher:

Group Presenting:

	1	2	3	Score
Visual Presentation	Poor colors and visual design choices. Few or no pictures and music included.	Some good colors and visual design choices. Some pictures and music included.	Excellent colors and visual design choices. Many pictures included along with music.	
Science Content	No science content was included from the activity done at Fireside Park.	Some science content included from the activity done at Fireside Park.	Lots of science content included from the activity done at Fireside Park.	
Place Meaning	No Place Meaning vocabulary or descriptions used.	Some Place Meaning vocabulary and descriptions used.	Lots of Place Meaning vocabulary and descriptions used.	
			Total	
Student Reflections:				