Culturally Sustaining Pedagogy in a Science Classroom:

The Phenomenology of the Pit House

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Authorization to Submit Dissertation

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Abstract

American Indian students often experience dissonance between their own worldview and Western Modern Science (WMS). This tension between their cultural understanding of how the world works and what is taught in the classroom can create barriers to learning. Institutionalized racism and historic education policies and practices designed to assimilate American Indian students have contributed to the marginalization of American Indian students in traditional classrooms. This phenomenological study examined the affordances offered in a science classroom, when a culturally sustaining pedagogy (CSP) was used to teach physical science, biology and environmental science concepts. CSP is a framework for instruction that creates an environment where trust is established and student worldviews are honored enabling teachers and students to examine the role of race and social inequity in the learning process. This study provides an overview of a curriculum that teaches WMS concepts using CSP with a pit house (subterranean earth lodge) as the focal point for learning. The study examines the lived experiences of six purposefully selected American Indian high school students, discussing the practical and theoretical implications for CSP through the lens of Critical Race Theory (CRT) and Tribal Critical Theory (TribalCrit). Methods used in this study included interviews, sacred mapping, journaling and sharing circles. The study gives voice to the student experiences as well as shedding light on the role of the teacher (author of the study) as a facilitator for creating a culturally sustaining learning environment. Several themes emerged from the interviews including connection to community and family, the politics of identity and racism in school, and agency/self-efficacy in science. The results of this study indicate that CSP is a useful tool for creating a space for learning where student identity and cultural expression are valued. The conclusion discusses

the practical and theoretical significance of the study particularly regarding teacher behaviors and interconnections between race, racism, identity and sense of efficacy in science. In addition, the study provides implications for other classrooms or communities wanting to develop culturally sustaining curriculum.

Key words: culturally sustaining pedagogy (CSP), critical race theory (CRT), critical tribal theory (TribalCrit), American Indian education, science education

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Dedication

This dissertation is dedicated to my former students and their families as well as the Tribe for their trust in my telling their stories and their inspiring vision for a better educational future. It is my sincere hope that they will continue to regain control over the education of their children and will be able to create a learning environment that fosters culturally sustaining learning and reflects their tribal identity and knowledge.

It is also dedicated to my children, for whom I strive to make the world a better place.

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Chapter 1

Rationale

In today's efforts to attain social and cultural equity, creating an environment for culturally sustained learning to take place is essential for schools. All aspects of the educational system contribute to the success or hindrance of students. Institutional racism and colonial practices inherent in the education model used in the United States create barriers for students of color (DeCuir & Dixson, 2004). The science classroom is often a place where cultural differences and contrasting worldviews create an environment hostile for learning. American Indian students in science education often experience this discord, where Western modern science (WMS) tends to be in conflict with their cultural worldviews (Aikenhead, 2001). Culturally Sustaining Pedagogy (CSP) developed by Paris (2012), provides a framework for 1) developing curriculum that is relevant to the students' cultural values, 2) helping student become competent in engaging in the dominant culture, and 3) critiquing the educational experience and examining social inequities such as racism and colonization that break down barriers to learning.

The National Research Council (NRC) published "*A Framework for K-12 Science Education*" in 2013, summarizes effective teaching strategies for students from major racial and ethnic groups (i.e. African Americans, Latinos and Asian Americans) and provides guidelines for addressing equity in the science classroom. The NRC (2013) includes vignettes and specific strategies for reaching underrepresented populations. According to the NRC, best practices fall into the following categories:

1) culturally relevant pedagogy,

2) community involvement and social activism,

3) multiple representation and multimodal experiences, and

4) school support systems including role models and mentors of similar racial or ethnic backgrounds (NRC, 2013; p. 7).

CSP reflects the recommendations of the NRC. Unfortunately, the NRC report is vague and does not provide specific examples of how to implement CSP in classrooms serving American Indian students. There is a need for research on culturally sustaining science education for American Indians students, especially in the context of national education reform and tribal sovereignty. CSP builds on the work of Ladson-Billings (1995) and others to create a framework for designing learning opportunities that honor and sustain traditionally marginalized cultures. In addition, CSP engages the student and the instructor in a dialogue about oppression, colonization and injustice (Paris, 2012).

Tribal sovereignty is not simply about maintaining culture. It is about understanding culture as a "living context and foundation for the exercise of group autonomy and the survival of Indian nations" (Coffey & Tsosie, 2001, p. 191). Federally recognized tribes have jurisdictional control over the management of natural resources on Tribal lands. Stewardship of the land is not simply paramount for economic sustainability, but for cultural sustainability, as well. According to Whitt (2009), tribal sovereignty or self-determination must be distinguished from a Western view of state sovereignty. "Traditional Indigenous forms of governance hold themselves accountable above all for protecting the land and resources which constitute them as distinct people" (Whitt, 2009, p. 202). This worldview is often counter to the non-Indian science experts' perceptions, creating tension and conflict when tribes need to rely on non-Indians for help. Tribal dependence on non-Indian expertise "is often frustrating and clouded in the mystique of Western science and technology, offers

solutions based on ‘exact’ scientific knowledge that often hides political assumptions and agendas” (Berardi et al., 2002, p. 49).

The United States education system and public schools operate within an assimilationist model, which attempts to make all students the same, fashioned after the behavioral and cultural norms of the dominant culture (Hornesy & Hogg, 2000). This model reinforces Western culture’s hegemonic control over what have historically been deemed less desirable minority groups including American Indians (Deloria & Wildcat, 2001). Many minority students struggle to fully engage and prosper in traditional academic settings because they are less competent in the dominant culture and their own cultural wealth is undervalued (Yosso, 2005). Reforming science curriculum to be more culturally sustaining is an avenue to consider for more fully representing non-dominant cultures in WMS conversations. This study contributes to an increasing knowledge base regarding the importance of CSP and American Indian education. CSP creates an environment for students to develop competencies in their own linguistic and cultural heritage while gaining access to dominant culture competence (Paris, 2012).

Most of the contemporary research on cultural capital draws upon the work of Pierre Bourdieu (1974). He stated that education is one of “the most effective means of perpetuating the existing social pattern, as it both provides an apparent justification for social inequalities and gives recognition to the cultural heritage, that is, to a social gift treated as a natural one” (Bourdieu, 1974, p. 32). This phenomenological study examines how a science curriculum utilizing CSP influenced student motivation to learn science as well as create a context for students to connect their learning to community, family, and tribe.

Background of American Indian Education

Great strains on Indigenous culture and language came about after decades of assimilationist education policies, systematic removal of American Indian people from their ancestral land, removal of their children to boarding schools, and the subsequent development and degradation of that land (Dehyle & Swisher, 1997; Rehyner & Eder, 2004). Researchers suggest that lower academic achievement among American Indian youth is not a result of some form of intellectual deficit, instead, Indigenous epistemologies and cultures are so different from the Western modes of education that Indigenous students have a difficult time learning under the dominant culture (Dehyle & Swisher, 1997; McCarty, 1998). Both the historical marginalization of Native culture in schools and the persistent policies of assimilation work to seriously disrupt and create negative views about school for American Indian youth (Ladson-Billings, 2001).

Historically, education policy in the United States was driven by a desire to assimilate American Indians into the dominant culture and resulted in the near extinction of the American Indian's extremely diverse cultural, linguistic and spiritual bodies of knowledge (Reyhner & Eder, 2004). According to McCarty (1998), the US government assumed primary responsibility for the assimilation of American Indians by the late 1880s. Schools became "the battleground for the 'civilization' and the extermination of Indigenous languages, cultures and ethnic identities" (p. 29). Federal policy was guided by an ideology of racial superiority and planned cultural transformation. During the 1960s and 1970s, federal legislation authorized and funded Indigenous teacher preparation and the development of Native language and culturally relevant teaching materials (Spring, 1996). In addition, Tribes

were finally granted local control of the education of their children (Public Law 93-638, 1975).

According to Berardi et al. (2002), there was an increasing number of American Indian youth who want to go to college as a result of learning about tribal issues, particularly in fields of resource management. However, the absence of a culturally sustaining instruction creates a hazardous learning environment for American Indian students who are expected to bridge cultural borders that are often in conflict with one another (Jegede & Aikenhead, 1999). There is an increasing desire among American Indian youth to attend college and to study science, yet very few colleges or universities offer degree programs that align with the histories, values, and philosophies of tribal communities, for examples a program that could combine practical applications such as engineering with cultural context (Berardi et. al. 2002).

Even fewer primary and secondary schools offer curriculum that use CSP. Reforming education for American Indian students is complicated by the politics of identity, sovereignty rights, national and state policies that reinforce colonial practices. There is also the complexity of the fact that over 90% of native students are served in schools outside of the reservations (DeVoe & Darling-Churchill, 2008). In addition, only 16% of teachers working in schools that serve a large population of Native students are enrolled tribal members themselves (Manuelito, 2003). All educators, particularly non-Indian teachers, must play a central role in developing CSP that alleviates the inequities created by racism, poverty, and decades of colonial practices that privilege Western culture and silence Indigenous voices in education.

Statement of the Problem

American Indian students often experience "cultural violence" (Jegede & Aikenhead, 1999) when participating in traditional science education courses. They encounter two dissonant worldviews: they must grapple with own belief systems and a worldview that is informed by the dominant culture. These students must cross cultural borders to make sense of a WMS they are presented in school with their own Indigenous cultural and linguistic identities. Privileging Indigenous culture is central to supporting their tribal sovereignty. Cultural border crossing for American Indian students are accomplished by incorporating traditional language into the school curriculum, either through specific course offerings or inclusion in other classes. Additionally, tribal communities are pushing for the integration of culture and Traditional Ecological Knowledge (TEK) into the learning process (Snively & Corsiglia, 2001). Unfortunately, culturally responsive curricula tend to follow an agenda of acculturating students into WMS rather than sustaining opposing worldviews (Pomeroy, 1994).

Indigenous students often reject WMS, choosing to hold onto their Indigenous worldviews, becoming more alienated from WMS (Aikenhead, 2001). In addition, research that supports CSP is often ignored among non-Indian researchers and many policymakers (Demmert, 2001). This practice of marginalization and silencing can be understood through analysis applying Critical Race Theory (CRT) and Tribal Critical Theory (TribalCrit). Scholars such as Gloria Ladson-Billings (2001) and Tara Yosso (2005) challenge marginalization by asking educators to consider whose knowledge counts and whose knowledge is discounted. Racism shapes this epistemological debate and CRT critiques the idea that the outsider's transgressive knowledge (or counter to the norm) is less valuable than

the dominant culture's (Yosso, 2005). Brian Brayboy (2005) offers TribalCrit as a nuanced critical lens specifically designed for research in Indigenous communities. TribalCrit addresses the unique status of American Indians as political/sovereign peoples as well as racialized peoples. According to Brayboy (2005), TribalCrit includes a critique of colonial structures and policies that work to privilege dominant culture, silencing and invalidating Indigenous worldviews.

CRT and TribalCrit question why the dominant cultural norms are privileged over the norms of non-dominant cultures. In the context of examining science education, CRT is invaluable because the act of conducting science is a cultural enterprise that typically privileges WMS and positivist perspectives over the scientific processes of minority cultures.

Purpose Statement

This phenomenological study, occurring on an Indian Reservation in the Pacific Northwestern United States, used qualitative methods to interpret the lived experiences of six students and their teacher (the researcher). The results of this study are significant both practically speaking and from a theoretical perspective. The study adds to the limited published information about race, politics of identity and education in the United States. In addition, the results highlight effective ways to design and deliver curriculum in schools with significant populations of American Indian students. The results may also be beneficial to other populations who find themselves in conflict with the dominant cultural paradigm in their education systems.

The Context of the Study

This phenomenological study explores the lived experiences of American Indian students and me, the researcher, after participating in the construction of a historically and

culturally significant Pit House on the school campus. Pit Houses are domed houses with sod roofs, built into the ground to provide added insulation against the heat of summer and cold of winter. In 2008, the Little Falls School District (pseudonym) and the Culture and Language Department of the Tshimikan Tribe of Indians (pseudonym) began planning the construction of a Pit House on campus. This marked the first time the Tribe had built a Pit House on the reservation in over 200 years. During that time, I was hired as the science teacher at the only high school on the reservation. I began attending meetings hosted by the Culture and Language Department and asked how I could help them with the project. The elders asked me to create curricular opportunities for the students to learn about their culture while learning science.

This study examined how the application of CSP in the development of the Pit House curriculum impacted the lives of students and the researcher involved in the project. In a climate of standardized tests with Smarter Balanced Assessments, Common Core and the Next Generation Science Standards, decisions about instruction in the classroom do not always reflect the best interests of students or the needs of the community. Due to more than a century of destructive educational policies, many American Indians are distrustful of the educational system. For example, the historical trauma of boarding schools has been shown to have intergenerational impacts (Evans-Campbell, 2008; Bombay, Matheson, Anisman, 2014). Student voices are silenced as research and evaluation in education tends to emphasize quantitative data and achievement numbers, under the guise of "scientifically based research" (Howe, 2004).

The stories in this study provide a vivid retelling of a learning experience that included a culturally sustaining context for learning where the American Indian voice is

heard. The community requested a school curriculum rich in culture and history; that fostered healing and trust building between the two worldviews. The curriculum developed in this study bridged WMS with the Indigenous knowledge of the Tribe.

Research Questions

The student participants, the community, and the society in which they live are interconnected and interrelated (von Bertalanffy, 1968). Science education and the wider educational system in the U. S. are both cultural/political endeavors that reflect the worldviews of the dominant culture. Institutional racism creates a system in which the ideas, cultural norms and values of American Indian students are typically suppressed or ignored. The main question of this study is: What are the affordances of a culturally sustaining pedagogical science curriculum for American Indian students understanding of science, technology, engineering, and mathematics (STEM) content, culture, self, identity, and their future? "Educational affordances are those characteristics of an artifact (e.g. how a chosen educational paradigm is implemented) that determine if and how a particular learning behavior could possibly be enacted within a given context. Educational affordances can be defined as the relationships between the properties of an educational intervention and the characteristics of the learner" (Kirschner 2002, p.14). Educational affordances are a combination of the perceived affordances (effective instructional strategies the support learning eg. Pit House curriculum), the constraints that interfere with this process (institutional racism, teacher student relationship, poor implementation of curriculum) and the conventions regarding how the affordances are perceived and acted upon (cultural, social context that influence student and teacher behavior).

There are several sub-questions in this study that seek to uncover the relationship between the perceived affordances, constraints and conventions that shaped the learning experience:

1) In what ways did the science lessons afford a "safe space" for student learning and dialogue?
2) What are the students' perceptions about the integration of culture and STEM, and their ability to do STEM that is integrated with culture?
3) What are the lived experiences of students regarding social inequity in school and life (i.e. experiences with racism, incongruent learning experiences, sense of agency or empowerment)?

This study explores how the participants (students and teacher) perceived their involvement in the Pit House project, particularly within a cultural context. In addition, the study examines other life experiences of the students outside of the science classroom. Phenomenological research explores the perceived reality of a shared phenomenon. It is about understanding the nature of a lived experience. For an educator, the questions at the center of my vocation and personal life concern the meaning of pedagogy and its impact on the learner. My students were able to explicitly answer these questions, becoming my teachers. Who better to identify possible discrepancies between what I professed to do and what happened in the classroom? The answers to these questions are nuanced with rich descriptions of our lived experiences during the Pit House project and after.

Assumptions

I am the descendent of Scandinavian and German immigrants who were loggers, farmers, and ranchers. My great grandparents settled in the Pacific Northwest and I am the

third generation born there. I am from families who benefited from the displacement of Indigenous people. Our presence in that place irrevocably changed the lives of generations of people. Our interconnected lives are complicated and tainted with historic trauma, colonization, deceit, and silencing as well as glimmers of hope, reconciliation, reparation, and healing.

The participants in this study know me well. In addition to acting as principal researcher, I was their science teacher, colleague, friend, and collaborative partner in the development of the Pit House curriculum. The students and I had a great rapport in the classroom and continued to stay in touch, even after I moved away from the community. I was particularly attentive to my role as a member of the dominant culture myself and someone who directly benefited from colonial policies and practices that continue to undermine the Tribal sovereignty of American Indians. I do not claim to be an expert regarding the history, culture, or Indigenous knowledge of this tribe. I am a professional educator and firmly believe in advocating for best practices in education. As a person of Western European decent, I am ethically bound to use my privileged voice to bring injustices in education to the forefront; particularly if the audience is also privileged.

In an effort to be completely transparent there is no denying my personal gain from this endeavor. Even amidst the complications of roles and voice in this study, the curriculum and the phenomenology of the Pit House are worthy of scholarly research. The alienation of Indigenous students in the science classroom perpetuates inequities in education. The inclusion of culture and language are significant factors in developing educational models that work for American Indian youth (Benham & Cooper, 2000) including science education (Jegede & Aikenhead, 1999).

Summary of Following Chapters

Chapter 2 provides a review of the literature surrounding American Indian education, science education, and CSP. The literature review is broken up into the following sections: 1) introduction; 2) an overview of the history of American Indian education and subsequent reforms including current understanding of recommended practices for science education with American Indian students; 3) the role of CRT and TribalCrit as a lens for analyzing and interpreting the content of this study; and 4) a detailed description of CSP and its potential for facilitating cultural border crossing in education.

Chapter 3 provides a rationale for the use of phenomenological methodologies and the appropriateness of this methodology in relation to my role as a non-Indian conducting research in an Indigenous community. This chapter includes a description of the qualitative methods that were used to conduct this study. The context for the study is also included in this chapter with an overview of the curriculum and detailed information about the participants involved.

Chapter 4 tells a story about the Pit House project and the curriculum that was developed. This chapter provides an overview of the science curriculum's alignment with state standards as well as a description of the activities.

Chapter 5 provides an overview and analysis of the findings from the study. The Pit House is used as a framework to understand these themes and how they are interconnected. The student experiences are examined within three major themes; agency and student sense of success, politics of identity particularly related to race and cultural expression, and family/community connections.

Chapter 6 begins with a summary of the findings discussed in Chapter 5. The chapter highlights the practical and theoretical contributions of this study and goes on to highlight implications for educators and other stakeholders in the education system, recommendations for future research, limitations and concluding remarks.

Definitions

***American Indian/Alaska Native*:** people having origins in any of the original peoples of North and South America (including Central America) and who maintain tribal affiliation or community attachment (US Census 2010).

***Assimilationist*:** to advocate or support institutions, policies, and behaviors that forces certain racial or cultural groups to become part of the dominant culture.

***Colonization*:** the practice of domination, which involves the subjugation of one people to another (Kohn, 2012).

***Critical pedagogy of place*:** aims to "(a) identify, recover, and create material spaces and places that teach us how to live well in our total environments (re-inhabitation); and (b) identify and change ways of thinking that injure and exploit other people and places (decolonization)" (Gruenwald, 2003).

***Culture*:** the norms, values, beliefs, expectations and conventional actions of a group (Phelan, Davidson, & Cao, 1991).

***Culturally sustaining pedagogy*:** instructional methods that "seek to perpetuate and foster, to sustain, linguistic, literate and cultural pluralism as part of the democratic project of schooling (Paris, 2012).

***Culturally relevant pedagogy*:** instructional methods that produce students who can achieve academically, demonstrate cultural competence and can understand and critique the existing social order (Ladson-Billings, 1995b).

***Hegemony*:** In the context of this study, hegemony refers to the domination of a culturally diverse society by one particular ruling class. The beliefs, values, and world view of that dominant culture are used in the systematic control and destruction of divergent or minority groups.

***Historic Trauma*:** is the cumulative emotional and psychological wounding over the lifespan and across generations, emanating from massive group trauma (Brave Heart, MYH, 2000).

***Indigenous*:** relating to a group of people that are directly linked to a particular place through their Creation beliefs, culture and history, people subjected to the colonization of their lands and cultures, and the denial of their sovereignty (Smith, 1999). Within the context of this dissertation, Indigenous is also synonymous with American Indian or Native American.

***Indigenous Knowledge*:** embodies a web of relationships within an ecological context including language, epistemologies, relationships, and customs. This body of knowledge is

inherently tied to the land and the ceremonies, stories, medicines and transfer of knowledge connected to that place (Battiste, 2002).

***Identity*:** is defined by membership rules and characteristic attributes or expected behaviors. As a socially distinguishing feature a person may take pride in or view their identity as unchangeable and consequential (Fearon, 1999). In the context of Indigenous politics, identity also relates to self-determination, sovereignty and the privileging of Indigenous knowledge.

***Oppression*:** occurs "when individuals are systematically subjected to political, economic, cultural, or social degradation. Results from structures of domination and subordination and, correspondingly, ideologies of superiority and inferiority" (Charleton, 1998).

***Phenomenology*:** the science of describing, "what one perceives, senses, and knows in one's immediate awareness and experience" (Moustakas, 1994).

***Pit House*:** winter dwelling of Columbia Plateau tribes. A Pit House is typically round in structure with a domed, earthen roof built over a subterranean structure.

Post-colonialism: the political and theoretical struggles of societies that experienced the transition from political dependence to sovereignty (Kohn, 2012)

***Race/Racism*:** a social construct used to classify people by the color of their skin as a means of oppression. "A system of ignorance, exploitation, and power used to oppress African-

Americans, Latinos, Asians, Pacific Americans, American Indians and other people on the basis of ethnicity, culture, mannerisms and color" (Marable, 1992, p. 5)

***Traditional Ecological Knowledge*:** experience and observations gathered over thousands of years as a result of human interaction with the environment. TEK is unique to bio-geographic regions and the people who live within them. It tends to be holistic, viewing the world as an interconnected whole (Snively & Corsiglia, 2001).

***Western Modern Science*:** a system of conceptual constructs "approved by logical empiricism (positivism); includes sanctioned knowledge derived through a rational perceiving of reality" (Ogawa, 1995).

Chapter 2

Literature Review

This chapter begins with an overview of the history of American Indian education in the U.S., educational reforms and recent academic achievement benchmarks, and a discussion about the influence of racism and colonialism in the education system. In response to the endemic and pernicious presence of racism and colonialism, the chapter provides an overview of CRT and TribalCrit and how these theories create a framework for researching inequities in the U.S. education system. This is followed by a discussion about several pedagogical theories or models including multicultural education (MCE), culturally responsive pedagogy (CRP), and the evolution of CSP. One of the essential tenets of CRT and TribalCrit is social change. This chapter concludes with a discussion of preferred practices for curriculum design and teaching of American Indian students.

Each student within a classroom brings their own unique cultural background and set of worldviews to a classroom setting. American Indian worldviews are often in conflict with WMS. It is important for educators to understand and appreciate these differences (Allen & Crawley, 1996; Warren, 2006). When the worldviews of American Indian students conflict with what is taught in the classroom, students become disenfranchised from their educational experience. American Indian students often experience a disconnect in the science classroom, when teachers and the curriculum fail to create cultural border crossing that allow students to create schema for WMS even when the ideas conflict with their own Indigenous world views. Chronically institutionalized racism, policies, and practices that support colonization creates barriers that diminish American Indian students' ability to successfully bridge those cultural border crossing with WMS.

Porter (2005) defines colonization as "the process by which a people exploit and/or annex the lands and resources of another without their consent and unilaterally expand political power over them" (p. 108). In the U.S. during the early late 1800s and early 1900s, Indigenous peoples were viewed as obstacles to civilization and progress. One manifestation of colonization was the assertion of cultural imperialism, laying the foundation for assimilation and cultural genocide (Haynes-Writer, 2008). Legters (1988) outlines the consequences of cultural genocide which include:

> Coerced abandonment of religious and cultural underpinnings of the subject society, preemption or destruction of resources necessary to native survival…transmittal of disease and addiction against which native populations have inadequate immunity, disruption of kinship and familial relations basic to the native social structure, treatment based on modes of definition that obliterate a group's identity, and finally, outright extermination of native populations (p. 771-772).

Young (2000) explains that experiencing cultural imperialism is to "experience how the dominant meanings of a society render the particular perspective of one's own group invisible at the same time as they stereotype one's group and mark it as other" (p. 44). The dominant group's experience is elevated, sanctioned, and universalized. Michael Yellow Bird (2005) speaks to the colonization manifested within our educational institutions:

> The U.S. educational system has been one of the most hostile and oppressive aspects of colonialism…Colonized-based educational systems contributed significantly to the destruction of cultural knowledge, and the imposition of the belief that Indigenous Peoples and their knowledge and ideas were-and remain-less than those of mainstream peoples (p. 16).

Historical Overview of American Indian Education

According to Noel (2002), any discussion about American Indian education must start with a historical overview of the policies and practices that systematically forced American Indians to assimilate or perish. The main agenda of missionary and federally run schools was to "eliminate the children's sense of Indian identity, their memory of their religion, language and the sense of community" (Noel, 2002, p. 29). American Indians were displaced from their homelands and fashioned into farmers of small acreages as a means to divest them of larger territories. Their native languages, representing their worlds, complex knowledge, and spiritual centers were stripped away and replaced with English language, applied as a tool for oppression, silencing, and assimilation (Adams, 1995; Spack, 2002).

Nearly 200 years ago, Congress passed the Indian Civilization Act, which authorized funding to support Christian missionary schools. The Christian missionary schools were financed through the Civilization Fund, which Congress enacted in 1819. The missionary schools banned Indigenous cultural traditions, especially spiritual ones, while forcefully promoting Christian conversion (Kelly, 1999; Noel, 2002; Stokes, 1997). These schools continued to be supported by the federal government until the late 19th Century, when the Indian Office developed and expanded a system of day and boarding schools.

The Carlisle Indian Industrial School in Carlisle, Pennsylvania, was the first such school, opening its doors in 1879. According to the school's founder, Army Capt. Richard Henry Pratt, the primary goal of the school was to "kill the Indian in him, and save the man" (Reyhner, 2006). The boarding schools were used as a means to separate children from the influence of their parents and to facilitate the assimilation of these children into white culture (Stokes, 1997). Students in these schools were expected to think, dress, speak and work like

white Americans. Any students caught speaking in their Native language or practicing their faith was punished (Allen, 1999; Stokes, 1997). These oppressive practices were implemented in an attempt to remove the child's sense of Indian identity (Noel, 2002). Children in these schools were mentally, physically, and sexually abused (Haynes-Writer, 2008).

Boarding schools were an instrument of federal policy guided by an ideology of racial superiority and planned cultural transformation (Spring, 1996). These policies diminished somewhat in the 1930s. Franklin D. Roosevelt and Commissioner of Indian Affairs, John Collier, instituted reforms that established community based day schools, promoted recruitment of Indigenous teachers, and supported bilingual programs (Spolsky, 1974; Medicine, 1982). However, reports of abuse and displacement of children from families continued well into the 1960s. In addition, throughout the history of boarding schools, there have been stories of Indian resistance and student agency, which will be discussed later in this chapter.

A Local Context

In the Pacific Northwest, treaties negotiated between the federal government and with the tribes in the 1850s that promised educational support. In eastern Washington, federally run boarding schools were established at Fort Spokane on the confluence of the Spokane and Columbia Rivers and at Fort Simcoe near present day Yakima, Washington. Prior to that, missionary schools were set up throughout the state. King (2008) interviewed survivors and their family members, examining the legacy of historic trauma in American Indian communities, in Washington State. Survivors described being beaten for bed wetting, being sexually abused, and assaulted for speaking their native language. Many children tried to run

away, and an unknown number died. “With little communication from home and heavy indoctrination at boarding schools, many children felt alienated, abandoned and not sure whether to identify with the white or Indian world” (King, 2008, p. 5).

Forceful removal from family, home, and community created a generational rift. Children lost their language; their spiritual identity and their connection to loved ones. Without parents or grandparents as mentors, many of these children grew up to parent their own children based on the same disciplinary models they learned in the boarding schools. “Spiritually and emotionally, these children were bereft of culturally integrated behaviors that led to positive self-esteem, a sense of belonging to family and community and a solid American Indian identity” (Brave Heart & DeBruyn, 1998).

American Indian Educational Reforms

For most of the 20th Century, American Indian education was defined by policies set forth by the US Department of Interior in 1902. The Indian Affairs Commissioner reported that:

> Indian reservations were the outgrowth of the policy of the Government in dealing with wild bands of marauding savages who in the early portion of the last century roamed over large sections of the United States. It was a matter of segregating and confining them upon limited areas, where they could either be under definite surveillance or exterminated as a race (Department of the Interior, 1902, p. 9-12, as cited in Noel, 2002, p. 20).

In 1930, the Commissioner of Indian Affairs set out to reform American Indian education with the ultimate goal of closing boarding schools (Bloom, 1996). This was in response to the landmark Meriam Report (1928) that presented a severe critique of the Office

of Indian Affairs and the state of American Indian education in the U.S. The recommendations in the report were unprecedented at the time (Lomawaima & McCarty, 2002), proposing that American Indian people should have the power to make their own choices and the federal government should support those choices:

> The position taken, therefore, is that the work with and for the Indians must give consideration to the desires of the individual Indians. He who wishes to merge into the social and economic life of the prevailing civilization of this country should be given all practicable aid and advice in making the necessary adjustments. He who wants to remain an Indian and live according to his old culture should be aided in doing so (Meriam, 1928, p. 88).

In the 1940s, the Bureau of Indian Affairs (BIA) worked with Native language speakers and illustrators to create reading resources for American Indian students. These booklets were in Native languages and English. They sometimes celebrated Indigenous culture and the idea of self-determination and other times promoted the federal agenda at that time (Lomawaima & McCarty, 2002). The 1960s brought a groundswell of political and cultural activism that continued into the 1970s, bringing about significant changes in federal policy regarding American Indian sovereignty and education. The 1964 Economic Opportunity Act supported Head Start, Upward Bound, and Volunteers in Service to America (VISTA) and Indian Community Action Programs. The first American Indian controlled school was founded in 1966, in the Navajo community of Rough Rock, Arizona. The mission of the school included community development initiatives and bilingual/bicultural education was a central tenet of the curriculum (Lomawaima & McCarty, 2002).

In 1972, Congress passed the Indian Education Act as an amendment to the Elementary and Secondary Act. This law marked the first federal legislation to support Indigenous bilingual/bicultural curriculum development, teacher preparation, and parent and community involvement (Lomawaima & McCarty, 2002). The 1975 Indian Self-Determination and Education Assistance Act, along with the Bilingual Education Act of 1968, formalized procedures for tribes to establish and run their own educational programs (McCarty, 1997).

By 1978, there were 34 American Indian controlled schools in the U.S (Spolsky, 1974). American Indian students were gaining access to colleges and universities and evidence from research indicated that children in bilingual/bicultural programs were improving academically, at a much higher rate than children in conventional English only schools (Rosier & Farella, 1976). Despite the academic success these schools were seeing, they were mired in bureaucratic complications and conflict.

Unlike public school districts, which are financed almost exclusively through property taxes and state allocations for basic education, reservation schools are dependent upon often inadequate and unpredictable funding from the Federal Government. The community controlled tribal schools are forced to cobble together educational programs that are supported by disparate and often conflicting federal grants:

> No other U.S. school system functions under such a cloud of uncertainty. No other U.S. school system must invest the prodigious time and energy that this chaos requires. The pernicious results are that funding is neither permanent nor adequate and that Indigenous students are all but guaranteed an inferior education…forced to ride a roller coaster of policy shifts and rule changes; these schools have operated

> under conditions of constant financial, curricular and staff instability (Lomawaima & McCarty, 2002, p. 294).

Under this system, tribes are forced to compete with one another and among their own programs for resources. This patchwork of funding and complicated conditions exemplifies institutionalized racism (McCarty, 2002).

Reforms in the late 1980s stabilized funding from the federal government in a guaranteed lump sum based on student population size. However, schools seeking this funding were abruptly required to meet standards determined by national, regional or state accrediting agencies rather than local school boards. Tribal schools were caught up in the accountability and high stakes testing movement. The reauthorization of the ESEA in 2001 or the No Child Left Behind Act (NCLB) signified a nationwide push for standardization in assessment, firmly positioned education as a science, and wrangled control of education away from local communities. One of the key flaws of the NCLB is that the students most hurt by mandated testing are the very students the law hoped not to leave behind (Bracey, 2008; Lee, 2004).

Beaulieu, Sparks and Alonzo (2005) provide a preliminary summary of the impact of NCLB on American Indian schools and students. Testimony gathered from communities throughout the U.S. voice concern about loss of community control, increased emphasis on testing at the expense of culture, language, art, and music programs, students losing motivation, and a general sense of demoralization among American Indian students, parents, and teachers. Starnes (2006), an American Indian educator, reported:

> NCLB implementation is not only ineffective; it is detrimental to them [American Indian students]. It threatens academic achievement, guts, effective culturally based

> programs, and further alienates children and communities…If NCLB is fully implemented, it will leave Indian students further behind…there is a definite mismatch between NCLB and what works for Native students (p. 388).

Four years ago, in 2010, the U.S. Department of Education consulted with tribal leaders and American Indian educators across the county. In the context of National education reform, one would expect that this consultation was being done on a regular basis to inform policy. However, 2010 marked the first year in the history of the U.S. Department of Education for this type of consultation to occur (U.S. Department of Education, 2011). Tribal leaders and educators testified that American Indian students continue to face "a number of significant challenges, including lack of access to culturally appropriate curricula, educators without sufficient cultural training and poor learning conditions" (p. 9). Their testimony is an indictment of the status quo in our education system and is evidence of the legacy of racist and colonial policies and practices that are supported and perpetuated in schools across the United States.

Deficit approaches to teaching view the languages, cultural traditions, and worldviews of students of color as deficiencies to be overcome in order to academically achieve in schools. These deficit approaches normalize the language and worldview of the dominant culture (Lee, 2007; Paris & Ball, 2008). The goal of deficit approaches "was to eradicate the linguistic, literate and cultural practices many students of color brought from their homes and communities and to replace them with what were viewed as superior practices" (Paris, 2012, p. 93).

Individual and Societal Racism

According to Young and Laible (2000), individual racism, is “conscious behavior by the person of one race that causes harm to a person of another race based on her/his race” (p. 5). They go on to say that this behavior includes action and inaction. Often, racist policies and cultural perceptions are devised without the intention of causing harm to people of color (Barndt, 1991; Delpit, 1995; Hacker, 1995). Many schools continue to reinforce the status of the dominant culture and utilize Euro-American instructional techniques including the use of curriculum that are not representative or equitable for students of color (Donaldson, 1996; Fine, Weiss, Powell, & Wong, 1997; Ladson-Billings, 1994; Nieto, 1996). This even happens in states and schools with policies guaranteeing equal educational opportunity for all children (Young & Moore, 1999). In addition, these schools fail to teach students of color the rules of the dominant race, or the "the culture of power" (Delpit, 1995, p. 25). Societal racism influences White educators’ personal and professional practice (Young and Laible, 2000). Societal racism can be defined by the societal or cultural assumptions, norms, mores, and expectations that favor one race over one or more other races (Adams, Bell, & Griffin, 1997).

Local Policy and Reform

Among members of American Indian communities, traditional culture and language are highly valued in education but are rarely included in state-mandated directives for educators. Indigenous perspectives and ways of learning, counter to Western perspectives, are marginalized in national and local debates about education and the United States’ role in the global economy (Sleeter, 2012; Hursh, 2007). Washington State’s Legislature and Governor recently signed legislation redefining what basic education means for Washington students. Central to the State’s definition is the idea that students should be able to

"understand the importance of work and finance and how performance, effort, and decisions directly affect future career and educational opportunities" (RCW 28A.150.210). Essentially, educational policy defines the role of public education as being a tool to support economic growth and global competition. This is in conflict with how American Indian communities define the role of education.

At the same time, the need for CSP in Washington State schools was acknowledged in the Centennial Accord of 1989 and the Millennial Accord of 1999 (RCW 28A.345 and 28A.320 [HB 1495]). The Washington State School Directors' Association and Washington State Tribal Leaders' Congress on Education (2012) recommend that the Legislature fully fund professional development and pre-service courses for teachers, curriculum development, and collaborative partnerships between tribes and schools.

Benchmarks in Education

Data from the National Assessment of Educational Progress (NAEP) and other indicators serve as a reminder that even after landmark policy changes in the last 50 years; we still have not arrived at education equality (Ladson-Billings, 2005). The 2009 NAEP study shows that American Indian students face achievement gaps as compared to the non-native peers. In the U.S. Department of Education report (2011), tribal leaders testified that these achievement outcomes "perpetuate cycles of limited economic opportunity, resulting in significant health, welfare and justice inequities in Indian Country" (p. 9).

Results from state exams in Washington mirror the NAEP data. The Office of the Superintendent of Public Instruction publishes district level and statewide data for exams (Office of Superintendent of Public Instruction, 2014). American Indian students score well below white students in all of the tested subject areas, with the greatest discrepancy occurring

in science. The average percentage score difference in reading over the last 15 years is 21.4% between American Indian and white students, 24.4% in math, 19.04 % in reading and 23.6% in science. In 2011, the State switched from a comprehensive science exam to End of Course exams. The first exam implemented was Biology in Grade 10. Overall, student performance improved with 77.1% of white students passing and 45.1% of American Indian students passing. A quick sorting of the data among other students of color shows a similar trend, with students of color scoring about 20 percentage points lower than their white counterparts.

Critical Race Theory and Tribal Critical Theory and Education

CRT emerged out of legal scholarship providing a critical analysis of race and racism in the justice system. CRT recognizes that race is a social construct created to justify the domination of one group of people over another. It also acknowledges that racism is still engrained in all aspects of American society. Institutional racism is endemic in the dominant culture, used as a tool to maintain a position of status and power. These power structures perpetuate the marginalization of people of color (Delgado, 1989). CRT also includes an activist dimension, fostering social justice and transformation as a result of deeper examination of issues of race (Delgado & Stefancic, 2001).

CRT allows for the "contestation, deconstruction, and reshaping of the master narrative by enlisting multiple perspectives and experiences as sources of valid knowledge that serve as catalysts for transformation" (Haynes Writer, 2008, p. 3). CRT scholars use "parables, chronicles, stories, counter-stories, poetry, fiction and revisionist histories These counter-stories provide crucial information to white people about what it is like to be nonwhite (Delgado & Stephanic, 2001, p. 39). Ladson-Billings and Tate (1995) were some of

the first researchers to use CRT as an analytical tool for understanding school inequity. Their critique of the U.S. education system was based on three central propositions:

1) Race continues to be a significant factor in determining inequity.

2) U.S. society is based on property rights.

3) The intersection of race and property creates an analytic tool through which we can understand social (and, consequently, school) inequity (p. 48.).

Indigenous scholars have used CRT to evaluate the effects of race, racism and power in their communities, and they used CRT as a mechanism for truth telling; speaking out about colonization and oppression (Write, 2008). A CRT lens provides a framework for critiquing the educational experience of American Indian students from a racialized perspective, but it fails to address the unique legal status of American Indians in the U.S. compared to other ethnic groups. Brian Brayboy (2005) introduced TribalCrit as a solution to examining the dual status of American Indians as "both legal/political and racialized beings" (p. 428) in the context of colonization. TribalCrit consists of nine tenets:

1) Colonization is endemic to society.

2) U.S. policies toward Indigenous Peoples are rooted in imperialism, White supremacy, and a desire for material gain.

3) Indigenous Peoples occupy a liminal space that accounts for both the political and racialized natures of our identities.

4) Indigenous Peoples have a desire to obtain and forge tribal sovereignty, tribal autonomy, self-determination, and self-identification.

5) The concepts of culture, knowledge, and power take on new meaning when examined through an Indigenous lens.

6) Governmental policies and educational policies toward Indigenous Peoples are intimately linked around the problematic goal of assimilation.

7) Tribal philosophies, beliefs, customs, traditions, and visions for the future are central to understanding the lived realities of Indigenous Peoples, but they also illustrate the differences and adaptability among individuals and groups.

8) Stories are not separate from theory; they makeup theory and are, therefore, real and legitimate sources of data and ways of being.

9) Theory and practice are connected in deep and explicit ways such that scholars must work towards social change (Brayboy, 2006, 429-430).

TribalCrit offers a more culturally nuanced analytical lens for examining the lives and experiences of Indigenous peoples. TribalCrit and CRT facilitate social justice and change as a result of speaking truth to colonization in larger social and structural contexts. “Since the truth about injustices perpetuated against Indigenous People has been largely denied in the United States, truth-telling becomes an important strategy for decolonization” (Wilson & Yellow Bird, 2005, p. 7).

Multicultural Education, Culturally Responsive Pedagogy, and Culturally Sustaining Pedagogy

Multicultural education emerged in the U.S. following the Civil Rights movement in the 1960s. Since that time, multicultural education has become an international movement, created to challenge and confront oppression and inequities established through individual, institutional and structural discrimination. However, many Critical Race theorists are critical of multicultural education because, as May (1999) states, “it promised much and delivered little” (p. 1) and because it was often presented and practiced superficially. Janine Pease-

Windy Boy (1995), addressed the superficiality of multicultural education inclusion stating "All too often, the mainstream educational instructions regard cultural diversity as a few learning units that are cosmetically brown or black in complexion or as a few festivals that celebrate the food, clothing or dance of minorities" (p. 399). Haynes-Writer (2008) proposes applying TribalCrit to MCE to reclaim the role of MCE in being a pedagogical model for social change. Hayes-Writer argues that critical pedagogy is a vital component of MCE. It "links knowledge of diversity and inequality with actions that can make the culture more socially just" (Oakes & Lipton, 2007, p. 100). Bell (1997) defines social justice as a:

> Vision of society in which the distribution of resources is equitable and all members are physically and psychologically safe and secure…in which individuals are both self-determining (able to develop their full capacities), and interdependent (capable of interacting democratically with others)...it involves social actors who have a sense of their own agency as well as a sense of social responsibility toward and with others and the society as a whole (p. 3).

As both process and goal, social justice advances a deconstruction of the manifestations of power and dynamics of oppression that exist as a result of colonization and racism.

Culturally relevant pedagogy

CRP emerged out of the work of Gloria Ladson-Billings (1995). She was one of the first scholars to propose the use of CRT in education research and subsequently proposed CRP as a means for addressing the racialized aspects of education in the U.S. She defines culturally relevant pedagogy as:

> A pedagogy of opposition not unlike critical pedagogy but specifically committed to collective, not merely individual, empowerment. Culturally relevant pedagogy rests

> on three criteria or propositions: (a) Students must experience academic success; (b) students must develop and/or maintain cultural competence, and (c) students must develop a critical consciousness through which they challenge the status quo of the current social order (Ladson-Billings, 1995a, p. 160).

These three tenets are accomplished through a variety of pedagogical strategies. For example, educators can draw upon issues and ideas that students find meaningful and then engage them in leadership roles, in class discussions and projects. Teachers can invite community members into the classroom as resident experts to teach particular skills (such as baking a pie or weaving a basket) and then design units of study that are interdisciplinary and centrally focused on the contribution provided by the resident expert. Additionally, the native languages and cultural traditions of students of color should be integrated into the curriculum so that students feel safe expressing themselves within their personal worldview. Teachers must also facilitate students developing a broader sociopolitical consciousness, creating a space for students to "critique the cultural norms, values, mores and institutions that produce and maintain social inequities" (Ladson-Billings, 1995a, p. 162). This process is what Paulo Friere (1970) called "conscientization", which invites learners to engage in the world and others critically.

Ladson-Billings (1995a) shares the story of several teachers who, in conjunction with their students, critiqued their out of date textbooks and the knowledge presented in the books. As part of their inquiry, they examined why some schools received funding for new books when others did not. They wrote letters to the editor of the local newspaper to promote awareness about the problem and the teachers provided counter narratives from alternative articles and papers to help the students develop multiple perspectives on a variety of issues.

Philosophical and ideological underpinnings of CRP practice

Ladson-Billings (1995a) discovered that the teaching strategies employed by the exemplary educators she studied were as divergent as the personalities of the teachers themselves. However, they shared common philosophical and ideological ideas about what it meant to be a teacher. They were proud of their vocation and saw their work as artistry, not a scientific task. They were active members of the communities where they taught and saw teaching as a form of service. They also believed that all students could and must succeed and that it was their responsibility as teachers to work with the students to guarantee that success.

Culturally sustaining pedagogy

CSP (CSP) builds on CRP in several ways. According to Django Paris (2012), terms such as "relevant" and "responsive" fall short in accurately describing the teaching and research founded upon them. In addition, he is concerned that too often curriculum labeled as relevant or responsive does not go far enough to authentically center the languages and cultural practices of communities marginalized by systemic inequalities. Nor do these curricula take that final step of engaging students in sociopolitical discourse and social justice work. CSP seeks to "perpetuate and foster—to sustain—linguistic, literate, and cultural pluralism as part of the democratic project of schooling" (p. 93). Paris (2012) explains that:

> Relevance and responsiveness do not guarantee in stance or meaning that one goal of an educational program is it maintain heritage ways and to value cultural and linguistic sharing across difference, to sustain and support bi-and multilingualism and bi- and multiculturalism (p. 95).

CSP requires that teaching and curriculum support young people in sustaining their own cultural competence while simultaneously gaining access to dominant cultural competence. In response to Paris's critique, Ladson-Billings (2014) reflects on CRP and suggests that CSP is the much needed "remix" of her original theory. She argues that CSP will create an environment where researchers and educators can "engage critically in the cultural landscapes of classrooms and teacher education programs" (p. 74).

There are many American Indian scholars and research studies that embody CSP. Their work represents a resistance to dehumanizing deficit approaches to education and honors and extends the languages, cultures, and practices of American Indian students and communities in the struggle for social and cultural justice.

Teacher Preparation for Diversity in the Classroom

Too often, American Indian students find themselves in classrooms where the teacher is not American Indian. Most white teachers are ill prepared to teach students of color. Studies show that white teachers negatively evaluate students of color more often than white students (McGrady & Reynolds, 2014). This is due to teacher perceptions about students based on stereotypes and assumptions about academic capabilities influenced by the students' ethnic background. Even teachers who identify themselves as culturally responsive may still hold deficit perspectives of their students (Garcia & Guerra, 2004; Villegas & Lucas, 2002).

Deficit perspectives create situations where White teachers "unintentionally oppress students because they have failed to resign dominant frames of reference when attempting to determine which examples, activities and instructional experiences are culturally responsive" (Warren, 2013, p. 175). At the core of CSP is the interaction between the teacher and the

student. Morrison, Robbins and Rose (2008) acknowledge that engaging in CSP may seem "herculean" to teachers who are juggling the multiple and often conflicting demands of their profession.

Teacher preparation programs and professional development for certificated teachers provide a platform for preparing teachers to work with diverse student populations (Irvine, 2003; Vavrus, 2002). However, many researchers are critical of the efficacy of most diversity or multicultural courses taught in teacher preparation and professional development programs. Irvine's (2003) research indicates that preservice teachers continue to have negative beliefs and low expectations of their students even after multicultural education coursework. Too often, the courses offered to teachers fail to provide a space for self-reflection and examination of privilege, especially for White teachers (Bloom & Peters, 2012; Marshall, 1996; McIntyre, 1997).

Programs offering stand-alone courses versus integrating multicultural education throughout the program consistently fail to shift student beliefs or sense of efficacy with diverse student populations (Bloom & Peters, 2012). Successful professional development for implementing CSP should include instructional modeling, strategies for helping teachers understand their role as student advocates, and induction programs that facilitate teachers moving from cultural disequilibrium to cultural responsiveness (Bergeron, 2008).

Agency and the Politics of Identity

McCarty (1998) discusses the role of schools as the "center of the arena" where the politics of language and culture are negotiated" (p. 27). Students are embroiled in the politics of identity and the lack of CSP creates an environment that is not conducive to student self-efficacy and agency. CSP promotes agency of students and according to Paris and Alim

(2013) it "focuses on the plural and evolving nature of youth identity and cultural practices and a commitment to embracing youth culture's counter-hegemonic potential while maintaining a clear-eyed critique of the ways in which youth culture can also reproduce systemic inequalities" (p. 85). For example, athletic achievement in boarding schools often became a source of pride for American Indian students and their families even though the introduction of sports was part of a campaign to erase American Indian culture from memory (Bloom, 2000). Self-efficacy influences choice of activities, determines persistence and the amount of effort people will expend in the midst of adverse experiences (Bandura, 1982).

Student Voice and Counter-Stories

Student voice is silenced by a national emphasis on the scientific approach to education, including a push from the U.S. Department of Education for empirical studies on educational outcomes (Eisenhart & Towne, 2003). The phrase "scientifically based research" appears 122 times in the reauthorization of the Elementary and Secondary Education Act, known as the "No Child Left Behind Act of 2001". The law defines scientifically based research as "research that involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs" (NCLB, 2002, §9101-37). According to the law, the research must use systematic, empirical methods that draw upon observation or experiment, involve rigorous data analyses, and utilize experimental or quasi-experimental design (NCLB, 2002, §9101-37). Methods widely utilized in medical and scientific research are now applied to educational research. The emphasis of research is now on large sample size, randomization, outcome driven data and the generalization of data (Eisenhart &Towne, 2003).

The emphasis on empirical studies in the federal education policy is counter to research methods that honor Indigenous populations. In particular, research on American Indian education should be community-based, and involve participatory research as well as a variety of other research methodologies, while incorporating perspectives from the classroom, the school, the district, the state, the community, and the family (Demmert, McCardle, Mele-McCarthy & Leos, 2006). Research should examine learning preferences and the role of language and culture when teaching American Indian students (Deyhle & Swisher, 1997; Demmert, 2001).

Cook-Sather (2006) presents several arguments supporting student voice in education research. She argues that youth perspectives are unique, informing us about learning, teaching and schooling with alternative viewpoints. Youth should be afforded opportunities to shape their education. Voice implies that students have an active role "in decisions about and implementation of educational policies and practice" (Holdsworth, 2000, p. 355). According to Shannon (1993), "voice is the tool by which we make ourselves known, name our experience, and participate in decisions that affect our lives" (p. 91, quoted in Nagle, 2001, p. 10). The youth perspective is conspicuously absent in the debates and literature about education policy, educational priorities, or pedagogies. Students having more meaningful educational experiences and feel empowered when their stories are privileged (Gay, 2000; Nieto, 2004).

Recommended Practices in American Indian Education

American Indian scholar Cornel Pewewardy (1993) asserts that one of the reasons American Indian children experience difficulty in school is that educators typically try to insert culture into the curriculum rather than shaping the curriculum around the culture.

When schools did employ CSP, students experienced enhanced self-esteem (Agbo, 2004) and were more self-directed and politically active (Garcia &Ahler, 1992). Students had a positive influence in their communities (Cleary & Peacock, 1998), were more respectful to elders (Agbo, 2004) and exhibited more positive classroom behavior and engagement (Cleary & Peacock, 1998; Lipka, 1990). In addition, students developed healthy identity formation (Trujillo, Viri & Figueira, 2002), and had higher academic achievement (Apthorp, D'Amato & Richardson, 2002; Demmert, 2001; Demmert & Towner, 2003, Klump & McNeir, 2005).

A discussion about what constitutes CSP in American Indian education should start with an Indigenous definition of culture. Castagno and Brayboy (2008) define culture as:

> A concept that is simultaneously fluid and dynamic, and ---at times---fixed and stable. Like an anchor in the ocean, it is rooted to some place---for many Indigenous peoples, the seafloor is the lands on which they live and their ancestors lived and roamed before them. The anchor shifts and ways, like culture, with the changing tides, ebbs, and flows of the ocean or the life connects and situations for Indigenous peoples (p. 943).

The three primary themes of culture presented by Borofsky, Barth, Shweder, Rodseth, & Stolzenberg (2001) are that:

1) Culture is the collective beliefs, behaviors, and/or artifacts that are portrayed as developing through time, often toward some progressive end.

2) Culture is often portrayed as the beliefs and/or behaviors people retain despite interaction with the "West".

3) Culture consists of a peoples' shared beliefs and behaviors that distinguish them from others and, at the same time, offer them a sense of shared meaning" (p. 433).

Castagno and Brayboy (2008) suggest that traditions and ontologies of Indigenous peoples in the U.S. are linked to the second cultural theme. They propose that the three themes taken together offer a range of possibilities for discussing culturally sustaining education:

> There are components of belief systems and behaviors that have remained stable, but that Indigenous peoples have adapted and adjusted throughout time, both for survival and because they are, like all humans, groups of peoples who create and transmit culture (p. 944).

This is important, because it places American Indians in the present as active, engaged citizens, neighbors, students, colleagues, and friends. This is counter to the view that Indigenous Peoples are some unknown group relegated to history books, museums, and games of cowboys and Indians (Yellow Bird, 2004).

Racism and colonialism and CSP

It is insufficient to define low achievement among American Indian youth as a motivation problem (Halpin, Halpin & Whiddon, 1980; Pewewardy, 2002; Pewewardy & Willower, 1993). Low academic achievement is a reflection of the cultural disconnect in the classroom and subsequent feelings of injustice and discrimination. This cultural discontinuity is partially to blame for the achievement gap among American Indian students (Reyhner, 2001). Failing to recognize the cultural difference of American Indian students may cause them to react in negative ways in the classroom (Ladson-Billings, 2001). This disconnect can create obstacles for student learning that is reflected in lower grades and a perceived lack of motivation (Barta, et al., 2001).

CSP supports academic achievement for American Indian students as well as contributing to the self-determination goals of Indigenous communities (Brayboy, 2005). Sustaining culture is intricately woven into the unique legal status of tribal nations as political entities. Cultural expression is a form of resistance and act of sovereignty (Castagno & Brayboy, 2008). CSP provides a space for counter narratives that speak truth into the racism in the U.S. education system. Cleary and Peacock (1998) note "few articles on teaching American Indian students have addressed the complex and troubling issues that characterize contemporary American Indian education in the context of racism and oppression" (p. 61). The various sources of racism include prejudice, paternalism, low expectations, harmful assumptions, stereotypes, violence and biased curricular materials (Deyhle, 1992; Hickling-Hudson & Ahlquist, 2003; Sparks, 2000).

Indigenous knowledge (epistemologies)

Battiste (2002) notes that "Indigenous knowledge comprises the complex set of technologies developed and sustained by Indigenous civilizations" and that this knowledge is "passed on to the next generation through modeling, practice and animation" (p. 2). Meyer (2001) notes that Indigenous knowledge serves as threads woven together to make up the cultural cloth of a particular community. These knowledge systems include a central focus on communities (Battiste, 2002; Deloria, 1970), relationality (Burkhardt, 2004), a sense of responsibility to self and others (Basso, 1996; Deloria, 1970), a rootedness in place (Barnhardt & Kawagley, 2004; Cajete, 2001), and a responsible use of power (Basso, 1996).

There are 566 federally recognized tribal nations within the United States (NCAI, 2015). The challenge for any educator is to not essentialize and generalize any group of people. However, multiple epistemologies exist and, in U.S. classrooms, western knowledge

is often in conflict with or privileged over Indigenous knowledge. Deloria and Wildcat (2001) note that:

> The educational journey of modern Indian people is one spanning two distinct value systems and worldviews. It is an adventure in which the Native American sacred view must inevitably encounter the material and pragmatic focus of the larger American society (p. v)

Characteristics of culturally sustaining pedagogy for American Indian students

Multiple studies highlight the benefits of culturally sustaining teaching with American Indian youth. Skinner (1999) identifies a set of shared values that educators should draw upon including generosity and cooperation, independence and freedom, respect for elders and wisdom, connectedness and love, courage and responsibility, indirect communication and noninterference, silence, reflection and spirit (p. 17).

The Alaska Native Knowledge Network (1998) developed a list of cultural standards for students involved in culturally sustaining curriculum:

> 1) Culturally-knowledgeable students are well grounded in the cultural heritage and traditions of their community.
>
> 2) Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life.
>
> 3) Culturally-knowledgeable students are able to actively participate in various cultural environments.
>
> 4) Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning.

> 5) Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.

These standards are meant to sit alongside the academic standards advanced by Common Core, NCLB, local school districts, and state accrediting agencies. The goal is for American Indian youth to become multicultural (Castagno & Brayboy, 2008).

The Alaska Native Knowledge Network (1998) also provides cultural standards for curriculum development. A culturally responsive curriculum reinforces the integrity of the students' cultural knowledge, recognizes cultural knowledge as part of a living and constantly adapting system, uses the local language and cultural knowledge as a foundation for the rest of the curriculum, fosters an understanding of diverse knowledge systems, and situates local knowledge and actions in a global context. Successful pedagogical practice includes:

> Trust building, connection to community, cultural relevance in the curriculum, intrinsic motivation, humor, family support, situations that yield small successes, personal connections between students and teachers, highly engaging activities, cooperative learning, role models, flexibility, fairness, consistency, and a real audience and purpose for student work (Cleary & Peacock, 1998, p. 13).

Cultural Border Crossing and Science Education

All learning is mediated by culture and takes place in a social context (Aikenhead, 2001). Research shows that student achievement in science hinges upon educators and schools recognizing the social context of learning as well as the effect of the learner's socio-cultural background (Cobern, 1994; Jegede, 1995; Ogawa, 1986). Multicultural science

education is important because it can serve as a pedagogical stepping-stone, particularly for multicultural students of science (Aikenhead, 2001; Atwater & Riley, 1993; Hodson, 1993; Jegede & Aikenhead, 1999). However, some science educators who champion western science tend to dismiss multicultural science as heretical (Good, 1995; Gross & Levitt, 1994). This stance reflects how WMS is normalized and privileged by the dominant culture. However, "Westerners freely acknowledge the existence of Indigenous art, music, literature, drama and political and economic systems in Indigenous cultures, but somehow fail to apprehend and appreciate Indigenous science" (Snively & Corsiglia, 2000, p. 7). WMS is often taught at the expense of Indigenous science, which can create conflicts for American Indian students (Snively & Corsiglia, 2000). In some cases, the science content itself conflicts with the worldview of the learner, violating sacred beliefs or community/cultural practices (Cajete, 1999a). Taylor and Cobern (1998) explain that:

> Local cultures are in danger of suffering erosion and loss of integrity as a powerful culture-insensitive science education, operating through the agency of local schools, delegitimizes and rapidly displaces traditional ways of knowing, being and valuing (p 204).

When the culture of science harmonizes with the student's own culture, smooth border crossing into school science occur (Aikenhead, 2001). Disruptions to the student's worldview and an educational stance that forces the learner to abandon or marginalize his or her cultural beliefs are a form of assimilation (Cajete, 1999b). These cultural conflicts between the student's Indigenous knowledge and the world of Western science create barriers to learning science in meaningful ways.

Jegede and Aikenhead (1999) present a model for helping multicultural students bridge cultural border crossing in science classrooms. Their model is based on two tenets: a) science is a cultural endeavor and many students encounter WMS as a cross cultural experience and b) student worldviews are sometimes in conflict with WMS creating situations where collateral learning occurs, often at the detriment of the student of color. The idea of cultural border crossing emerged from Giroux (1992), where he contrasts modernist and postmodernist views on education. Modernism defines borders and situates people within those borders along with the sociopolitical power afforded each entity. In contrast, postmodernism supports people having multiple identities, where we live in a world of border crossing, living "multiple narratives that define reality" (p. 54). Jegede and Aikenhead (1999) draw upon cultural anthropology that regards the learning of science as the acquisition of the culture of science. Many students are left to navigate cultural border crossing without explicit assistance and not all students can navigate those transitions smoothly (Costa, 1995; Phelan, Davidson & Cao, 1991).

Costa (1995) identified four types of students in the science classroom based on their ease of navigating cultural border crossing; a) Potential Scientists whose transitions are smooth, b) Other Smart Kids who manage the transitions with little conflict, c) "I Don't Know" Students whose transitions tend to hazardous, and d) Outsiders whose transitions between the two cultures are virtually impossible. Success in science depends on the degree of cultural convergence that students perceive, how effectively they move between the two cultures, and the quality of assistance they receive in making those transitions easier (Aikenhead & Jegede, 1999).

The cognitive experience of border crossing represents a form of collateral learning (Jegede, 1995) in which two or more conflicting schemata are held simultaneously in long-term memory. Collateral learning occurs on a continuum where student worldviews and what is taught in the classroom are either parallel and compartmentalized or secured and converged together. Jegede (1995) explains that parallel schemata are only accessed in the context of school but never in home/community life and, on the opposite end of the spectrum, students hold both schemata in their memory, sometimes using one to reinforce the other, resulting in new conceptions.

Aikenhead and Jegede (1999) explain that cultural border crossing in science occur when a) teachers act as cultural brokers or travel agents, making the transitions between the different worldviews explicit; b) employ interactive and culturally responsive teaching strategies, and c) centers the curriculum around the cultural context and Indigenous knowledge of the student. These strategies allow for what Taylor and Cobern (1998) call "critical enculturation" which supports a dynamic view of culture, involves a dialectical view of cultural adaptation, and recognizes the need for reciprocal accommodation of the beliefs, values, and practices of multicultural perspectives.

Summary

When the academic performance of American Indian students is compared to that of other groups of students, the disparities are evident. American Indian students are more than twice as likely as their White peers to score at the lowest level on the NAEP reading assessments and almost 3 times as likely to score at the lowest level in mathematics (Freeman & Fox, 2005). Shifts in pedagogical approaches, teacher dispositions, and school/community relations are needed. Research shows that American Indian students are more successful

when culturally sustaining methods are implemented in the classroom. These strategies facilitate cultural border crossing for students between their own Indigenous worldview and that of the dominant culture. Historically, these types of teaching strategies have been absent from the classroom as a result of endemic racism, colonial policies, and institutional structures. TribalCrit and CRT provide a powerful framework for evaluating the effectiveness of CSP curriculum in the classroom. McCarty and Lee (2014) call the result of such work, “critical sustaining/revitalizing pedagogy”. Inspired by Paris (2012) and Paris and Alim's (2014) notion of CSP, McCarty and Lee argue that CSP in American Indian classrooms must also be understood as culturally revitalizing pedagogy. The development and praxis of CSP requires an “inward gaze” (Paris & Alim, 2014) that allows the participants to acknowledge, analyze and confront colonizing influences that limit language and culture reclamation.

Chapter 3

Research Design

This chapter provides a detailed description of the components in this study's research design. The chapter begins with a review and rationale for the use of phenomenology followed by a discussion about power and the role of Indigenous methods, CRT and TribalCrit in this study. The chapter goes on to describe the context of the study and the student participants' backgrounds. This is followed by a description of how our stories were collected and interpreted. The chapter concludes with a discussion about issues of quality and ethical considerations.

In this phenomenological study (Van Manen, 1990) I analyzed the experiences of six American Indian students who participated in the Pit House project, a science project that incorporates pedagogical practices aimed at sustaining and honoring the students' Indigenous culture. The Pit House project curriculum applied the tenets of cultural border crossing in science education (Aikenhead, 2001; Costa, 1995; Jegede & Aikenhead, 1999; Pomeroy, 1994) to create a curriculum that is culturally sustaining (Paris, 2012). This study examines the lived experiences of the participants over a 5-year period, examining initial impact of the Pit House project and potential change in perspectives over a period of 5 years. My personal experiences as their teacher are interwoven in the study as our lived experiences are intertwined. The stories of the participants were analyzed and interpreted by applying CRT and principals of CSP. This study examines the lived experiences of the students in the midst of the project as well as their reflections several years later.

The research design of this study is informed by Indigenous research methodologies (Kovach, 2010), CRT (Ladson-Billings & Tate, 1995), and TribalCrit (Brayboy, 2005)

Kovach (2010) explains that Indigenous research methodologies are important in education because (a) any research or conversation about the education of American Indians should be conducted with the goal of decolonizing the educational process; and (b) because inequity in education among American Indian students and the internal colonization of American Indians are a direct result of racism. Tuhiwai Smith (2012) warns that research as perceived by Western researchers and scholars:

> becomes so taken for granted that many researchers simply assume that they are as individuals embody this ideal [of benefiting mankind] and are natural representatives of it when they work with other communities. Indigenous peoples across the world have other stories to tell which not only question the assumed nature of those ideals and the practices that they generate, but also serve to tell an alternative story (p. 2)

This study is exploratory in that it attempts to identify the beliefs, actions, and shared experiences of the students. Student perspectives were collected through a variety of methods aligned with Indigenous research including journaling, semi-structured interviews, sharing circles, and creating sacred maps of the Pit House. Given the exploitive nature of research within Indigenous communities, strategies were used to collect data that mitigated the power differential between teacher/researcher and the participants. Students were reminded that their participation was voluntary. Trust was established prior to the study due to the students having a relationship with me as their teacher. The results were shared with the students for feedback and to verify I had interpreted their ideas and experiences correctly.

Rationale for Conducting a Phenomenological Study

Castagno and Brayboy (2008) discuss the need for educational research grounded in CRT and TribalCrit. Their extensive literature review of research on Indigenous education

provides striking evidence of the benefits of CSP with American Indian students. However, for the most part, the research does not critique the racism endemic in learning environments and the racialized experiences of American Indian students. TribalCrit and CSP are relatively new theories to emerge from CRT scholarship. This study is one of the first to apply both in educational research.

Foundations of phenomenology

Phenomenological research is rooted primarily in philosophical work of Edmond Husserl (1859-1938), Martin Heidegger (1889-1976), and Hans-Georg Gadamer. According to Husserl (1913), we can only know what we have had the opportunity to experience. When we focus on our perceptions we become conscious of the meaning attached to those experiences. As a scientific process, Husserl believed we must suspend judgment or "bracket" our interpretation of the phenomenon we are trying to perceive in order to objectively, observe the phenomenon (Husserl, 1970). Heidegger and Gadamer disagreed with Husserl and felt that bracketing was impossible, that observing and reporting on phenomena could not be done objectively. Heidegger believed that the pre-judgment or "pre-understanding" is a structure of being in the world that cannot be separated from the phenomenon (Heidegger, 1962). Essentially our background, culture, and previous life experience shape our current understanding of new and future lived experiences. Gadamer helped provide practical applications of interpretive or hermeneutic phenomenology. "Hermeneutics must start from the position that a person seeking to understand something has a bond to the subject matter that comes into language through the traditional text and has, or acquires, a connection with the tradition from which it speaks" (Gadamer, 1998, p. 295). Gadamer believed that understanding and interpretation are inseparable and that

interpretation is always an evolving process, rendering a definitive interpretation virtually impossible (Annells, 1996).

Phenomenological research

According to Creswell (2009), phenomenology is "interpretive research, with the inquirer typically involved in a sustained and intensive experience with participants" (p. 177). It is an approach where individuals create meaning from their life experiences. This study was conducted inductively, moving from particular meaning units to themes. The participants shared their experiences while planning, building and testing the strength of their model Pit Houses. Their experiences with the Pit House built on campus were also explored. The meaning units and themes emerged from our intertwined lived experiences.

Phenomenological studies do not start with a predetermined hypothesis or *a priori* assumptions to be tested. Rather, an inductive process takes place where shared experiences emerge during data collection and analysis (Creswell, 2009). In addition, qualitative research allows for post-positivist and constructivist approaches, which assume that reality is, to some extent, subjective (Creswell, 2009). The participants have worldviews that have traditionally been silenced and marginalized by the dominant culture.

Phenomenology is well suited to answer the research question in this study because pedagogical research requires sensitivity to the lived experiences, particularly the children's realities and life-worlds. "Pedagogy requires a hermeneutic ability to make interpretive sense of the phenomena of the life-world in order to see the pedagogic significance of situations and relations of living with children" (Van Manen, 1990, p. 2). In other words, pedagogy is not simply what we do as educators, it is relational and transformative. We are immersed in learning with the students and must "act in the lives we live with our students and wonder,

always wonder whether we did it right. We need to listen to pedagogy so as to be able to act in a better way pedagogically tomorrow" (p. 149). According to Leedy and Ormond (2001), the purpose of phenomenology is to attempt to understand the perceptions, perspectives, and understandings of a particular situation to an individual. Phenomenology is naturalistic, attempting to "inductively and holistically understand human experience in the context-specific settings" (Patton, 1992, p. 37).

Phenomenological studies strive to examine and interpret the essence of lived experiences and their existential meanings (Van Manen, 1990). The hermeneutic process is reflective and action oriented. As the researcher, I am reflecting on my actions as the teacher and attempting to understand the essence of my students' experiences. I was mindful that teaching is an act of service. Therefore, phenomenology was the most appropriate methodology for describing the lived experiences of students and their teacher in a science classroom. In particular, the student stories merit a thick description and interpretation. Student voices have the potential to speak truth to oppressive and discriminatory policies and practices within the learning environment.

This study is mainly based on the phenomenological theoretical work of Van Manen whose writings about phenomenology focus primarily on education and researching pedagogy. His definition of phenomenological research is as follows:

> Phenomenological human science is the study of lived or existential meanings; it attempts to describe and interpret these meanings to a certain degree of depth and richness. In this focus upon meaning, phenomenology differs from some other social or human science, which may focus not on meanings but on statistical relationships

> among variables, on the predominance of social opinions, or on the occurrence or frequency of certain behaviors (Van Manen, 1990, p. 11).

Van Manen goes on to add that:

> Phenomenology is distinct from other methodologies since it does not explicate meanings specific to a particular culture (ethnography), or to an individual's personal life history (biography). Rather, phenomenology's goal is to gain a deeper understanding of the nature of meaning of our everyday experiences (1990, p. 11).

To me, the work of capturing the essence of a lived experience is about getting at the emotional, spiritual and deeply personal aspects of that experience. Phenomenological methodology allowed me to recognize and give voice to the unique identities and stories of my students. Phenomenology also fits as a methodology aligned with critical theory in that Phenomenological engagement can be very personal, it has the potential to appeal to each of us, and how we understand ourselves and others (Van Manen, 1990). Hermeneutic phenomenology is action-oriented research, with change being the end result of understanding the lived experiences of the participants. I wanted to understand how my students felt while building models in class, or while visiting the Pit House. I ultimately sought a teaching praxis that helped students to better understand meaning in their lives.

Researcher Relationships and Power

In any teacher-student relationship power is a concern. CRT and TribalCrit are essential lenses for this phenomenological study as they provide a framework for exploring our collective sources of knowledge, while examining whose knowledge counts, WMS or Indigenous knowledge. In general, CRT proposes that (a) racism is "ordinary" or the norm in society; (b) the ascendancy of Whites over "others" serves important purposes, particularly in

maintaining a privileged status quo; and (c) race is a construction of social thought used to justify domination of one group over another (Delgado & Stefancic, 2006). Lorde (1992) provides a concise definition of racism as "the belief in the inherent superiority of one race over all others and thereby the right to dominance" (p. 496). Marable (1992) further defines racism as "a system of ignorance, exploitation, and power used to oppress African-Americans, Latinos, Asians, Pacific Americans, American Indians and other people on the basis of ethnicity, culture, mannerisms and color" (p. 5). Marable's definition shifts the conversation about race and racism from a Black-White discourse to one that includes a myriad of faces, experiences and voices (Solorzano & Yosso, 2002).

CRT provides a strategy for acknowledging the role of racism and race in our education system and works toward the elimination of racism along with other forms of subordination "based on gender, class, sexual orientation, language and national origin" (Solorzano & Yosso, 2002, p. 25). According to Brayboy (2005), CRT fails to address the role of colonization and the subjugation of American Indians. He presents TribalCrit as a solution, building on the work of CRT and adding specific language about the dual status of American Indians as sovereign peoples and as racialized human beings. "TribalCrit emphasizes that colonization is endemic in society while also acknowledging the role played by racism" (Brayboy, 2005; p. 430).

As a White woman, I represent the dominant culture. Without the use of CRT or TribalCrit, my representations of the students' stories would be disingenuous and fraught with contradictions. Too often, research that attempts to explain inequalities in education end up supporting "majoritarian" stories; or stories that normalize the dominant culture and cast the stories of people of color in a dim light (Solorzano & Yosso, 2002). These majoritarian

stories perpetuate stereotypes and presume that cultural deficits are to blame for academic failure. Rather than examining how the educational system should change, these majoritarian stories argue it is the people that should change, and that the solution is cultural assimilation (Banfield, 1970; Schwartz, 1971). Solorzano and Yosso (2002) offer a counter methodology rooted in CRT. Their counter-methodology articulates the experiences of people whose stories are rarely told. The counter-story is a tool for "exposing, analyzing and challenging the majoritarian stories of racial privilege. Counter-stories can counter complacency; challenge the dominant discourse on race and further the struggle for racial reform" (Solorzano & Yosso, 2002, p.32). Counter-stories based on CRT contain the following elements:

- An acknowledgement that race and racism are intertwined with other forms of subordination;
- Challenge dominant ideologies;
- Demonstrate a commitment to social justice;
- Center around experiential knowledge;
- Present a trans-disciplinary perspective.

CRT and TribalCrit allowed me to analyze the influence of race and racism in education as I reflected on my craft and journey as a white teacher and as I interpret the lived experiences of my students and myself during the Pit House project. TribalCrit and CRT were particularly useful in analyzing the stories of the student participants. Their narratives demonstrate whether or not the curriculum was in fact culturally sustaining. Their stories provide insight into potential hazards that still exist as a result of endemic racism and colonialism, as they transition between Western and Indigenous worldviews.

In order to minimize inequities between my students and myself, I humbly clarified to the participants that their stories are powerful and I was eager to hear their responses and truly learn what their experiences have been. In addition, I used hermeneutic interviewing techniques (Van Manen, 1990). Hermeneutic interviews are "collaborative in that the researcher can mobilize participants to reflect on their experiences (once these have been gathered) in order to determine the deeper meanings or themes of these experiences" (p. 99). In other words, my students and I attempted to interpret the significance of the preliminary themes identified in the first set of interviews. This was done by me sharing the write up of the first interviews with the students and allowing them time to read the report prior to our second interview. During the second interview, I asked questions about their reaction to reading my interpretation of their stories. We weighed the appropriateness of each theme by asking: Is this what the experience is really like? Once the second set of interviews was completed and interpreted, the students were invited to review the results again. The participants in this study were able to re-interpret or determine if the narrative does in fact resonate with their personal experiences (Van Manen, 1990).

Methods and Data Collection

The methods I used to gather the participants' stories also reflect accepted practices within Indigenous research. Indigenous research acknowledges and brings to light the historic trauma of colonization and modern practices and policies that continue to reinforce colonial ways of thinking (Smith, 1999). Many Indigenous scholars advocate for careful review and control over who should conduct research within their communities (Brayboy & Deyhle, 2000; Dehyle & Swisher, 1997; Smith, 1999; Swisher, 1996; Wilson, 2008). After centuries of exploitation in the name of science, it makes sense that, at the hands of Western

researchers, Indigenous communities would desire their own set of rules about (a) who can conduct research, (b) who can benefit from the research and (c) in what ways the research should be carried out. Researchers must reconsider traditional methods of conducting research in American Indian communities (Brayboy & Deyhle, 2000). Researchers must demonstrate cultural competence in their actions amongst people of the community and in the design of the research. In other words, their research should:

- include the promotion of community input and participation in the research;
- consider the benefits and contributions of the research to the community;
- develop a rapport with the community of interest;
- be knowledgeable about their history, culture, and way of life;
- avoid exploitation of participants; and
- encourage participatory research and respect the desire for local control of the research (Crazy Bull, 1997; Hermes, 1997; Smith, 1999; Wilson, 2008).

Throughout the narrative of this study it is apparent that I addressed the criteria described above and seek approval to conduct the research by the following entities: The Tribal Council, the Culture and Language Office, the School District, and the students. Students and community members were asked to read this study to provide feedback and to express concerns about potential misinterpretation of the Tribe and the students' stories.

Phenomenological research creates a platform for presenting student stories, shifting the privileged voice away from myself as a white teacher. Student opinions about the science curriculum and the use of culturally sustaining pedagogy represent a local knowledge base not traditionally utilized in western research methodologies (Lomawaima, 2000; Lomawaima & McCarty, 20002). This study utilized qualitative methods to go beyond test scores and

statistics that tend to focus on the deficits and negative experiences of marginalized youth in American schools.

The Site

The narrative is bound by my experiences as the teacher, and six purposefully selected high-school-aged American Indian youth who attend a small, rural school on an Indian Reservation in the Northwest United States. The reservation has about 2,000 people, covering approximately 159,000 acres of mountainous land. Their ancestral lands cover over 3 million acres, nearly twenty times the current land within the reservation. The high school is a public, non-tribal school serving youth on the reservation. There are about 300 students in the K-12 system.

The participants

Six purposefully selected American Indian students and I participated in this study. A boy and girl were selected from three different graduating classes out of a population of about 80 students. Consideration of overall academic performance and involvement in the school and the community were factored in as well. There is a balanced cross section of students who are doing well academically and some who are not. In addition, students with a strong interest in science and students who typically do not show interest in the class were identified. This is important because the crux of this study is to identify how perceptions and attitudes about science change when CSP practices are used. Below is a brief biological sketch of each student participant.

Jennifer

Jennifer is an enrolled tribal member and has spent most of her life on this reservation. Her family lived on a reservation on the west side of the state for a short time

when she was an infant. She has an older brother and a younger brother and sister. Her grandmother is one of the elders who advises the Culture and Language office and was involved in the creation of the Pit House project. Jennifer is now a junior in college, majoring in Environmental Science. She recently completed a summer internship assisting with a National Science Foundation STEM educational grant awarded to her university to work with her Tribe. She was one of a handful of students selected to travel to Hawaii with her college outreach program to study about Native Hawaiian culture and Hawaiian ecosystems. Jennifer has always enjoyed science, taking college preparatory science courses during her last two years of high school. During 11th grade, she enrolled in a college credit course in ethno-botany, offered by a local university, and at the same time was taking chemistry at the high school. During the summer between her 11th and 12th grade years, Jennifer participated in a summer internship, assisting with research on the impacts of a Superfund site on the reservation. In this experience, she learned about a variety of environmental issues that are impacting the well being of her family and friends on the reservation. This experience inspired her to pursue a degree in environmental science in college. In 12th grade, she carried out additional research examining possible contamination of culturally significant plants growing in the watershed below the mine. She presented her findings at a regional environmental youth conference and received an award for her work. Jennifer regularly participates in cultural events and is very close to her family. She dances in powwows and beads.

Marshall

Marshall was born and raised on the reservation. He loves horses and is very close to his family. When Marshall was in the 8th grade, he decided he wanted to be a Millwright like

his dad and uncle. He figured out what classes he needed in high school to get into an apprenticeship program and stuck with his goal. He is in his 3rd year of his apprenticeship and loves what he is doing. He is deeply connected to his family and community and is an avid hunter. Marshall learned the traditional way to tan hides for his senior project. This was a powerful experience for him because he is a hunter and he wanted to learn how to use every part of the animal as a way to provide for his family and community. Marshall was a wrestler in high school and made it to state in his weight class. He also played baseball. Marshall is good with his hands and excelled at anything that requires engineering or construction. His grades were inconsistent in high school, reflecting his variable level of interest and engagement based on the subject and relevance to the things he found meaningful. He took only the minimum courses required to graduate, knowing he wasn't going to be entering college.

Alan

Alan is from a family of tribal leaders. His grandfather was on the tribal council, and his mom was instrumental in helping to promote awareness about the Tribe's culture and heritage among non-natives. Alan sings and drums with his family and is actively involved in cultural activities. He was a football player in high school and played baseball. Alan was viewed as a class clown among his peers and was often at odds with teachers. Early on in high school he talked about going to college to study construction management. After his freshman year, his grades slipped considerably, and he struggled to stay focused in school. He stood out as a leader particularly when representing his Tribe or helping in his community. Like Marshall, his academic achievements were in courses or during projects where he found deeper meaning in the learning or relevance. Alan barely graduated from

high school. I flew back to see his class graduate because I'd been their advisor for three years and felt more like family with that class than any other. Alan is now living on a reservation in Idaho and working at a casino resort. He likes his job but is barely making ends meet and is hopeful about going back to school someday.

Kaia

Kaia is enrolled in a neighboring tribe and spent her whole life on the reservation. She is in her second year of college, and she is considering becoming a pharmacologist and is planning on majoring in biochemistry. In high school, she talked about becoming a marine biologist or a pediatrician. Kaia took chemistry in 11th grade and opted not to take AP science her senior year. She is very close to her family and attends college with her brother, who is also her roommate. Kaia was active in school sports, playing volleyball, basketball and softball. Her senior paper was on genetic disorders, and she did a genealogy of her family for her senior project. She was also in my AVID (Advancement Via Individual Determination) elective course for three years. I was her advisor as well as her science teacher.

Doug

Doug is an enrolled tribal member and has spent most of his life living on the reservation. His family moved into the city for a short time so he and his siblings could benefit from programs offered in larger school districts. His mom works in the school on the reservation. He is part of a large and well-known family among tribes in the area. He is in his first year of college and is planning on majoring in engineering. He received the Gates Millennial Scholarship and was one of the first students from his high school to receive that scholarship. He is attending college with two of his best friends who also received the

scholarship. Doug was a leader in his class and an all-star athlete in high school. He did his senior project on recycling and waste management on the reservation. Doug is very close to his family and is active in his community and always willing to lend a helping hand. He was also involved in community youth leadership efforts. He was recently able to travel to New York City with other American Indian youth to visit colleges and universities.

Sashia

Sashia is enrolled in the tribe and has lived on the reservation her whole life. Her father is a leader, serving the school board. Sashia is a freshman in college. When asked how it was going, she said, "it's like high school, only more walking," which is typical of her sense of humor and positive outlook on most things. Sashia wants to pursue a career in a health related field. She used to talk about being a pediatrician, but now she isn't sure. She got to travel to England with People to People near the end of her senior year of high school and enjoyed the experience. She wants to travel more. Sashia has a learning disability involving reading and spelling. She struggled in school but was motivated to do well and to go to college. She was engaged in sports in high school, was a member of the yearbook team and enjoyed taking science classes.

Timeframe

The study took place over several years, capturing the lived experiences of the students while they are in high school and after graduation. According to Saldana (2003), long-term qualitative studies provide two primary benefits:

> to capture through long-term immersion the depth and breadth of the participants' life experiences, and to capture participant change (if any) through long-term comparisons of their perceptions and actions (p. 16).

Asking Questions: Seeking Meaning

Phenomenological research is about asking what something is really like. It is about getting at the root and character of a lived experience. For an educator, the questions at the center of my vocation and personal life concern the meaning of pedagogy. My students can explicitly answer these questions, thus becoming my teachers. Who better to identify possible discrepancies between what I profess to do and what actually happens in the classroom than my students? According to Gadamer (1975), the essence of the question is "the opening up, and keeping open, of possibilities (p. 266). Van Manen (1990) elaborates by stating that truly questioning is to "interrogate something from the heart of our existence"…we must therefore "live" and "become" the question (p. 43). This study explored the question: What are the affordances of a culturally sustaining pedagogical science curriculum for American Indian students understanding of science, technology, engineering, and mathematics (STEM) content, culture, self, identity, and their future? There are several sub-questions including:

1) In what ways did the science lessons afford a "safe space" for student learning and dialogue?
2) What are the students' perceptions about the integration of culture and STEM, and their ability to do STEM that is integrated with culture?
3) What are the lived experiences of students regarding social inequity in school and life (i.e. experiences with racism, incongruent learning experiences, sense of agency or empowerment)?

Investigative Methods

The meaning or essence of a phenomenon is multi-dimensional and multi-layered. A diverse array of methods should be employed in order to identify the structures of meaning or themes that define the phenomenon (Van Manen, 1990).

Table1. Types of Methods Used in this Study.

Personal Experience	I provided a reflection of my own experiences as the teacher, particularly from the perspective of a White woman teaching American Indian students. Awareness of my own experiences provided me with insight into the experiences of my students (Van Manen, 1990).
Sharing Circles	The students participated in sharing circles, which is a culturally responsive interviewing technique where participants joined in a group discussion and shared stories and ideas (Nabigon, Hagey, Webster, & MacKay, 1999; Benham & Cooper, 2000; Kovach, 2010).
Sacred Mapping	The participants engaged in a visioning exercise within the context of the sacred place (Pit House) and then drew what they envisioned (Lavallee, 2009; McNiff, 1998).
Journaling	The students reflected on their sacred maps and their prior experiences and briefly wrote about the significance of those events (Van Manen, 1990).
Surveys	Two short surveys were distributed to gather background information about student attitudes about science and about their

	acculturation to dominant culture. These surveys helped jumpstart dialogue during one on one interviews as well as evaluating cultural border crossing (Jegede & Aikenhead, 1999).
Hermeneutic Interviews and Collaborative Analysis	Semi-structured interviews were conducted a minimum of 2 times. These interviews served two purposes: (a) exploring and gathering experiential narrative material and (b) developing conversational relationships to discuss the meaning of the experience (Van Manen, 1990).
Experiential Anecdotes	I collected experiential material through "close observation". This was done by me entering the life-world of my students through direct participation and simultaneous hermeneutic reflection (Van Manen, 1990).

The primary sources for capturing the fundamental life-world themes of the Pit House project consisted of close observation, my personal reflections, student journal entries, sacred maps created during a sharing circle and the transcripts from semi-structured, hermeneutic interviews conducted individually with each student. The interviews were conducted more than once. The first round of interviews lasted for about 10 minutes each, the second round of interviews lasted for about 45 minutes to an hour. After the initial interviews and interpretation of those interviews, the students were asked to read the results. Following that, a second interview was conducted several months later to explore how the Pit House project continues to shape their lives. Two surveys were also be used to supplement the interviews.

The students represent a cross section of learners and each student demonstrates varying abilities to transition between Western science and their home culture. Costa (1995)

identifies students as Potential Scientists, Other Smart Kids, “I don't know” Students, or Outsiders. The Likert survey informed my interpretation of which type of science student each of the participants was. Reflecting on each student’s orientation toward science helped me interpret their life-world experience with the Pit House project.

In the Beginning

Throughout the study, I reflected my own personal experiences. I began the study by meeting with the students in the Pit House for a sharing circle. I asked each student to take a moment to visualize the Pit House and its surroundings. I invited them to imagine how the Pit House was traditionally used and how it is used today. I also asked them to think about why the Pit House is important to them, their families and the community. Sharing circles are similar to focus groups. However, the underlying principles behind a sharing circle are very different. Circles are acts of sharing one’s heart, mind, body, and spirit—and permission is given to the facilitator to report on the discussions (Nabigon, Hagey, Webster, & MacKay, 1999). The practice of research circles is closely aligned with cultural traditions around story telling (Benham & Cooper, 2000) and are “meant to provide space, time and an environment for participants to share their story in a manner that they can direct” (Kovach, 2010, loc. 2229).

The students then drew what they visualized, creating maps of the space. The group took turns sharing what they imagined. The maps of the Pit House are examples of what Lavallee (2009) refers to as the use of art in Indigenous research as a method for “finding meaning beyond words” (p. 30). These maps represent arts-based research, using elements of creative arts expression, including the making of art by the participants and/or researcher, as a way of understanding the significance of experiences (McNiff, 1998). I provided paper and

pencils, asking them to write their thoughts and feelings about the Pit House and the activities we just did.

The Next Day

The next day, the students completed two, short, Likert-scale surveys. The first survey, adapted from Dubner, et al (2001) includes a series of statements, both negative and positive, regarding student attitudes about science and math. I asked my students to rate each of the following statements from "strongly disagree" to "strongly agree":

- I enjoy learning science.
- Science is important to everyday life.
- Doing science often makes me feel nervous.
- Science challenges me to use my mind.
- I am good at science.
- Science and math will help me in the future.
- Science and math have improved the way we live today.
- Knowing science and math won't help me to get a job.
- Learning science is difficult for me.
- Even without a strong background in math and science, I will probably end up with the kind of job I want.
- Overall, science and mathematics have caused more good than harm in our lives.
- My parents expect me to go to college.
- My parents think that science and math are important subjects.
- I would like a job that involves science, mathematics and/or engineering.

The second survey was modified from a survey developed by Garrett and Pichette (2000). Their survey was developed to assess the level of acculturation of college-age American Indian students. I modified the questions by eliminating items that were not applicable to high school age students. The survey contained the following items:

- A language other than English is spoken in my home on a regular basis.
- I can speak my American Indian language with some proficiency.
- I participate in cultural events at least 3 times a month.
- I prefer listening to traditional music over what's on the radio.
- I am more interested in movies about my culture than what's at the theater.
- I would prefer living on the reservation (or in my cultural community).
- My family uses traditional healing and ceremonies on a regular basis.
- I prefer traditional food over stuff from the store.
- I think learning about my culture is important.
- I enjoy activities at school that involve my culture.

I used both surveys to gather information from my students that might be difficult to elicit from the interviews. In addition, the survey responses helped to identify the extent of cultural border crossing my students experienced as science students. The responses to the surveys were used to supplement the descriptions of student responses in the results section.

Capturing lived experiences over time

Finally, the students were individually interviewed using hermeneutic interviewing techniques. The initial interviews lasted about 10 to 15 minutes. An audio recording was be created for each interview using Quick Time on a Mac Book. The interview questions included the following prompts intended to draw out greater detail from the students:

- Tell me what you remember about the Pit House project.

- What did you find most challenging about the assignment?
- Do you remember what science topics you were learning about when we built the models?
- Did you have to redesign your model?
- What was most memorable for you about the project?
- How can we use the models to relate to the real Pit House?
- How do you feel about cultural activities being incorporated into the science lessons?

The delayed interviews, which occurred two years after the initial interviews, lasted about an hour each. These were conducted over the phone, via Skype and in one case using Facebook messenger. Between the first and second interview, the students were given a chance to read my written interpretations of their experiences during the Pit House project. I asked for their input regarding accuracy of what they intended to say. During the second interview, I took some time to ask questions that captured new details about the Pit House and science as part of their life-world. For example, I asked some of the following questions:

- Tell me about the last couple of years of your life.
- In what ways has the Pit House project continued to be part of your life?
- Can you give an example of a time when you compared a learning or life situation to what you experienced during the Pit House project?
- What was it like to read my interpretation of your interview?
- Can you tell me about a time when you experienced racism in school?
- Can you tell me how you felt when I left?
- What science classes have you taken since then? How did it go?

- What was it like to start college or get your acceptance letter?
- How did you choose your major?

Interpreting Lived Experiences

Making sense of the stories gleaned from the sources included in this study requires a process of insightful invention and discovery. Identifying and creating thematic understanding is not a "rule bound process but a free act of seeing meaning" (Van Manen, 1990, p. 79). Phenomenological themes are the structures of the experience and they are best described as the means to get at the notion, giving shape to the shapeless, describing the content of the notion. But the themes are also reductions of a notion and can never completely unlock "deep meaning, the full mystery, the enigmatic aspects of the experiential meaning of a notion" (Van Manen, 1990, p. 88).

According to Van Manen (1990) there are three general approaches to uncovering or isolating thematic aspects of a phenomenon within text: (a) the holistic approach which asks what sentence phrase captures the fundamental meaning of the text, (b) the selective reading approach which asks what statement(s) or phrase(s) seem to reveal the essence of the lived experience, and (c) the detailed reading approach which asks what the sentence or sentence cluster reveals about the phenomenon or experience. For all of the textual items, including transcriptions of the interviews, I used the selective reading approach.

All of the journal entries, sacred maps, observational notes, and interviews were transcribed and sorted using NVivo 10. The maps and journal entries were scanned and annotated. Student interviews were also uploaded into NVivo 10. I read and re-read the material, to identify emerging themes. The data from the surveys were analyzed qualitatively using an Excel spreadsheet to organize the student survey responses. The survey results were

incorporated with the experiential anecdotes as part of the results. The student responses to those surveys helped to describe cultural border crossing in the science classroom.

The second interview also served as an opportunity for analysis through conversation. The students were invited to interpret the essence of the Pit House through dialogue and from the questions that I asked. Prior to the second interview, the students had an opportunity to read my initial interpretations of their lived experiences. This provided a scaffold for further conversation and collaboration.

Veracity and Ethical Considerations

Van Manen (1990) writes that participants involved in phenomenological studies tend to become more invested in the project. In this context the students became co-investigators, exploring our lived experiences with the Pit House project together. I have a moral obligation to them as well. Their review of the written results and the second interviews is what other researchers call member checking (Carlson, 2010).

Before conducting this study, I sought approval from the University of Idaho's Institutional Review Board. I also notified my school board and the culture and language office with the Tribe. It was essential that community members knew that my intent was not to disparage their work as culture and language educators. I made it known that the results will be used to identify strategies for helping students in the school feel that their education is pertinent and important. While conducting interviews, I made it clear that participants could opt out at any time and they may decide to have their responses removed from the study. I made every effort to keep identities anonymous. In addition, various members of the tribal community were asked to read and review the chapters of this study. Names have been changed and any references to particular places or items of Indigenous knowledge that Tribal

members feel need to be omitted were removed prior to publication. My intent is to gift this study to the Tribe and to my students.

Chapter 4

The Pit House Project

Prelude

Close your eyes and smell the forest in the walls. Picture the soil above enveloping you in a protective cocoon. Imagine a small fire at the room's center. Perhaps you are cleaning moss or preparing roots for cooking. Maybe there is a drum and you and your family are singing together. Outside a deer passes barely noticing the mound of dirt in a clearing in the trees, confused by the smoke coming out of the ground.

Within what seems a blink of an eye, a circle of lichen covered rocks and rotting logs remain. Many of your friends and family have died from disease and endless fighting. You and your siblings have been taken away from your parents and sent to boarding schools. You were beaten yesterday for speaking your grandmother's language.

Several years pass and you have grandchildren of your own. You try to remember how your family used to catch salmon at the falls on the river and collect berries in the mountains. You look at a cedar basket and wonder how it was made and wish you could still carry on the traditions of your family. Your grief and the sadness of your community are drowned in decades of substance abuse, poverty and exploitation. Although the boarding school is closed, you dread sending your grandchildren to the public school down the road. You fear for them and mistrust the white teachers and the standardized tests.

And then... The crowd was overflowing, spilling out of the door of the Pit House, circling around its roof and out through the woods to the road. Off in the distance, the concrete walls of the school paled in significance. Children, parents, elders, teachers, and community members bowed their heads for a blessing and honor song. Today there would be

no spelling tests, or extra math classes to bring up math scores on the state exam. For many of the people gathered, today marked the first time they had ever seen a Pit House. For those involved in the construction of the Pit House, it meant a dream come to fruition, a vision for healing begun and a watershed moment in the education of their children.

Introduction

This chapter provides an overview of the Pit House curriculum and discusses the context provided for the students to engage in their lived experiences in the science classroom. The Pit House curriculum was developed to provide students and myself a way to explore specific western science content and engage in a space where issues that impacted the students' experiences as American Indians could be discussed. This chapter starts with a brief history of the project followed by a description of the activities and the correlating state science standards.

Background

In the winter of 2008, I began teaching secondary science at a small public high school on an Indian reservation in the Pacific Northwest. This was my second time to teach there; between 2004-2005, I worked as a science specialist in the elementary school. Shortly after beginning my position in the high school, I was invited by the school's Superintendent to attend a planning meeting between the school district and the Tribe's culture and language office. Under the direction of Mary Whittaker (pseudonym and tribal cultural leader), I learned about their desire to build a culturally sacred dwelling

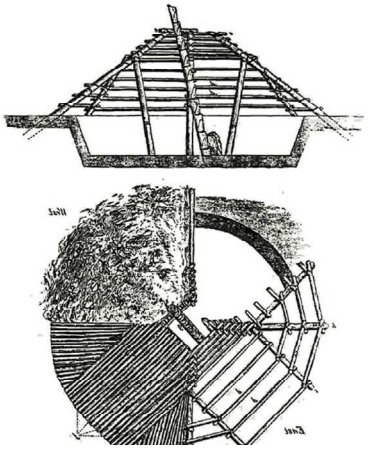

Figure 1 Plan and cross-section of a Pit House built by the Thompson Indians in the Nicola Valley during the 1890s. By Archaeologist James Teit. Courtesy of the American Museum of Natural History

to the Tribal community, the Pit House, on the school campus. Pit Houses are subterranean dwellings made of wood and soil for the roof, creating a well-insulated structure that can withstand the cold of winter, and are well insulate to withstand the hot summers of the Columbia Plateau. The educators and elders working with the Culture and Language Office, wanted to develop curriculum that centered on the Pit House. They had started to develop a children's story for the lower elementary grades about a Pit House and had hopes that once the Pit House was built, it would be a gathering place for learning and community events. Teachers like myself were asked to create lessons that incorporated the Pit House into what we were already teaching. Only 4 teachers participated in the planning meetings. This project became significant because no one in the Tribe had built a Pit House in over two hundred years. In addition, it signified a shift in the relationship between the Tribal community and the school.

Over the last decade, small inroads had been made to improve the relationship between the school district and the Tribal community. In 2004, the school district, the Tribe, and two local universities received a grant to provide professional development for teachers and staff. Summer workshops and encampments conducted for educators and paraprofessionals to learning about the Tribe's culture and history. The desired outcome was for the teachers to incorporate what they learned into their curriculum and instruction. I was fortunate to participate in those summer encampments and used that experience along with my involvement in the information I learned at the planning meetings for the construction of the Pit House to develop the science curriculum, the focus of this study. In 2008, the school district received an Indian Education Demonstration Grant from the U.S. Department of

Education. This grant enabled the school district and the culture and language office to implement innovative and culturally sustaining projects like the building of the Pit House.

One of the key people involved in the project was Sam Beaman, a tribal member and aboriginal architect, who's architectural renderings provided inspiration and a blueprint for the other members of the planning group. In addition, local historian Jack Nisbet, contributed a variety of historical documents written by white explorers and anthropologists (Figure 1). He and Shawn visited my classroom two times in the early stages of the project. Their contributions provided a conceptual framework for what a Pit House might look like, and the Historic Preservation Office with the Tribe provided us with access to a couple of archeological sites where we could see remnants of a Pit House.

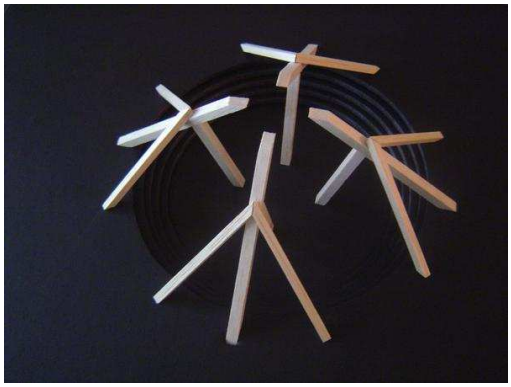

Figure 2 © 2008 ____ (Aboriginal Architect) All Rights Reserved- Contemporary Plateau Pit House Design.

Shawn shared a Northern Plateau [Columbia River watershed up into Canada] style of the Shuwswap [Secwepemc] Pit House because of his father's ancestral roots. Shawn's design provided the blue prints for the construction of the Pit House on the school campus two years later.

Shawn's model (Figure 2), made from balsa wood, reminded me about a common physical science challenge where students build a bridge and then calculate the force needed to break the bridge. I began to configure a lesson where students would learn about forces by calculating the forces needed to collapse a Pit House frame instead of a bridge (see next section and Appendix A for more details).

In 2009, the students and I had the opportunity to visit several Bands of First Nations in British Columbia who were still building Pit Houses. We traveled with several community people, including a couple of elders, the director of the Tribal carpentry apprenticeship program, several high school students and myself. We visited three different communities where Pit Houses were built. In Kamloops, we observed several houses that blended into the grassland environment along the riverbank (Figure 3). These houses were built at an interpretive center where a former boarding school used to operate. Further south, we visited a remote Band in the Okanagan and participated in a gathering in their Pit House. The house there utilized modern amenities such as electricity and was constructed from milled wood. In that community, the house was used for community gatherings, tribal meetings and special ceremonies. Physically stepping inside the Pit Houses in Canada, gave us the insight we needed to finally begin constructing a Pit House on the school grounds.

Figure 3 Pit Houses located on the Kamloops Reserve in British Columbia. Photo by Bree Reynolds

The house was built in the woods in an area used by the school and community for other cultural events. This area was designated for cultural activities in 2005, which was also a significant shift for the community. Prior to that year, Culture Week was organized by school employees and was relegated to a section of concrete behind the school. When Tim Ames took over as Superintendent, he handed over the reigns to the Culture and Language Office and suggested they use the wooded land to the south of the school. A trail through the woods connects the school to the Pit House. The trail continues meandering through the trees

to a sweat lodge by a stream and to the space where meat was dried and cooked every year as part of the school's cultural celebration.

The Curriculum

The Pit House curriculum began in the fall of 2008. The first activity consisted of students examining the dynamics of forces working on Pit House models. As the year progressed, I continued to identify additional science topics that could be taught within the context of the Pit House. The science curriculum I developed embodies the principles of CSP by:

1) Supporting the students in sustaining their cultural and linguistic competence, and;
2) Creating a space for students to simultaneously develop dominant cultural competence (Paris, 2012).

As discussed in Chapter 2, CSP in an Indigenous context must emphasize cultural revitalization (McCarty & Lee, 2014). CSP honors Indigenous Knowledge Systems (IKS) and integrates the intertwined physical, spiritual, emotional and intellectual epistemologies of IKS. In addition to the incorporation of specific cultural materials, stories or ideas, shared group activities and cooperative learning are culturally responsive teaching methods for American Indian students (Ward, 1993). Drawing on recommendations made by Aikenhead (2001), Jegede and Aikenhead (1999), Demmert and Towner (2003) and Gilbert (2011) the Pit House curriculum: 1) motivated students to learn a scientific concept via a cultural, historic and placed based context, 2) involved collaboration between elders, the community and the school, 3) connected the science concepts with traditional ecological knowledge (TEK), and 4) expanded and explored the concepts using scientific inquiry. TEK can be understood as "a cumulative body of knowledge, practices and beliefs, evolving by adaptive

processes and handed down through generations by cultural transmission, about the relationship of living beings with one another and with their environment" (Berkes, 1999, p. 8). A detailed discussion about the students' experiences in the classroom can be found in chapters 5 and 6.

Several overarching or crosscutting western science practices derived from the state standards were explicitly taught throughout the curriculum. These practices included; systems thinking, inquiry and the application of those science practices particularly in the context of experimental and engineering design and the communication of ideas (see Table 2).

Table 2. Pit House curriculum overview and alignment with standards

ACTIVITY	DESCRIPTION	STANDARDS (WA State 2010, v.1.2)	INTEGRATION OF TEK AND IKS WITH THE SCIENCE STANDARDS
Strongest Pit House	Students planned and designed a model frame for a Pit House (9-12 APPB, 9-12 APPC) to examine the potential downward forces on the frame. Students worked collaboratively to test and revise their models of the Pit House (9-12 INQF Students reflected on the results of the experiment explaining their results (9-12 INQC)	9-11 PS1C An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. 9-11 PS1E Whenever one object exerts a force on another object, a force of equal magnitude is exerted on the first object in the opposite	The typical science inquiry lesson for these science standards would be for students to design and build a balsa wood bridge. The students would then test the strength of the bridge and explore the forces at work. Building Pit House frames created a cultural context that allowed students to perceive the western science within their worldview. They reflected on the Indigenous knowledge that informed their ancestors' engineering

	Students communicated their results through posters they developed (9-12 INQG)	direction (Newton's Third Law of Motion)	and design process. Traditional Ecological Knowledge informed the student's decision-making process as they considered the physical properties of different types of wood and traditional uses for each wood type.
Insulated Pit Houses	Students planned and designed a model of a Pit House using different materials for insulation (9-12 APPB, 9-12 APPC) Students used the model of a Pit House to investigate the role of insulation materials in modifying the transfer of energy in a system (9-12 SYSC)	9-11 PS3A Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system is constant and can neither be created nor destroyed (Conservation of Energy) 9-11 LS2A Matter cycles and energy flows through living and nonliving components in ecosystems. The transfer of matter and energy is important for maintaining the health and sustainability of an ecosystem.	Indigenous knowledge systems and TEK in this learning context include personal and collective knowledge of how other organisms in nature build shelters that incorporate natural materials for warmth, camouflage or strength. Badger holes, coyote dens, and bird's nests). The Pit House represents a built environment that can be related to modern efforts to build ecologically sustainable and energy efficient homes. The students can relate the IKS and TEK to the western science concepts.
Tensile Strength of Indian Hemp	Students generated questions about the tensile strength of rope made from Indian Hemp (9-12 INQA) Students designed experiments to test the strength of the rope based on	9-11 PS1C An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force.	A variety of plant fibers were used to make rope for specific purposes. The type of plant used depended on its function. IKS and TEK includes knowing what types of plants would be used for wet environments (fishing weirs or nets) or dry environments (lashing branches

	specified variables (9-12 INQB) Students communicated their results by writing a formal lab report (9-12 INQG)	9-11 PS1E Whenever one object exerts a force on another object, a force of equal magnitude is exerted on the first object in the opposite direction (Newton's Third Law of Motion)	together in a frame). Additionally, the steps for making the rope are also part of IKS.
Ecology of the Pit House	Students generated and evaluated questions about plants in the ecosystem around the Pit House (9-12 INQA) Students planned and conducted a field experiment, using transects on the roof of the Pit House, evaluating which types of plants are ideal for that system (9-12 APPB, 9-12 APPC) Students examined the interactions of light, water, slope, soils and plants in an ecosystem (9-12 SYSC) Students analyzed and reported their results to help the school in making decisions about what types of plants to grow (9-12 INQB)	9-11 LS2E Interrelationships of organisms may generate ecosystems that are stable for hundreds or thousands of years. Biodiversity refers to the different kinds of organisms in specific ecosystems or on the planet as a whole. 9-11 LS2F The concept of sustainable development supports adoption of policies that enable people to obtain the resources they need today without limiting the ability of future generations to meet their own needs.	IKS and TEK inform the placement and design of the built environment. The Pit House blends into the ecosystem and is made out of materials found within that system. Regionally, the house may vary in design based on the geological constraints (soil type, rocky soil etc) and raw materials for building (e.g. vapor barriers made from buckskin, needles or bark).

Replacing the bridge building activity with the Pit House frames allowed students to see the relevance of their cultural experience and Indigenous knowledge with the Western science standards they were learning. Cajete (1999) and Kawagley, Norris-Tull and Norris-

Tull (1998) discuss the conflicting juxtaposition of Indigenous worldviews and positivist Western scientific perspectives espoused in the National and State science standards. TEK becomes a critical component of bridging these two worldviews, enabling students to learn the science concepts while validating their cultural identity (see Table 2 for comments about the intersection of IKS and TEK with western science).

The curriculum consisted of three physical science activities and one biology project, spanning 9th and 10th grade. In 9th grade, the students engaged in two engineering and design challenges where they had to create models of the Pit House to examine the concepts of force and motion and the transfer of energy. The first model consisted of wooden dowel frames and the second model used paper Mache` and insulation material of the students choosing. The third activity in 9th grade consisted of students making rope from Indian hemp and testing the tensile strength of the rope. In 10th grade, students enrolled in Biology. In that class, the students evaluated the ecological landscape where the Pit House was built. The students developed field studies where they used a transect of the roof to test which types of native plants would grow the best in the soil on the roof. Each of these activities is discussed in more detail below.

Figure 4 Archaeological site of a Pit House. Photo by Bree Reynolds

Strongest Pit House

As a way to introduce my 9th grade physical science students to the history and culture of the Pit House, I took class on a field trip to visit archeological Pit House sites (Figure 4). Tribal members and employees of the tribal Historic Preservation Office organized the field trips. Several elders and staff from the Culture and Language Office also accompanied us. We also visited the woods near the high school campus, exploring the site where the Pit House would be built. Our field trips and visits to the physical location of the Pit House created a place-based context for the assignment. I asked students to note the types of natural materials used in the construction of the houses as well as the size, orientation, and location. I asked the students to visualize the structure in tact and in use by their ancestors. In the classroom, the students referred to several historic documents provided by Jack Nisbet as well as the architectural models Sam Beaman provided. I instructed the students to refer to these resources as well as their observations at the archeological sites to design their Pit House models.

The students were instructed to calculate the total mass of books and converted the mass into Newtons. I gave the students a set of questions to answer as a formative assessment of their learning. Figure 5 lists the questions students were asked. The students were able to demonstrate their conceptual understanding of the concepts in their answers. This came up in the interviews as well when students were able to recall specific concepts such as Newton's Laws of Motion.

1. In terms of the Pit House frame, explain when the forces were balanced and when they were unbalanced.

2. Newton's second law of motion states that the amount of force required is directly related to the amount of mass. Justify how this law applies to the frames that were built, the type of wood that was used, and how the mass was spread out or distributed through the frame (think about the physical structure and what parts of the frame helped distribute mass more evenly in an upward direction).

3. If a 100lb student stands on the frame and nothing happens, is work being done? (Think about the definition of work, is the frame moving?)

4. Reflect back to the lab where we determined the amount of force required to break different samples of wood. Which types of wood required more work to break?

5. Apply Newton's First and Third Law of motion to justifying why the force of gravity and the force of the frame are balanced.

6. Work can be described as the amount of force required to move an object a specific distance. Explain the relationship between force and work and the Pit House frame. We didn't measure how tall the models were, but what direction did they move?

7. If a Pit House was 0.25 meters tall and 1000 Newtons were required to collapse the frame, how much work was done in Joules?

8. Imagine the transfer of energy in this experiment. From what objects did the energy transfer? Draw a picture demonstrating this.

Figure 5 Reflection Questions from the Pit House Curriculum. These questions provide a formative assessment of the students' mastery of the science concepts taught in the unit.

The students were then asked to produce a poster display of their model and their results using Power Point. The students were given time in class to develop the displays. These posters were displayed in the school. I used the poster displays as a final cumulative assessment of the project. Figure 6 provides an example of the poster displays students created to demonstrate their learning about balanced and unbalanced forces as well as to report their findings from the design challenge. The students and I used a rubric to evaluate their learning during this unit. See Appendix A.

Insulated Pit House

The second physical science activity explored the transfer of energy in a system. I gave the students another engineering/design challenge. They had to design a Pit House model that would insulate a cup of ice cubes. The students used paper Mache` to create the body of the Pit House and then they were invited to select whatever types of materials they wanted to use as insulation (Figure 7). I provided an assortment of items including fabric scraps, bubble wrap and Styrofoam. But the students were allowed to bring in materials from home as well. Once their models were built, an 8-ounce cup of ice cubes (10 each) was placed under the model. We used Vernier temperature probes to track the change in temperature inside the models by inserting the probe through a hole in the top of the Pit House model. After 20 minutes the students used graduated cylinders to measure the amount of melt water in the their cup. I created a spreadsheet in Excel and projected it on the screen in the classroom. The students reported their results to the class and they used the class data to evaluate the efficacy of their insulation compared to others.

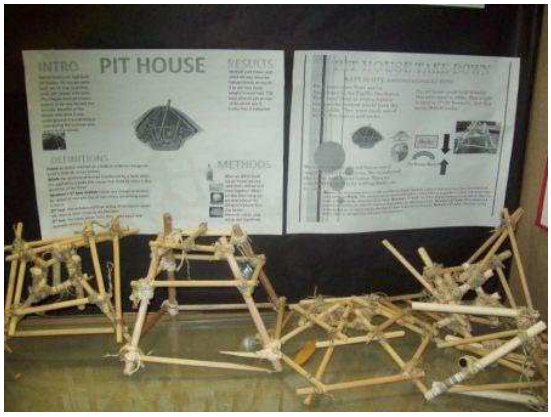

Figure 6 Poster display made by a student and Pit House models after they've been collapsed. Photo by Bree Reynolds

Figure 7 Models of Pit Houses utilizing different materials for insulation. Photo by Bree Reynolds

The students then used computers to write up a formal lab report for this experiment. The students illustrated the transfer of energy in the Pit House model. They were asked to reflect on the insulative properties of soil and why building a structure into the Earth would help minimize the transfer of energy in the house. The students displayed their models and their reports in the window display outside of my classroom.

Ecology of the Pit House

In 10th Grade Biology, students learn about ecosystems and the interactions of living and non-living matter in that system. Pit Houses are built to blend and fuse with the environment. They were traditionally built from timber found near the site of the house and plants would re-establish themselves on the soil roof, providing stability for the soil. The students and I visited the Pit House once it was built and examined the ecosystem around the structure. We documented which types of plants were growing there and used a local field guide to identify the plant names. We documented sun light, tree cover, water sources and the characteristics of the soil. We also examined plant structures and discussed the types of plants that would be best suited for the roof of the Pit House (i.e. root structure and depth of soil, shade versus full sun plants, plant height, growth rate). The students divided the roof into several wedges, marked off with string. Each wedge represented a transection of the roof. The students selected plants to grow in their transect. A local native plant nursery provided plant starts for the class. Once the plants were established, the students went out in the field every couple of days to monitor the growth of their plants. At the end of a 3-week period, the students reported their results with the class and they made a collective decision about what types of plants would work best on the roof in that environment. These plant

types were given to the Culture and Language Office as a reference tool for maintenance of the house.

Summary

The Pit House project inspired me to create a learning environment that was culturally sustaining. What started as a single lesson in physical science continued to grow and evolve over time. My involvement in the Pit House project and the enthusiasm for the curriculum motivated me to develop additional learning opportunities that modeled CSP. In biology and chemistry, students learned about macronutrients by qualitatively analyzing traditional foods for proteins, carbohydrates and fats. Students in all of the science courses I taught were expected to complete a research project of their own design. They worked in teams to develop research questions and to plan their investigations. Students were given the choice of picking topics that applied science to an issue or problem with cultural significance. In essence, I afforded students the opportunity to create their own locally relevant knowledge (Davidson-Hunt & O'Flaherty, 2007).

Several students researched the presence of parasites on trout in a local lake and partnered with the Tribal Department of Natural Resources (DNR) to collect their data. Another group of students analyzed soil, water, plant and macro-invertebrate samples for heavy metals contamination along the river and its tributaries on the reservation. We partnered with faculty at Gonzaga University and Tribal DNR to conduct the stream and river studies.

I created a learning environment where students could answer questions about the meaning of phenomena they were studying as well as questions about the structure, function and mechanics of the system they were studying For example, in some communities in the

Columbia Plateau, Pit Houses are oriented so the door faces the nearest body of water. From a Western perspective I immediately thought about the door's orientation in terms of pragmatism and wanting to build with convenient access to water. For the tribe that built those Pit Houses, water is representative of the source for life. From a Western perspective, the draw down of water on a reservoir poses questions about economic costs, fisheries viability, irrigation for farming and utilities. For the Tribe, the draw down of water threatens sacred burial grounds flooded by the dam, and poses an environmental health risk as heavy metals in the sediment become airborne in the wind. Deloria (1999) writes about the importance of the relational questions within an American Indian learning context. Asking 'what does this mean' is counter to how Western science frames questions reflecting an epistemology that "the world is constructed to serve [human] purposes" (p. 134).

Testing the physical forces acting on the Pit House was a variation on the traditional "strongest bridge" assignment commonly used in physical science classes. Replacing the bridge building activity with the Pit House frames allowed for students to bridge their understanding of Indigenous knowledge with the Western science standards they were learning. Cajete (1999) and Kawagley, Norris-Tull and Norris-Tull (1998) discuss the conflicting juxtaposition of Indigenous worldviews and positivist Western scientific perspectives espoused in the National and State science standards. "You had out kids out there using instruments, doing things that benefit culture." (T. Ames, personal interview 2012). TEK was a critical component in giving students an opportunity to unite these two worldviews, giving them opportunities to learn while honoring their cultural identity. In Chapters 5 and 6 I examine the student experiences in more detail, analyzing the findings from the student interviews, discussing the themes that emerged during the interviews. In

addition, Chapter 6 provides discusses the practical and theoretical contributions of this study in relation to CSP and science education.

Chapter 5

Findings

This chapter provides an analysis of the experiences of the students who participated in the Pit House project. The findings emerged from the data compiled during the project as well as from the delayed interview process. The results analyzed in this chapter used the frameworks articulated by CRT and TribalCrit. The CRT lens provides a framework for critiquing the educational experience of the students from a racialized perspective, recognizing the realities of institutional racism in the school as well as the participants' experiences with racism. TribalCrit takes the analysis a step further, examining the dual status of American Indian students as having a sovereign politically recognized Indigenous identity as well as a racial identity.

The chapter begins with an overview of the themes identified through analysis of the data collected in this research. The common themes emerged from both the early and later interviews, while further insights and nuanced perspectives were shed through the delayed interviews, occurring two years later. These themes provide a framework for a more detailed discussion about implications for the education of American Indians students and future research that follows in Chapter 6. The central themes are presented through a visual framework using the Pit House.

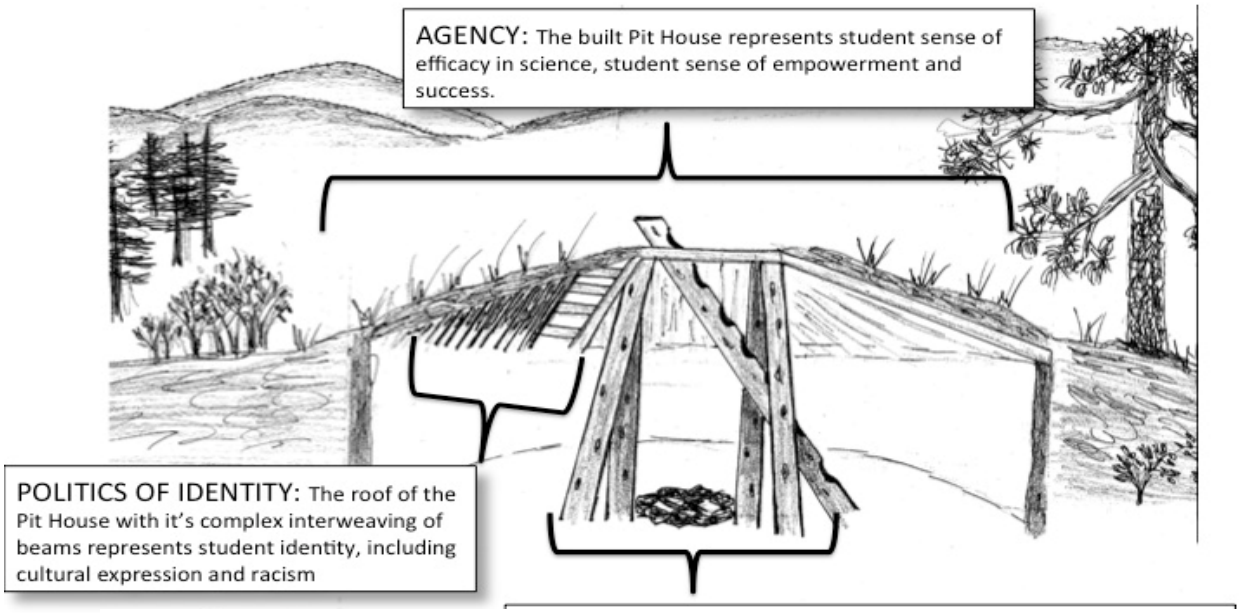

Figure 8 Illustration depicting the Pit House as the framework for examining the themes that emerged from the interviews.

Three over-arching themes emerged from the interviews and other artifacts (a) personal connections to family and community, (b) politics of identity, and (c) sense of agency. These broad themes and their inter-related sub-themes are summarized in the visual framework above (Figure 8). The Pit House represents the theme of agency as a completed structure with strong pillars and walls for support, built to completion and used by the community. Within agency, three sub-themes fall under this overarching theme 1) sense of efficacy in science and math, 2) sense of success as defined by the student, and 3) student's personal voice emerged. The roof of the Pit House, with its spanning cross pattern of timber and complex layers, represents the theme of politics of identity. This theme informs the students' sense of self-efficacy and agency. Within politics of identity, two sub-themes cultural expression and race are represented. Finally, the cardinal posts represent personal connection to family and community. These posts bare the weight of the structure and provide critical support. There are typically four posts in the center of a Pit House, acting as the load bearing beams for the structure. Four sub-themes, 1) family, 2) ancestors, 3) life off and on the reservation, and 4) culture as it relates to family and community emerged.

The themes identified were based on their prevalence within the interviews alongside the artifacts gathered during the sacred mapping and journaling exercises and on the student responses to the surveys. The participants' stories are interconnected, and the themes are interwoven with each other. It is within this wider account that the true complexity of the phenomenon and the inter-connections that exist between each of them is captured.

The Pit House curriculum created a space for students to apply Western Modern Science (WMS) and Indigenous Knowledge to learn about the interactions of forces and matter and to solve a design challenge, to build a scale model of a Pit House. Aikenhead and

Jegede (1999) explain that cultural border crossing in science occur when a) teachers act as cultural brokers or travel agents, making the transitions between the different worldviews explicit; b) employ interactive and culturally responsive teaching strategies, and c) centers the curriculum around the cultural context and Indigenous knowledge of the student. The Pit House curriculum encouraged cultural border crossing by affording students a space to explore physical science and engineering concepts in the context of a culturally sustainable design challenge.

The Cardinal Posts: Personal Connection to Family and Community

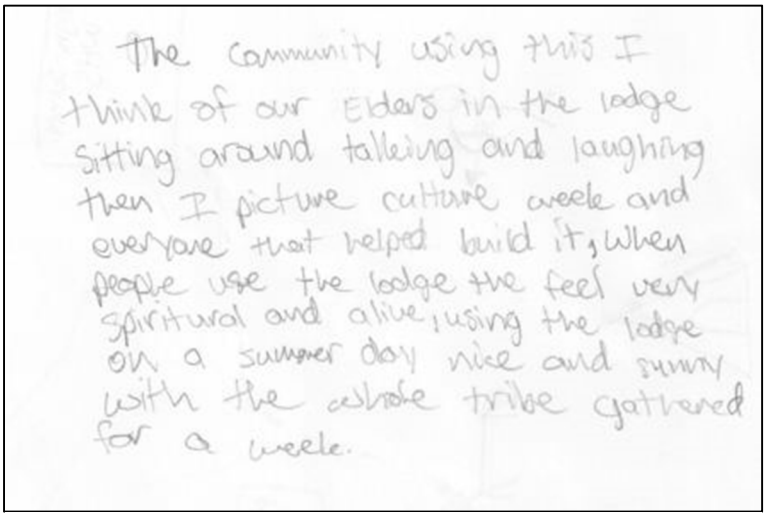

Figure 9 Sample of student writing during the sacred mapping exercise in the Pit House.

For a Pit House the cardinal posts carry the brunt of the forces acting to hold it up; the strength of these beams and their significance are critical to the structural integrity of the Pit House. Similarly, the student's connection to family and community was critical to his or her sense of agency, both academically and personally. One of the stronger themes to emerge from the interviews involved the way the students related their life and learning experiences

to family and community (see Figure 9). This theme emerged across all data sets including the sacred maps, the sharing circle and in the individual interviews. One of the students noted the connection of science to her ancestors writing, “People will be inside the real one (Pit House), so knowing the forces on the roof is important.” She went on to say that the inclusion of culture:

> *Makes science more interesting and more important, because I am learning about what my ancestors did. It makes me think about how hard it would have been to build a Pit House when they were originally built. The Pit House is special to people.*

The centrality of culture in family and community interactions, and the honoring of ancestors as part of those interactions define the theme of personal connection to family and community. Student connection to family and community influences their lived experiences, their view of self, culture, and the world and how they perceive life on the reservation. Additionally there is a potential tension between family/community and the students’ pursuit of college and career.

Connection to Community and Family

The participants were led through a visualization and reflection exercise while

Figure 10 Sacred Maps made by the student participants.

visiting the Pit House. They were asked to create "sacred maps" illustrating the Pit House and its surrounding environment (Figure 10). They also wrote brief reflections about their maps. A majority of the students included the surrounding mountains, forest and stream in their illustrations. This was striking because it indicated a sense of place and connection to the land that reached far beyond the confines of the school property or the immediate vicinity

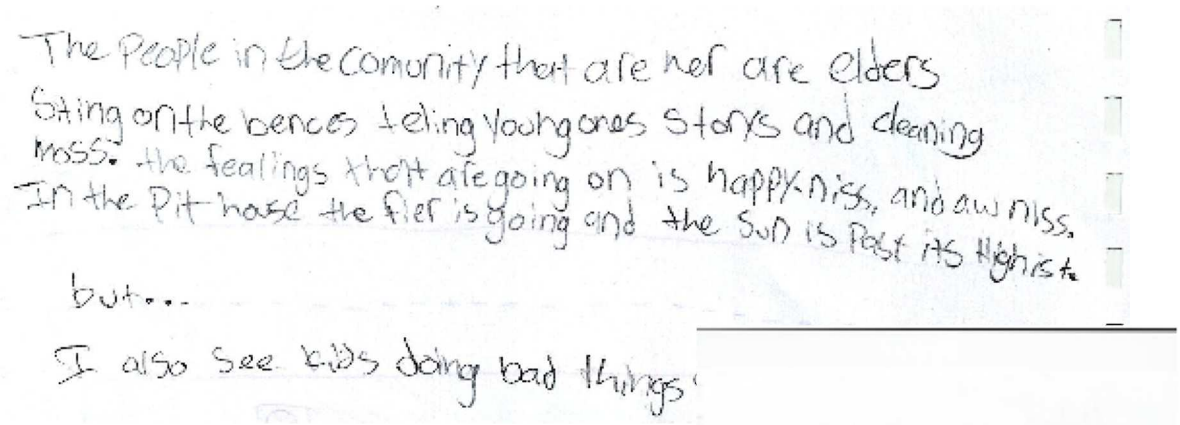

Figure 11 Sashia's reflection about her sacred map of t

Figure 12 Marshall's sacred map depicting hide tanning.

of the Pit House. They included culturally significant and ecological aspects of that place, drawing animals such as deer, elk, and salmon. Several of the students drew cultural or community activities happening inside or near the Pit House. Sashia wrote about elders telling stories or cleaning moss inside the Pit House (see figure 11). Marshall drew a picture of a deer hide being dried and tanned (Figure 12). Kaia and Jennifer drew their family members. Several students also included images of their community members dancing in regalia, drying meat or using pits to cook food. Kaia included a drum circle, referencing actual people in the community, imagining specific people in that place. Kaia also included an outline of the reservation boundary and referenced other landmarks in the community such as the school and the local grocery store (see Figure 13). Alan included a picture of a tipi as well as someone hunting using a bow and arrow.

Figure 13 Kaia's sacred map depicting community use of the Pit House.

Doug expressed how the Pit House related to community and family when he wrote, "the Pit House symbolizes more than just wood piled on top of each other. To me it symbolizes tradition and family." Sashia and Jennifer wrote about how much time it must have taken to build Pit Houses and they both wondered about the stories that must have been shared and passed down. Alan expressed a desire for the new Pit House to be used for council meetings and for morning circles, where the school gathers with elders and community members to participate in traditional songs and prayer. We used to have morning circles at the start of the school week. He also said:

> *We have been veering away from what it really means to be a tribe. We used to be one big family, everyone caring for each other. Now it is just about politics. There used to be other gatherings other than the powwow.*

Honoring ancestors

Kaia said the project made her think about her ancestors. She thought her ancestors "probably felt more stress because they actually had to live in the Pit House." I asked her what she meant and she explained that they would have to worry about what type of materials to use so the house lasted through the winter, and they would have worried about the roof collapsing while people were in it. Marshall's map of the Pit House included a

picture of a deer hide, drying in the sun. In his reflection after the sacred mapping exercise, he wrote about how the building of the Pit House on campus "shows our tradition never died, and we are trying to keep it alive." He also noted "it only took like three months for the one at school to be built, but it would have taken longer for our ancestors." This is aligned with a comment made by an administrator in the Tribe's culture and language program. She said:

> *We have let ourselves be identified by a race/culture that does not look past the surface of us. We need to get back to looking at our selves from our eyes. We are a beautiful people and we need to realize that again. Someone said our culture is dead, I said no it is sleeping. Assimilation continues through the school system, integration, and the media*.

Doug and Sashia both related their experiences to what their ancestors would have built. During the initial interview, Doug said, "I am pretty sure the ancestors had to build at least two to get it right. They would have to check it as they went to see if it would hold. I bet some collapsed." He thought the actual Pit House was cool and important because it was "part of our culture and finally meant something other than powwows could be used to celebrate culture." Sashia was happy "our school was making something that everyone would be able to use and benefit from."

Their comments about the Pit House and its connection to family and community reflect what Beaulieu (2006) says about schools and teachers needing to incorporate community values and goals into the curriculum. The school must not simply develop congruent social linguistic approaches to effectively accomplish academic content in the learning of students but must incorporate into its purposes and goals those values of the

community for the continued socialization and education of children to adulthood (Beaulieu, 2006).

Life on the reservation

The sacred maps and journal entries reflect glimpses of the participants' lived experiences on the reservation. The Pit House became a pivotal place for cultural activities that are a regular part of reservation life. The maps depicted images of people using the space for activities that the students were personally engaged in such as hide tanning, root cleaning, singing and dancing, and participating in sweat ceremonies.

In the delayed interviews, several students talked about reservation life. In particular, they talked about the challenges in relating what life was like on the reservation and their personal relationships with the reservation. Marshall joined a millwright apprenticeship program that allowed him to work near reservation. Working near the reservation allowed him close access to spend his off work time with his family at home. Kaia and Jennifer shared stories about being the "token Indian" in a class at their respective colleges. Jennifer reflected on how hard it was adjusting to college at first. She was homesick and called her family almost every day. She wants to get her degree and then go back to live and work on the reservation. Kaia was glad to be off the reservation but also struggled with being away from family. She has no desire to return to live on the reservation stating, "I don't like to go to the rez. I don't know, I just don't like it out there anymore. I am happy I got away." I asked her why, and she said it was too hard to see friends and family struggling or wasting their lives away.

Both Kaia and Jennifer were grateful to go to schools close enough to drive home so that they can see their families. Kaia talked about an American Indian Studies course she was

enrolled in and how some of her non-Indian classmates didn't believe her and others when they talked about "life on the rez." She reflected on the experience and said, "It's hard to understand unless you see it." Meaning, that people who have never seen or spent time on a reservation have a hard time relating to the experiences of people who live there. The lives of non-Indians may be so sheltered from that reality that stories about the reservation seem fictional and an exaggeration. Doug and Sashia expressed a desire to leave the reservation for a while but not be too far away. They would be attending universities close to home. Sashia will be at school with Kaia and several others from the reservation. Alan moved to another nearby reservation where he is working at the casino.

When I asked the students about experiences with racism, they all recalled instances where they encountered racism off the reservation, particularly during sporting events. They each saw the reservation as a safe place. Doug talked about how high school was different because everyone was "Native" or they had peers who understood what they were going through because they lived and went to school on the reservation. This ability to relate to the experience of living on the reservation was so important that the school district used to require teachers live in housing provided by the district. That policy changed many years ago, but housing is still offered at a significantly reduced cost as an incentive for teachers to live and work on the reservation.

Travel and worldview

Several of the participating students have had the opportunity to travel in the last two years and reflected on their travel experiences during the delayed interviews. Jennifer traveled to Hawaii with several other American Indian students from her university to learn about Hawaiian ecology and Native Hawaiian culture, history, and other issues. Sashia

traveled to London with a student exchange program, while Doug visited New York City with a Native student college exploration program called, College Horizons. All three of students talked about how much they loved seeing other parts of the world and learning about other cultures. Sashia shared that her trip to London was amazing and she wants to travel more, but knew she would never be able to live away from home. She talked about being the only Native on the trip. I asked her to share her experiences.

College, Career, and Life

All of the participants have graduated from high school. Jennifer, Doug, Kaia and Sashia all plan on pursuing STEM related professions. All but one is where they hoped to be when I interviewed them the first time, over two years ago. At that time, everyone but Marshall and Alan had expressed an interest in going to college. Jennifer is the farthest from home, attending a school about two hours away from the reservation. The rest are attending school or working in nearby cities or towns within about 45 minutes from their homes.

Marshall knew early on that he would go into the millwright apprenticeship, although I didn't know that was his goal until I asked during the interview. I see this as a failure on my part as an educator. I knew this student for several years and still missed knowing who he was or what he valued. Marshall told me during the delayed interview that both his father and uncle were millwrights. When he was in middle school, the class visited the Grand Coulee Dam and he saw first hand what his dad and uncle did for a living, he decided then he would follow the same path. In the delayed interviews, I asked him if he could think of incidents at work where he had to use math, science, or engineering skills. He talked about how they are retrofitting components of the dam that are over 60 years old. There are no manuals and everything has to be assembled from scratch. Similar to the Pit House model activity, he has

to problem-solve on the job. He has to understand scale and dimensions of the parts, the mechanical workings of the machinery and he has to consider cause and effect when planning which components to replace and how changes to one part might impact the function of another. He expressed pride in his work and that he is contributing to something that makes peoples' lives better (electricity, irrigation for food, recreation on the lake).

While in high school, Jennifer planned to go to college and study science. She was enrolled in AVID (Advancement Via Individual Determination) program, a college preparatory elective course offered at the high school. She was also active in student government. I asked Jennifer what it was like to move away from home and start college in another state. She said:

> *It was scary; I was really scared. I remember thinking oh my gosh, I am leaving home. I am actually leaving home. We got here and unpacked in my dorm, and we were sitting her and my mom started crying because she was proud of me, and she said well [Jen] you made it. When I walked to the car with them, they said, no, go make friends, you are here now. For a while whenever I went home I cried. Being near family comes first but being here I have to be selfish because in the end it will be worth it.*

Jennifer talked about how proud her family was, that she was going to college. Her father worked in a nearby town for a while and they would meet and have lunch together. She said he was always bragging about her to his friends. Her mother and sister are always "bugging her for school gear or trying to borrow my clothes." Her little sister beaded earrings with the college colors and wears them with the clothing Jennifer has brought home. Jennifer almost transferred to Eastern Washington University, which is much closer to home but she decided

to stay at her original school. She said she realized she had a supportive community at her current school and she was offered several scholarships as a returning student. She is actively involved with the Native American Center on campus and has made friends with other American Indian students. When she took chemistry last winter, she enrolled with other American Indian students and they formed a study group and found a tutor. She talked about helping one of her friends who went to school on a reservation where there were no college preparatory science courses taught.

When Jennifer was in high school, she applied for a regional scholarship called Act 6, which would have provided her with a full ride scholarship to either Gonzaga University or Whitworth College. She was devastated when she did not get in. In her last semester at the night, she came to me in turmoil, unsure of her future, we talked about how this was a disappointment but meant some other door would open up for her. She reflected on that disappointment during our delayed interview, particularly thinking about her cousin who had committed suicide while attending Gonzaga:

> *If I was at Gonzaga when Brian died, I would have dropped out. Brian would want me to keep going. It would have been too hard to be there. I know the reason why I didn't get the Act 6 Scholarship. In high school, you said God has a different path for me. I was supposed to be down here and to continue going to school, instead of quitting because something bad happened in my family.*

In the early interviews, Alan talked about going into the construction trade and was debating whether to go to college to study construction management. At that time, as a junior in high school, he was pretty sure college was a distant goal and still questionable. Alan is currently struggling financially. When we conducted the delayed interview, we

communicated via messaging on Facebook because he did not have minutes on his cell phone and did not have access to a landline. He was currently working for the tribal casino and, while he likes his job, he hopes to go back to school someday. He barely graduated from high school and reflected on the lack of direction in his life. In particular, he brought up his "18 money." Many tribes allot money to members when they turn 18. Alan received several thousand dollars and proceeded to spend it within a couple of months. He said the only thing he has to show for it is his truck. He wishes he'd saved some of it or that the Tribe had monitored how he used the money.

Kaia was also a student in my AVID class, I was her teacher for that program for three years. Kaia is in her second year of college now. When asked how her first year was, she expressed frustration about not knowing anyone in college and being used to knowing everyone, as she had in high school. However, outside of her classes, she still connects with other students from her reservation that are also going to the same college. She mentioned that her advisor made sure she connected with other American Indian students as well, which helped with the feeling of isolation. When she was in high school, she dreamed about going to the University of Washington (UW) in Seattle. I asked her if she was disappointed about not getting into or going to UW. She said:

> *I was kind of disappointed about UW, but then I was thinking, can I really move that far away? And my mom is really happy I am closer to home. I see her once a week, we go to Spokane to hang out.*

Kaia is living with her brother, who transferred to her college from Washington State University. She said, "He makes me go to class which is good."

I asked Jennifer and Kaia if they had experiences in college where the professor integrated culture into the curriculum. They both referred specifically to Indian studies courses and Jennifer talked about a research project she was doing for a global environmental issues class. Her professor encouraged her to focus on water issues and salmon recovery on the reservation. Kaia talked about how the Introduction to Indian Studies was her favorite class. The class provided a space for students to talk about life on the reservation.

Sashia and Doug were both finishing their senior year of high school when the delayed interviews occurred. They were also both AVID students and I asked them how the college application process was going. Sashia said:

> *It was a struggle. It was so intimidating, all the words I had to spell correctly in big 2,000 word essays. It was hard and really stressful. After the applications went in, we started to work on scholarships, and that was even more words.*

Doug talked about how much more "serious life was getting." At the time of the interview, he was trying to figure out which college to attend and whether he wanted to play college sports. Like Sashia, he said the application process was stressful. But he also said he felt happy and that he felt like he'd accomplished something applying to five different schools. Doug received the Gates Scholarship and is guaranteed free tuition through Ph.D. or medical school if he chooses.

The Roof of the Pit House: Politics of Identity

The roof of the Pit House is an intricate latticework of wood and other natural materials constructed to withstand the force of over a foot of dirt and potentially several feet of snow. As an expression of identity and creativity, he patterns laid down to construct the roof vary by family and tribe. Similarly, the stories of the students in this study are each

unique and similar at the same time. The students share a common identity as American Indians and their lived experiences are influenced by the politics of that identity.

All of the students share experiences that speak to their sense of identity as American Indian and to the politics of identity. During the initial interviews the students spoke about their tribe, family, and community and how the Pit House project helped them to identify with their ancestors and way of life. They liked how the Pit House project related to their culture and who they are. The delayed interviews provided an opportunity to explore this topic further. The participants were all able to greater articulate their identity as American Indians. Jennifer and Kaia both talked about being the only Indians in class or being singled out by professors because of their ethnicity. They both spoke about enjoying courses where Indigenous cultures were studied but voiced frustration about other students or faculty being ignorant about American Indians. Jennifer was grateful to be at a college with a Native American center and talked about other peers attending colleges further away from home who feel isolated. Kaia talked about how the American Indian studies class she was taking was an eye opener. She reflected on learning about domestic violence and substance abuse on reservations and the legacy of boarding schools and historic trauma.

At the time of the delayed interviews, Sashia and Doug had both recently traveled with student groups but shared very different stories about their experiences as American Indians visiting other parts of the US or world. Doug was with a program specifically for American Indian students while Sashia was the only Indigenous person on the trip. She said the other girls on the trip asked her questions like “do we still live in tipis, and stuff like that. It got really annoying.” In the delayed interviews, all of the students shared stories about explaining or representing themselves in a purposeful way because of ignorance.

Cultural Expression

This study grew out of a desire to examine the power of cultural expression in the science classroom. During the initial interviews, the students were asked about culture and the Pit House projects we did in science. All of the students talked about how they enjoyed the cultural connections in the classroom. Collectively they stated that the Pit House project helped them to connect with their ancestors, to understand more about the ingenuity that went into designing structures like a Pit House. They believed they learned the science better because of the cultural applications; it was more interesting to them. Many of them recalled other assignments where I incorporated culture. Alan said, "It is important to me to have culture in the school because it helps us stay connected."

During the delayed interviews, I asked the participants how they felt about the inclusion of culture in the school as well as what opportunities they'd had to continue expressing who they are as American Indians. All of the participants felt it was important to have culture and language classes in the school, even if just once a week, and they valued classes where culture was incorporated into the curriculum. They all mentioned science, particularly the Pit House project, and the nutrients in traditional food lab. Jennifer talked about how much she valued my inclusion of local environmental issues into the classroom. She appreciated the opportunity to be engaged in research that positively impacted her community.

Alan's favorite class was Current World Issues because so much of it focused on issues American Indians are facing. Marshall and Doug talked about how their US history class brought the Indian side of the story to light. Jennifer recognized this as well when talking about her white peers at college. She presumed they did not get the other side of the

American Indian story in school so they would not know any better. When I asked her who was responsible for teaching them this other story, she wasn't sure.

Sashia and Doug both mentioned the decline in cultural activities in the school and their concern that the pressures of test scores was forcing the teachers and administration to restrict student participation in community cultural events during school hours. They recognized the tension that Lowmawaima and McCarty (2002) describe as the current "Indian problem". Doug acknowledged that the inclusion of culture is "tough to implement in schools because of test scores. I heard our scores are really low. It's tough to integrate cultural stuff when we have to focus on the other school stuff." I asked about cultural material being mixed with the other subjects. He said, " I think mixing the culture with the science class was a great idea, not only because we'd learn how things work in society but also in their culture and how it can be used to solve real world problems." I asked if he meant science related problems or cultural problems and his response was, "both." In essence the rest of America must accept that "despite persistent stereotypes, American Indian people insist on surviving on their own terms, as real human beings, not as celluloid manifestations of a mythic fantasy or as passive and powerless victims." (p. 290)

Beaulieu (2006) speaks about the risk schools take when the values of the school are a mismatch to the values of the community. It was also interesting that they both mentioned their experiences in an anthropology course they took during their senior year of high school. In particular, they both mentioned how the class presented ideas that were counter to their religious beliefs but they felt teacher created a space where it is okay to share their beliefs.

> *I like anthropology; it's different, although it goes against my religion. I have an open mind. I believe in creation and in anthropology we learned about evolution. I*

> *don't know, I believe in the things they say about evolution, like the moths that changed color and Darwin's discoveries on those islands, but I still believe in Creation too (Delayed interview with Sashia)*

Doug had a similar experience in the anthropology class, "I believe in God and in the church and I also believe in science how you can prove something is real. I accept the evolution process because it's been proven and there are facts about it. " They both felt that the teacher was purposeful about not making the students feel that their tribal or Christian beliefs were wrong. Sensing that an opportunity to employ CSP had been lost in that class, I asked if they had discussed Kennwick Man or other conflicts between Indigenous communities and scientists. Doug said Kennewick man he was mentioned briefly in the context of human evolution and migration. Sashia said they each researched a tribe when learning about human habitation of North America, "but" she added, "We didn't get to learn about our own tribe, so it wasn't as cool. I asked if they discussed the tension between Indigenous communities and scientists and Doug responded by saying, "only briefly when introducing evolution."

The Kennewick Man is a striking example of the tension and disconnect between WMS and Indigenous worldviews. The Kennewick Man's 9,000-year-old remains were found in south-central Washington on the Columbia River in 1996. For many of the tribes in the region, Kennewick man is considered an ancestor and it was a desecration for the scientists to dig up his bones and study them. For scientists, Kennewick Man held answers to questions about human migration, human evolution and cultural anthropology of North America. While the teacher created an environment where the students felt safe to express their differing viewpoints, an opportunity for creating a culturally sustaining learning environment was lost. The practices of anthropology and archaeology as sciences are at odds

with American Indian worldviews about their origins and treatment of human remains. Kim Tallbear (2007) discusses the intersection of race and indigeneity in the context of genetic research and anthropology.

> *By getting caught up in the scientific debates about the truthfulness of molecular origin stories, we cede intellectual and moral authority to scientists. We enter their territory and give them the opportunity to render our worldviews as untruths, to demean their power* (p. 422).

Sonya Atalay (2006) discusses efforts to decolonize archaeology and asks whether it is a science that can be truly decolonized. Central to that work is the acknowledgement that "Western ways of knowing are not in any way superior or natural-they are produced and reproduced through daily practice. As such, these ways of knowing and understanding the world can be disrupted, changed and improved upon." (p. 300).

When I taught biology on the reservation, I included readings about bio-ethics and the exploitation of Indigenous people. I invited students to debate whether their tribe should develop unique research protocol and human subject review processes. We read, "The Immortal Life of Henrietta Lacks" and talked about the role of racism and colonialism in WMS. Anthropology taught from a CSP lens would include a discussion of the Native American Protection and Repatriation Act (NAGPRA), which was passed by Congress in 1990, as well as legal proceedings from the lawsuit over Kennewick Man and other landmark cases. In particular, the tireless efforts of attorney Walter Echohawk are worth examining. He represented several tribes throughout the US prior to the passing of NAGPRA. In a 1989 People Magazine article, he very poignantly expresses the privileging of WMS and Western education/research over Indigenous knowledge and worldviews:

> If you desecrate a white grave, you wind up sitting in prison. But desecrate and Indian grave, and you get a PhD. The time has come for people to decide: Are we Indians part of this country's living culture, or are we just here to supply museums with dead bodies? (Brower & Putnam, 1989)

Jegede and Aikenhead (1999), in their discussion of cultural border crossing in science classrooms address the potential for cultural violence:

> *When the science being taught contradicts the student's world-view, the tendency is to force the student to "abandon or marginalize his or her life-world concepts and reconstruct in their place new (scientific) ways of conceptualizing. This process is assimilation* (p. 4).

Jennifer and Kaia alluded to being treated like the "token Indian" in some of their classes. Jennifer shared several examples of this, saying, "professors find out I'm Native, and they'll defer to me to ask if their interpretation of Indian culture or life is correct. And I say, I don't know that's not my tribe you're talking about." Quaye and Harper (2007) discuss similar experiences of students of color. They highlight the need for pedagogical shifts in the classroom to avoid the objectification of students as the "native informant", which "disengages these students and does not afford white students the opportunity to challenge their own preconceived notions while striving to learn about differences." (p. 37)

Jennifer and Kaia have positive experiences as well. Kaia's favorite class so far has been an American Indian studies class. She appreciated being in a class where she and others could talk about life on the reservation, about their histories, and issues like historic trauma. Jennifer has taken a couple of science courses with an emphasis on resource management or conservation and in those contexts she's been allowed to design projects that apply what she

is learning in college to her home community. She talked about working with the Department of Natural Resources on a water quality project and about designing a recycling campaign on the reservation. Overall she felt that she had great opportunities to connect to her culture or other American Indians at her university:

> *I feel lucky most of the time. I talked to a friend, and she is going to school in Illinois and she said there is no Native American Center there, that she's the only one. Here, they recruit Native American students. I am lucky to have the diversity, lucky to have a powwow here. We also host Hoopsaloosa, which is a Native American basketball tournament for college students from Washington, Oregon, Idaho, and Montana.*

Kaia also mentioned going to the Native American Association meeting on her college campus:

> *We just talk and get together once a week. They do events like they do a powwow here too. Or they get together with the Mexican American Chicano Association. People just don't get what it's like to be Native American and going to college.*

Racism

The students in this study shared examples of how teachers in the school helped them deconstruct the version of history presented in their US history books. Doug talked about how his social studies teachers taught them that the people who win the wars not the people who lose them write history books.

> *We see it in the books all the time, and we point it out like how the white people are always triumphant, and it doesn't go into what happened to the Native Americans. We know what happened because it's in our own stories, but it's a touchy subject here because the books we use in school don't tell our stories.*

Jennifer also talked about how her social studies teacher taught them about the American Indian side instead of "just hearing the White man's side. Jennifer spoke about encountering people who were ignorant on the college campus:

> *I overhear conversations about Native Americans, about how we get stuff for free and settlement checks and that the government just gives us stuff for free, but there's more to it. They don't understand the cultural loss behind it*.

I asked her if she has ever spoken up when she's heard these comments:

> *I want to be mad and say something to them, but they don't know any better, they weren't taught the other side. Like, Ms. Smith always taught us the Native American side instead of just hearing the white man's side. They've always been taught through the white man's ways, so they don't know any better. During Halloween people were dressed up as Native Americans and some of my friends were offended, but a lot of us were like "they don't know any better, so we just left it alone.*

Then I asked her who was responsible for teaching them:

> *Schools I guess. I don't know. Here we have to take a diversity class. You have different options like Pacific Islander or Native American or African American. I guess it's kind of like everyone should know a little about everyone. But it's the people's choice to take it all in or they can let it go in one ear and out the other. Like culture week in high school. Some people [non-native] say why do I have to do this, it's not my culture and so they sit it out. But they are getting more out of it than they think because not many people get to do that. They get to be a part of our culture.*

Alan also felt that his Current World Issues class was one of the best classes he'd taken for similar reasons. The students benefited from teachers who chose not to participate

in what Ladson-Billings (2003) refers to as a "discourse in invisibility" (p. 4). If not for their culturally aware social studies teacher, the students in this study would have witnessed a silencing and erasure of their stories, contributions, histories, struggles and continued resistance against colonization. For most non-Indian students, American Indians are relics in a museum. "The contemporary Indian rarely emerges in the classroom. At most, our national discussion of American Indians focuses on gambling and alcoholism" (Ladson-Billings, 2003, p. 3).

One of the striking things that emerged from their stories about racism is they all gave examples that took place during sporting events. Marshall talked about a baseball game where a mom from the other team started calling them wagon burners and how the police were called. I remembered this event as well. The mother in question was barred from all home games at that school and our community was leery of playing any away games in that town again. Doug talked about his mom having eggs thrown at her when she was at an away game in high school. He also talked about his experiences during basketball season:

> *When we play in tournaments or season games, you can hear people in the crowd yelling slurs. I always tell the team to let our playing do the talking and when we win that reflects that. It sucks because it's hurtful, and we have to be the bigger person and let it go and walk away.*

Sashia also shared a story from a sporting event:

> *At the last district basketball game, I was taking pictures for yearbook and there were cheerleaders saying that our crowd was being disrespectful and childish and one of them said it was probably because it's one of their kind's things. I felt sad, mad, and ready to fight. I didn't say anything because I didn't want to start a conflict.*

She also talked about her experience traveling to London with People to People:

> *It was hard; they were rich kids and I was the poor native. They questioned me a lot like they were telling me the stuff they knew about Native Americans, but they didn't know much. They asked if I lived in a tipi and was it safe to go to school because of the drugs. None of them had met a Native American before or been to a reservation.*

Alan talked about being in nearby cities for sports in high school:

> *There are a lot of white people and a lot of racist white people just judging because you are a different colored skin or race than them…. The worst would have to be when I was still in school and playing sports like football when we had to go to away games to other schools. There was always white people being racist, not only to us but also to our parents other people there to support our team.*

Kaia brought up the school mascot issue and athletics. Their high school mascot is a Redskin. There is a division in the community about the mascot and the school made national news with the media coverage of the NFL and mascots:

> *People are trying to change it and think it's bad but if you ask a native kid they know what it is but they are proud of it somehow, like I wouldn't change it. The Superintendent did an article about it and everyone is mad about it.*

She also talked about participating in basketball and how other teams were "ugly to our team."

When the students were asked about personal experiences with racism, they all shared stories that occurred during school athletics. Sashia talked about overhearing cheerleaders from another team use stereotypes about American Indians, Marshall and Kaia recalled when a mom yelled racial slurs at the baseball team during an away game. Alan and Doug shared

about similar experiences in football and basketball. These incidents are specific examples of individual racism, or "overt acts of prejudice that are racially based" (Scheurich & Young, 1997, p. 8). Their experiences as athletes represent not only a battle of the fittest and most skilled on the court or field but also a battle against overt racism and stereotyping. Doug aptly reflected this when he said, "When we play in tournaments or season games, you can hear people in the crowd yelling slurs. I always tell the team to let our playing do the talking and when we win that reflects that." The inaction of bystanders in the crowd or the coaches and other team players also represent a form of individual racism, which Young and Laible (2000) refer to as racism through inaction. "One's behavior would also qualify as racist at the individual level if one had knowledge of this racist practice and yet failed to take any actions against it." (Young & Laible, 2000, p. 5). Doug's response to his teammates also demonstrates his sense of agency. He knew they could prove their worth on the court, not only as athletes but also as human beings.

Juxtaposed to the students' stories about racism in athletics is the national conflict about Indian mascots, particularly the increasing tension between American Indian tribes and the National Football League over the Washington Redskins. Ironically, the mascot for our high school was also the Redskin. Within the community, people were divided about the appropriateness of such a mascot. For most of the students, there isn't much controversy at all. This may change for them as they get older, but for now, Redskin is a name they "wear proudly and with respect", as Doug said. Strong (2004) argues that the perpetual use of caricatures of American Indians in sports creates a barrier for full inclusion and acceptance in society. She argues that the removal of the mascots is a "prerequisite for full cultural recognition and participatory citizenship for Native Americans" (p. 79). It is not difficult to

imagine the mixed messages such a mascot might send to non-Indian players and spectators. Kaia acknowledged there was tension around the mascot in her community:

> *People are trying to change it and think it's bad but if you ask a native kid they know what it is but they are proud of it somehow, like I wouldn't change it. The Superintendent did an article about it and everyone is mad about it.*

King and Springwood (2000) argue that mascots such as the Redskin allow non-Indian fans to "play Indian". The negative reaction of White fans to the mascot question sheds light on the underlying racism. LaRocque (2004) found that White students were less likely than American Indian students to see racist imagery regarding school mascots or nicknames as being disrespectful. The American Psychological Association (APA, 2005) has determined that "the continued use of American Indian mascots, symbols, images, and personalities by school systems appear to have a negative impact on the self-esteem of American Indian children" (p. 1)

The students interviewed in this study are proud of the Redskin mascot seeing it as a representation of Native pride. Unfortunately, their sense of empowerment and identity is lost on the White participants in the athletic event. Staurowsky (2007) discusses the identity politics of the mascot problem regarding who gets to claim being Indian and the racial trappings contained in the continued use of mascots that reference ethnic groups. It is striking that the students find pride in and take possession of the Redskin and simultaneously expressed frustration about ignorance they faced off the reservation.

During the interviews, almost all of the students shared stories where they experienced institutional or societal racism. The paradox of the mascot issue discussed earlier, is that the students had positive associations with an American Indian image

connected to their school and reservation but were frustrated about the limited ways others see them. Davis (2002), point out that the stereotypes created by American Indian mascots focus on the past and obscure the contemporary lives of Indigenous people; they misrepresent, distort and trivialize many aspects of American Indian culture, and have a negative impact on American Indian lives. Sashia's story about the girls who traveled to London with her is a great example of this. They asked her if she lived in a tipi and wondered about how dangerous the reservation was because in their mind it was a place rife with violence and drugs. Her encounter with the cheerleaders also reflects a societal racialization and stereotyping of American Indians, as the cheerleaders alluded to the crowds' behavior as "just being their way". Jennifer talked about getting angry on Halloween when White students were dressed up as Indians and about overhearing conversations where non-Indian students were stereotyping American Indians. "I overhear conversations about Native Americans, about how we get stuff for free and settlement checks and that the government just gives us stuff for free". She expressed frustration that they don't understand the cultural loss American Indians have experiences and why financial settlements exist in the first place.

Jennifer recognized that the students were ignorant due to a lack of education and awareness but she was unsure about who was responsible for reversing their ignorance. Kaia shared a similar story about being in an American Indian studies class and having a non-Indian student challenge the veracity of her and other's experiences on the reservation. The ignorance my students faced is a result of institutional racism, which results in a curriculum that reflects the values, histories and lives of the dominant culture, which in this case is White middle class America (Young & Laible (2000). The histories of Indigenous people are ignored in traditional American classrooms.

Constant confrontations with individual, institution and societal racism can take its toll on American Indian students. Fryberg, Markus, Oyserman and Stone (2008), argue that American Indian mascots remind American Indian youth of the stereotyped ways non-Indians view them, which constrains how they see themselves. When exposed to common American Indian images, students felt a positive association with the images but reported lower self-esteem and community worth, and had a lower sense of efficacy to achieve in school or life (Fryberg et al., 2008).

The Pit House Realized: Agency

Agency, or one's sense of purpose, ability, success, or empowerment is represented by the physical existence of the Pit House on the school grounds. Community, family, and culture support it. The Pit House exists because a space was created for cultural expression. This section reflects on the themes that emerged from the student interviews. It examines each student's sense of efficacy in science and math, their sense of their success, and opportunities they've had to be a leader in their community or to express their ideas as young adults.

Student sense of efficacy in science

Research shows that student achievement in science hinges upon educators and schools recognizing the social context of learning as well as the effect of the learner's socio-cultural background (Cobern, 1994; Jegede, 1995; Ogawa, 1986). During the initial interviews, the students reflected on the science they learned during the project.

Jennifer and Marshall were part of the first class to build Pit House frames. During their initial interviews, they both separately recalled Marshall's model being the strongest. Jennifer recalled how she thought it was great that "the class came together to help each other out" and Marshall also mentioned the "classroom effort".

Figure 14 Students trying to collapse the Pit House model using the mass of the textbooks to apply a downward force.

Kaia and Alan were part of the class that used tree branches to build their Pit House frames. They also witnessed the ground breaking for the Pit House on campus at the end of their freshman year. After their freshman year, Alan's grades and motivation began to decline and he barely graduated from high school. Alan was cast as the student that did not care and as someone who never took anything seriously. His comments during the interview, his demeanor when we held the sharing circle, and his map and journal entry tell a different story. He cared deeply about his community and his family. He also demonstrated pride in his Native identity.

Doug also felt it was a "big deal" to see people working together. Doug and Sashia are both about to start their first year of college. Each of them expressed interest in pursuing science related careers when they graduate. Doug is interested in engineering and Sashia is interested in medicine.

Jennifer and her teammates struggled with the assignment, which was a first for her. She said, "I remember being really frustrated because we didn't know how to make ours

sturdy." Jennifer also recalled a major scientific theme of the lesson: Newton's laws of motion and the relationship between balanced and unbalanced forces. She said the Pit House project was one of the "most memorable" for her in science and helped her be "more engaged."

For Marshall, the Pit House project was one of his greatest achievements and one of the most positive memories about science. He said, "My construction skills kicked in. It was easy, it was fun, and it was different." His model held over 150 lbs. of books, without breaking. Figure 11 is a photo of his frame and the books used to apply a force. Marshall ended up asking a classmate, who weighed more than the books, to stand on the frame. He liked science when he was able to do hands-on projects and, not surprisingly, his highest science grade was during that year. Marshall recalled several other memorable assignments, including the mousetrap car and the battery-operated cars. Marshall struggled academically in school but enjoyed classes where he was able to work with his hands. During his interview, he stated that he wished he could have taken more science, that he "missed it."

Marshall and Jennifer also talked about how they went through the engineering process with their frames. Jennifer expressed frustration about not knowing how to make the frame sturdy and how they used books to test the strength of the frame as they built it. Marshall spoke with confidence about the project, "I just imagined the design in my head and I guess my construction skills just kicked in." He went on to say they had to redesign their frame a couple of times because when they tried placing books on the first frame it collapsed. He recalled that "choosing how to use the rope and glue together [sic] to hold the frame together" was challenging but "actually testing it was the most exciting part about it, putting all those books on it [sic]." I asked Marshall about why the models were important or how

they related to the actual Pit House. He spoke of the danger if there was too much weight on top of the Pit House and people were inside when it collapsed.

During the interview, Jennifer said that "knowing it (the Pit House project) is about stuff from home and knowing the Pit House is going to be here" at the school helped her feel more engaged with the project.

Cleary and Peacock (1998) state that in addition to the community and family connections and cultural integration, students need to experience small successes and be engaged in collaborative learning. The Pit House project included multiple opportunities for this to happen. The models built to test forces at work on the frame and the models built to observe the transfer of heat energy were created in teams. Every year, students from one team would observe or assist other teams. Marshall's frame was so strong; the stack of books grew taller than he could reach, so other students assisted him. Alan's frame was so strong, several football players who were spectators, weighed in and stepped on the frame. Following the experiments, the students worked with their teams to develop posters to communicate their results and ideas about the science they were learning. The students were given reflection questions that helped them think about how the Pit House informed them about Newton's Laws of Motion, concepts like balanced vs. unbalanced forces and work. They had to calculate the force of the books, converting pounds into newtons. They applied their learning to current problems in the community. One year record snowfall caused roofs of large retail stores to collapse in Spokane. The students calculated the force of snow on a Pit House roof, factoring in the mass of the dirt on the roof and the surface area, which was the shape of a cone. Success in science depends on the degree of cultural convergence that

students perceive, how effectively they move between the two cultures, and the quality of assistance they receive in making those transitions easier (Aikenhead & Jegede, 1999).

The cognitive experience of border crossing represents a form of collateral learning (Jegede, 1995) in which two or more conflicting schemata are held simultaneously in long-term memory. Collateral learning occurs on a continuum where student worldviews and what is taught in the classroom are either parallel and compartmentalized or secured and converged together. Jegede (1995) explains that parallel schemata are only accessed in the context of school but never in home/community life and, on the opposite end of the spectrum, students hold both schemata in their memory, sometimes using one to reinforce the other, resulting in new conceptions. Jennifer said the Pit House project was one of the "most memorable" for her in science and helped her be "more engaged." For Marshall, the Pit House project was one of his greatest achievements and one of the most positive memories about science. Alan demonstrated ingenuity with the design of his Pit House frame. He chose larger diameter branches for the cardinal posts of the frame and secretly used screws and gorilla glue to secure the posts to a plywood base. All of the frames built by this class, required greater force than textbooks could reasonably provide. We used a scale to weigh several students and then calculated the force based on the total mass of students standing on the frames. Alan stated that he thought the Pit House project was one of his "most fun moments in science." He remembered how cool it was when "all those people (were) standing on it (the Pit House). I think it was me and almost the whole football team and it didn't break!" When asked about the process of building the Pit House models, Alan talked about how his group tried to think about the real Pit House and how their model was similar to it. They had the wood shop teacher stand on their first prototype and it broke. As a result,

they had to go collect more branches to start over with their design. I also asked Alan about other memorable moments in science. He recalled how we made rope out of local plants and tested the strength of the rope. He also mentioned a lesson in Biology when we collected edible plants and analyzed them to determine if they were sources of protein or carbohydrates.

Kaia felt similarly about the Pit House project. She remembered how she and her team built two different models. “The first one was really weak and we wanted to win.” The challenging part was “figuring out how we were going to build it and how big it was going to be.” Kaia remembered how exciting it was to see how much weight the frames could hold. “I remember three people had to stand on ours’ before it broke.” She recalled testing how much force the frames could withstand before breaking.

Doug and Sashia witnessed the building of the Pit House when they were in middle school. The house was dedicated on the first day of school when Doug and Sashia started high school. Teachers, students, parents, elders, community members, and guests gathered to bless the space and to officially dedicate it to the community and the school. It was an auspicious occasion and a symbolic breaching of that proverbial wall between the school and the community. During his interview, Doug recalled how he was certain the project was “going to be a piece of cake” but, after his frame quickly collapsed, he was kind of embarrassed. When Doug was asked about the science behind the Pit House frame assignment, he stated that they were trying to “see how much weight it could hold and how much force until it collapsed.”

Sashia talked about how she remembered seeing the house being built when she was in 8th grade. She enjoyed the assignment and said it was “more interesting” because of the

cultural connection. She also found the assignment easier because "it was hands on." She recalled how her group tested their frame with one book at a time and then redesigned it when the frame wasn't strong enough to hold the book. Sashia also remembered the science. She stated that they stacked books on top, creating a "force pushing down on the Pit House," and "the frame pushed up and it was equal until the frame collapsed. The force of the books was greater, it (the frame) started to crack." She was also able to apply this concept to the real Pit House, sharing that the "dirt on the roof applies a force."

Student sense of efficacy in science beyond high school

During the delayed interviews, I asked all of the participants about what additional science and math courses they were taking or if they could think of examples where they were applying math and science in their lives.

Marshall didn't take any advanced math or science courses in high school, but his career as a millwright requires problem solving and engineering skills that apply math and science everyday. He talked about how they are working on a total overhaul of the old equipment in the hydroelectric dam. They have to refurbish and reassemble the parts without manuals or preexisting components. He mentioned his project being one of the biggest in the Northwest and that it was a big deal:

> *We do a lot of repairs, a lot of the stuff is 40+ years old and you don't really know how to put it back together. It's a learning experience when you take it apart and put it back together again. We end up making a lot of our own tools and figuring it out as you go.*

Sashia talked about building windmills in physics and how the math seemed hard at first but then she got the hang of it. She took chemistry her junior year and anthropology her senior

year of high school. Since I moved, a new science teacher taught these courses. Sashia is planning on majoring in a health care field and was looking forward to taking science classes in college.

Jennifer has been in college the longest and was able to share several examples of her success in science and math as a college student. She's taken Environmental Science 101, Geology, Environmental Science 225 (international issues), and Chemistry. She joked about thinking there was no purpose for learning dimensional analysis in high school and now she wishes she'd paid more attention. She also talked about how she remembered being grossed out when I took her to a creek to collect micro invertebrate samples and how we laughed when she freaked out about a caterpillar on a branch. Now Jennifer wears hip waders and spends a lot of time out in the field collecting samples without any issues. She's been working on a water quality project for one of her classes and partnered with the Department of Natural Resources on the reservation. During her senior year in high school, she won an award for her presentation and research about the potential contamination of culturally significant plants growing near a mining Superfund site. She talked about getting a tutor to help her with chemistry and how she was helping a student who came from a reservation where there hadn't been any chemistry taught in the high school. Jennifer dual enrolled in a college level ethno botany science course her junior year along with chemistry and took AP Environmental Science her senior year.

Kaia is planning on majoring in biochemistry and wants to be a pharmacist. She took Chemistry her junior year of high school but was unable to take another upper level course her senior year due to schedule conflicts. She did continue with math and completed pre-

calculus and AP Statistics. Doug took physics, astronomy, anthropology and genetics his last two years of high school.

Student sense of success or ability to succeed

All of the participants are now leading independent adult lives. They are involved in their communities, are accomplished hunters, dancers, singers, drummers, and scientists. Their lives are filled with friends and family who form a tight nit and supportive community. They are making their way in college or in the workforce. They all seem happy with what they've accomplished and eager for the future. Marshall is excelling at his job as a millwright and loves what he does. Alan likes his job, is living with his girlfriend and is still actively involved in his tribal community. He reflected on mistakes he'd made in high school and right after graduating:

> *My senior year was going good for the first couple of months. I was going to school every day and showing up on time, but then in November I turned 18 and got my 18 money from my tribe. As soon as I got that money I was rarely going to school and when I did it was always late, so for those next three months that's how it was. I fell so behind on everything, all the senior requirements like the senior paper and everything I was doing last minute and doing just enough to pass. So after those three months my attendance was so bad, if I missed another day of school I would not be on track to graduate, so when I was told that, I made school my first priority like it should have been, and showed up every day on time the rest of the year. I did what I needed to do and got all my credits and graduated.*

I asked him what he would change about how 18 money is distributed:

You would get half of it when you turn 18 and the other half when you are a little older, like 21, because having that much money at a young age is nothing but trouble. It definitely taught me a life lesson which money because I blew through my 20 grand like no tomorrow. But it was the most amazing feeling I've ever had to do all that work and to graduate, especially when there were a few people saying I wasn't. It just made it even better when I did.

I was at his graduation and have to agree that seeing him walk was amazing. His class was my advising class. They knew I was flying back home from overseas to see the graduation. Keeping with tradition, I brought cupcakes for my AVID students and was honored when they recognized me in their class speech.

Sashia is living in a house at her college with other American Indian students. She has a learning disability that makes reading, spelling, and writing a challenge. However, her recent Facebook status said, "My English teacher said my paper was one of the best! That's never happened before!!! I love college!! — feeling proud." This speaks volumes to her determination and desire to succeed in school.

Jennifer talked about working with the Tribe on a recycling campaign over the summer. She felt she had accomplished a lot with that project and it influenced what she wants to do in the future:

I got a bunch of younger kids to recycle. If you see little kids out there grabbing recyclables and sorting them it has a bigger impact on people. My boyfriend and his sister helped on their reservation and my little brother and sister helped. It feels good on the inside. I am helping cut back on garbage that is there when people enter the

rez and it changes how the rez looks. It is kind of what I want to do in the future, clean that up and other things too.

Jennifer wants to go to graduate school. She talked about a mentor she had in college who recently passed away in a car accident:

He really opened our eyes, he talked about grad school and he got his graduate degree. We got to see him graduate and walk across the stage. I remember he had that enormous smile on his face. I thought if he can do it I could do it.

All of the students completed senior research projects, which is a graduation requirement in the state of Washington. Several of them talked about their Senior Projects and reflected on what they learned. I could hear their sense of pride and accomplishment when they told me about their projects and what they learned. The details of these projects are best told from the perspective of student voice. Their projects aligned with the concerns and values of the community. Cultural congruence in the classroom helps students become civically engaged in the community and fosters more self-directed learning (Garcia &Ahler, 1992).

Student voice and expression of voice

Throughout the Pit House project and during the interviews I observed the privileging of student voice. I anticipated that this study would create a space for student voice. Several of the students recognized that when I asked what it was like to read the write up of their interviews. Doug thought it was funny to read about himself because he thinks about himself differently than how others might see him. But it "was good self realization." Jennifer had similar comments, she said:

Sometimes I was like wow, did I really say that? That's me you're talking about. Like you coming in and interviewing us and putting it on paper for us to read, no one has ever done that, it was shocking I guess. I guess I also think, wow I've really grown up!

During the delayed interviews, I asked the students about their Senior Projects. Alan wrote a paper about homelessness and helped at a shelter. He met an American Indian man who had a great impact on him:

I learned about how there is a lot of ways people are trying to help the homeless. There actually was a lot of homeless natives in Spokane, but not so much on the reservation because of the help they were getting from families. I interviewed a guy in Spokane down by Dick's, which was pretty cool just hearing about how he grew up and his situation at that time. He said that the only people that would help him were other people on the streets and of course shelters and stuff.

Doug focused on recycling. He went to the tribal council about getting bins to set up a recycling system on the reservation and they are now in the process of implementing a plan for recycling. He planned an event to promote awareness that coincided with Earth Day. He talked about learning about environmental issues in other places like Bolivia and Africa. Sashia researched suicide and made a video about it as an awareness project. She talked to families on the reservation and teachers who knew a lot of the young people who died recently. "I was doing my research paper on it and was looking into it and Native Americans have the highest suicide rates. It kind of repeats itself like a vicious cycle." She talked about a classmate that recently tried committing suicide and said, "People didn't try to talk to her

until after it happened. People noticed she was depressed but didn't ask her if she needed help or anything."

Kaia did her paper on genetic disorders and researched the genealogy of her family. She talked about trying to figure out the history of both her parents' families. Her grandfather was adopted into her tribe but he was born in Canada. "My grandpa and most of my mom's side were in wars and they were in boarding schools too." I asked her why she chose genetic disorders as a topic. She said she was curious because it was a family oriented topic. Jennifer expressed similar interest in high school because one of her brothers had diabetes.

Since starting college, Jennifer's awareness of global environmental issues has grown, particularly regarding the plight of Indigenous populations and climate change. In a Facebook post (Figure 12), she shared a picture of an art installation made by an Indigenous artist and environmental activist. This post stands out among the typical posts about life as a college student and her comments highlight her concern about the environment and her desire to speak out about it. During our interview she talked about working for the Tribe on a recycling campaign. She made a t-shirt about recycling that featured an image of Sasquatch. She said people were always asking for the shirt.

Figure 15 Screenshot of a post on Facebook where Jennifer expresses her concerns and ideas about environmental destruction.

Overall, the stories told by the students through the course of the pit project and subsequent interviews, tell a tale of complexity and empowerment. It was within these wider

accounts that the true complexity of the phenomenon and the inter-connections that exist between each of them is captured. The students identified several factors that aided in their success; staying connected to family and family support, meeting other American Indian students and having faculty, advisors or mentors who could help them, and the ability to deal with the racism and ignorance they faced. Their experiences are similar to other American Indian students (Jackson, Smith & Hill, 2003; Jackson & Smith, 2001; Benjamin, Chambers & Reiterman, 2010).

Researcher Reflexivity

This research project as a classroom curriculum has been a source of growth and reflexive practice on my part as an educator, a student, and a researcher. I reflected on my role in shaping the data collection and analysis process. I did not want my own subjective experiences to bias the students' retelling of their stories. As previously discussed, my own values and professional beliefs as an educator informed the study. I believe the research project was supportive of the students with which I worked so closely.

During the data collection phase, I drew upon my well-established relationships and rapport with the students to create an environment where the participants would feel safe being open and honest about their experiences. I used Facebook to communicate when phone calls or video calls were not possible. During the initial interviews, I was aware that my role as their teacher might have constrained our discussions. The delayed interviews happened after I was no longer teaching at the school and most of the participants had graduated. Our relationship shifted and any concerns they may have had about my role or influence as a teacher were minimized.

The initial interviews were difficult to conduct and felt a little awkward. I struggled to get more than eight minutes worth of dialogue with each student. Two years later, each interview lasted about an hour. By then, the students had matured enough to be able to engage in longer conversations. In addition, I employed new questions exploring topics about race and racism in school in addition to talking about the Pit House curriculum. I have kept in regular contact with a couple of them or have continued contact with members of their families.

I tried to keep my own feelings and values out of the research process. However, I found that in some instances it was helpful to share my own personal stories or experiences as a way to relate to what the students were sharing or to help them continue the conversation. It is possible that the participants continued to speak about the Pit House project in a positive light because they knew it was something I cared about.

The interpretation phase was complex. I attempted to triangulate my findings through review of the student drawn sacred maps and journal entries a number of times to assure I had not missed any images or themes. Also while transcribing the student interviews,, I listened to the interviews multiple times to ensure I fully understood the nature of what was said. It is possible that my interpretations are biased and reflect some aspect of my own thinking and what I hoped to find. From the beginning, I hoped the research would uncover positive attitudes about science and the use of culture in the classroom. When I began developing the curriculum, I had not thought about the implications of this project regarding institutional racism and politics of identity. I struggled with my role as a white person writing about the stories of American Indian youth. I had lengthy and sometimes painful discussions with American Indian peers who questioned my motives and role in the project.

Those conversations and epiphanies lead to more in-depth interviews with the students and new directions for the study. Through a process of re-reading and crosschecking my interpretations with the participants, I believe the themes that emerged are substantiated. I contacted each of the participants to follow up on the early interviews. I gave each student a copy of my interpretation of the initial interviews before conducting the delayed interviews. At the conclusion of writing this chapter, the participants were given a copy to review again. I made contact via email and Facebook, asking for feedback, corrections, and clarification. In some instances, I asked additional questions to clarify uncertainties. I also shared a draft of my findings with several colleagues, which contributed to the cross checking process. These cross checks allowed for another way to interact with the data and identify alternative reflection points.

What is most striking about the findings from this study is the ability of the students, even as young adults, to articulate their ideas and wisdom regarding issues like education and racism. Their ability to contribute to the dialogue grew dramatically between the first and second interviews, which is not surprising. In Chapter 6, I analyze the findings discussed in this chapter, reflecting on how the lived experiences of the students can provide answers to questions about racism, education, and CSP. In addition, Chapter 6 discusses implications for the implementation of CSP in the science classroom and the limitations of this study.

Chapter 6

Analysis of the Results and Conclusion

The purpose of this study was to answer the following question: What are the affordances of a culturally sustaining pedagogical science curriculum for American Indian students understanding of science, technology, engineering, and mathematics (STEM) content, culture, self, identity, and their future? Affordances are operationalized as the specific aspects of the curriculum and/or instructional format that allowed students to perceive 1) the science classroom was a safe place for them to learn and to talk about their lives and culture, 2) their ability to do science, and 3) their sense of success in life and their identity as racialized individuals.

This chapter summarizes the findings and results discussed in Chapters 4 and 5 highlighting the practical and theoretical significance of the study. The three themes of agency, community and family connections and politics of identity are interwoven throughout this chapter. The chapter begins with an analysis of each of the research questions and continues with a discussion about the implications for educators and the education system in the US. The chapter concludes with a discussion about future research possibilities, the role of reflexivity for the researcher and the limitations of this study.

Creating a Space for Dialogue and Learning

The interactions of the students with each other and with the teacher, are influenced by the physical learning environment (Bradner, Kellogg, and Erickson, 1999). I created a learning environment informed by constructivist models for learning. Students worked in collaborative groups and directed their own inquiry into the Pit House models. I began the unit of study with cultural immersion through field trips, presentations by tribal and

community members and group brainstorming. This placed the cultural context at the center of the learning experience. As the students learned the WMS, they were able to apply that new information to their Indigenous knowledge about the world around them. Jegede (1995) explains that students who are able to hold two or more conflicting schemata in their long-term memory are engaged in cultural border crossing. When this does not happen, students often experience cultural violence. The dissonance between their worldview and what is being taught in the classroom can alienate the students from the learning process. During the interviews the students shared a great deal about the significance of the Pit House project for them. They also brought up other assignments where culture or tribal history had been a central theme during their high school years. Sashia and Doug talked about writing about their lives in Language Arts. Several of the students mentioned their US History class and Current World Issues. They appreciated how the teacher infused tribal history and local issues into the course.

Vine Deloria (1999) talks about how the relationship of American Indians with their natural surroundings is "not articulated in a set of doctrines". Nor is it generalizable to all tribes and individuals. Each tribe is a "community of people so intimately related to a natural environment that the natural environment shapes the very way they relate to each other and their conception of the world they live in." (p. 224). Too often, the Indigenous experience and ways of knowing are ignored and degraded in educational settings. Alan's eloquent and articulate insights regarding his tribe and community demonstrate a level of understanding and meaning for him that transcends whether or not he learned Newton's Laws of Motion. In addition, his comments reveal a level of maturity, care and relational connection that would have been silenced if he had not had the opportunity to speak. The wisdom and insights of

Alan and the other students in this study reinforce the value of student voice. These students have unique perspectives on teaching, learning and the experience of being American Indian students in non-tribal public schools. Their sincerity and respect toward the Pit House, the questions I asked and the activities we did, provide a clear image of the positive impacts of culturally responsive teaching.

Student perceptions about STEM and culture

The standardization of education in the United States runs counter to American Indian self determination. Lowmaiwaima and McCarty (2002) argue that the federal government supports self-determination within "safe" limits and that the education of American Indians since colonization has essentially been about standardizing American society. This push for standardization is happening in spite of the research that indicates CSP helps students developed healthy identity formation (Trujillo, Viri & Figueira, 2002), and gain higher academic achievement (Apthorp, D'Amato & Richardson, 2002; Demmert, 2001; Demmert & Towner, 2003, Klump & McNeir, 2005). The students in this study articulated their identity as American Indians and members of a tight knit community with the Pit House being at the center of those lived experiences.

All of the students expressed appreciation for the inclusion of culture in the science lessons and they shared positive memories about the project. When asked if the use of culture motivated them to learn, most of them said yes and they were able to explain why. Jennifer said that "knowing it (the Pit House project) is about stuff from home and knowing the Pit House is going to be here" at the school helped her feel more engaged with the project. The Pit House created a context connected them to family and place not only in the present but also in the past. They were all able to recall some of the science concepts covered in the

lesson as well. This was striking to me as the interviews occurred two or more years after the students had participated in the project.

Social inequity in school and life

It is important for educators to be aware of the conflicts that may arise due to differences in personal and cultural perspectives, linguistic differences and misunderstandings arising from varying expectations of student participation or engagement. It is also essential for teachers to be aware of the colonial and racialized history of the science they are teaching in relation to the student population. CSP can only be effectively implemented as an instructional strategy if attention is paid to the western science, the racialized context of the classroom, and the cultural conventions of American Indian youth in the classroom. If I had only implemented the Pit House curriculum as a tool for teaching the western science without setting aside time for student reflection and dialogue about their culture and it's contributions to their understanding of the physical world, then I would limited the affordances such a curriculum provides for establishing equity in the classroom.

CSP provides a space for counter narratives that speak truth into the racism in the U.S. education system. Cleary and Peacock (1998) note "few articles on teaching American Indian students have addressed the complex and troubling issues that characterize contemporary American Indian education in the context of racism and oppression" (p. 61). The various sources of racism include prejudice, paternalism, low expectations, harmful assumptions, stereotypes, violence and biased curricular materials (Deyhle, 1992; Hickling-Hudson & Ahlquist, 2003; Sparks, 2000).

Brian Brayboy (2005) argues that American Indians are "both legal/political and racialized beings" (p. 428). The lived experiences of the American Indian students in this

study are shaped by their dual status in a colonized world. The participants shared stories that took place both inside and outside of the classroom with the school environment. During the data collection process, the students expressed their deep connection to culture, family and community. Their individual and collective identities as American Indian shaped their experiences as students and participants in society. The students shared common stories about racism on the individual, institutional and societal level. In particular, three common stories emerged; 1) racism in athletics, 2) institutional racism in the school and classroom, and 3) cultural congruence vs. cultural violence

Practical Significance of This Study

The results of this study provide a compelling argument for the integration of CSP in classrooms with American Indian students. Within tribal communities and schools that serve children living on reservations, this method of teaching is essential. The lived experiences of the participants highlight the complexity of educating American Indian youth. The findings build on the existing research and can inform some recommendations for future practice. There are a number of points that have arisen in this study combined with prior research, which suggest that CSP can offer much to help deconstruct the colonial and racist policies and practices that create barriers for American Indian students. In particular, this study provides insight into practical recommendations for the science classroom. These points are listed in below and elaborated on further in this section.

Recommendations for science education in American Indian populations:

- Cultural competency and tribal history professional development for teachers
- Refer to tribal elders, educators as the experts and agenda setters for curriculum development and implementation

- Funded release time for educators to meet with tribal representatives, parents and students to discuss cultural inclusion and to plan curriculum

- Establish a variety of forums for students, parents, educators and community members to explore topics such as institutional racism, colonial educational policies, science education, and student advocacy

- Prioritize the implementation of CSP so that it is not marginalized or considered secondary to test scores and core curriculum. Rather, CSP should be applied to all courses including math, language arts, social studies and science.

- Provide adequate support for CSP implementation to ensure success.

- Modify appropriate pre-service teacher courses and certification requirements to promote the needs of American Indian student and their families and to develop teacher practice that empowers them to use CSP

Curriculum must originate with the community and elders

The Pit House project was successful because it originated with the elders and community leaders/educators on the reservation. They were the experts and agenda setters for the development of curriculum. The Director for the Culture and Language office articulated this well in reference to the teaching of math and other subjects:

> *We have math. The building of our tipis, Pit House and making of arrows, bows etc. took mathematical skills. Maybe not the way the European world sees math through numbers, but we have it and we problem solve, and we have our own science; medicines, foods, etc (*M. Whittaker, personal communication, September 8, 2014).

During the interviews, several of the students lamented about the school setting cultural integration and cultural education to the side. They talked about the pressure the school was under to raise test scores. This conflict is what Lomawaima and McCarty (2002) refer to as the “dilemma of doing Indigenous education”. Schools serving American Indian populations often have to balance meeting the cultural needs and interests of the community over the conflicting demands of high stakes testing and other requirements attached to much needed federal dollars (McCarty, 2002). The research shows that cultural congruence and the use of CSP in the classroom can improve American Indian performance in the subjects assessed with high stakes exams (Apthorp, D'Amato, & Richardson, 2002). When schools employ CSP, student self-esteem increases (Agbo, 2004) and students become more self-directed and politically active (Garcia &Ahler, 1992). Students have a positive impact on their communities (Cleary & Peacock, 1998) and more appreciation for elders (Agbo, 2004).

Place based professional development led by the community

When I started teaching on the reservation, the school district had just begun collaboration with area colleges to develop Tribal language courses for paraprofessionals and summer encampments for teachers and paraprofessionals. The purpose of the encampments was to teach the school personnel about tribal culture and to start a dialogue about how to incorporate culture in the school curriculum. The instructional activities took place outside; creating an authentic learning environment where elder imparted their wisdom in a place-based context that affirmed their Indigenous identity (Goulet & McLeod, 2013). The elders were not there to insert Indigenous knowledge and then leave. They and other Tribal members led the encampment. We learned about historic trauma and boarding schools while we figured out how to build tipi. We heard about personal experiences of American Indians

in school while we prepared deer meat for pit cooking. We learned about the loss of salmon, loss of land from the installation of hydroelectric dams. Conflict continues due to constant fluctuation of water levels in the reservoir and the erosion burial sites and loss of sacred artifacts along the riverbank. Goulet and McLeod (2013) discuss the importance of the inclusion of the politics of identity, the history of colonization and efforts to decolonize as part of teacher professional development.

During the encampments, there were discussions about teaching math through beading, weaving and the construction of tipis. We learned about traditional foods and their preparation. We listened to elders tell stories about their history. These encampments led to regularly scheduled meetings between the school and the culture and language office. During those meetings, planning began for the Pit House. This model, wherein teachers are immersed in the culture, collaborating with community members to develop curriculum, and then continuing to work together to implement the curriculum is supported by research in other Indigenous communities (Baskerville, 2009; McGregor, 2014; Tanaka, 2007). My immersion in the tribal culture through that summer program and subsequent meetings enabled me to develop the content knowledge and confidence in implementing CSP in the science classroom. I was also given verbal and financial support from the administration and the community along with continued feedback from tribal members regarding the curriculum. I experienced immediate success with implementing the Pit House project in my classroom, which encouraged me to develop additional modules in other classes that also reflected CSP. This is in line with prior research by Gusky (2002), Nam, Roehrig, Kern and Reynolds (2013) and Starnes (2006).

Pre-service teacher preparation

At the time of my certification process, the state of Washington's diversity education requirements were rooted in the human relations model, involved single group study, and promoted social reconstruction. I took several diversity courses at Gonzaga but they were rooted in a deficit model, portraying students of color or students in poverty as "other". Our role as educators was to understand their culture so we could help them conform to the norm, which was modeled after a white middle class system. There was never any critique of the system or deconstruction of educational policy or history. My experience is typical of most preservice teachers in the US. A review of teacher certification requirements across all 50 states in the US revealed that about half operate from a deficit model with standards that focus on providing academic help to the "other" so they fit into mainstream American society (Akiba, Cockrell, Simmons, Han, & Agarwal, 2010). Many state requirements are ambiguous and fail to promote pre-service teachers' understanding the realities of inequality in schools (Akiba, et. al., 2010).

Teacher preparation programs should follow a model where diversity isn't relegated to a stand-alone class, but is integrated throughout the curriculum. Students need multiple exposures to diverse teaching audiences and opportunities to see CSP modeled as well as opportunities to successfully teach using CSP.

> *Human beings are products of the society into which they are born, but they are also actors who bring institutional relationships to life and hence have the potential for influencing and changing these relationships. Individuals thus contribute to both the maintenance and the evolution of a racist system. In these dynamic interactions lie*

> *the mechanisms for either perpetuation of racism or its transformation (*Derman-Sparks & Phillips, 1997, p. 23)

Many white teachers are not self critical or reflective about their racial privilege (Marshall, 1996; McIntyre, 1997) and programs offering only one semester course in multiculturalism or diversity fail to adequately shift student beliefs or sense of efficacy with diverse student populations (Bloom and Peters, 2012).

White pre-service teachers and teachers already in the classroom, need opportunities where they can critically examine their whiteness and white racial identity (Bloom & Peters, 2012). Bergeron (2008) discusses the need for professional development that involved instructional modeling; strategies for helping teachers understand their role as student advocates, and induction programs that facilitate teachers moving from cultural disequilibrium to cultural responsively. An essential element to this process is patience and forgiveness from tribal members, parents and students, recognizing that the teachers are engaged in a journey of self-discovery (Starnes, 2006). Teachers need to genuinely listen and be open to criticism as well. There were many occasions where I was gently reminded or taught about the differences between my worldview and that of the Tribe. There were also times when I was confronted with anger and mistrust. But I'd had time to examine my racial identity in the context of discussions about race and education (Solomona et. al, 2006), which allowed me to listen and understand that anger and mistrust. Parent-teacher and community-teacher interactions are emotional practices, inseparable from the personal values and beliefs of the people involved in the interaction. In addition, privilege is an "inextricably interconnected" part of the relationships between teachers and parents or the community (Lasky, 2000).

Theoretical Significance of This Study

This study contributes to the theoretical conversation about race, cultural sustaining curriculum and science education. CSP requires that teaching and curriculum support young people in sustaining their own cultural competence while simultaneously gaining access to dominant cultural competence. The curriculum and its implementation are discussed below through a TribalCrit lens (Brayboy, 2005), using the tenets to examine the Pit House curriculum and interactions between the teacher and the students. TribalCrit provides a framework for determining if the Pit House curriculum and actions of the teacher were culturally sustaining versus merely being "relevant" or "responsive". According to Django Paris (2012), terms such as "relevant" and "responsive" fall short in accurately describing the teaching and research founded upon them. Too often curriculum labeled as relevant or responsive fails to authentically center the languages and cultural practices of communities marginalized by systemic inequalities.

Colonization is endemic to society.

As discussed in Chapter 2, the public education system is a colonial institution that continues to marginalize American Indian students. The Pit House curriculum was created to establish an alternative learning experience that privileged Indigenous knowledge over the dominant culture. Consistent use of CSP would be a useful tool for decolonizing the classroom. As the study progressed and students were given a space to reflect and discuss their lived experiences with the Pit House, we transitioned into a conversation about racism.

Schools would benefit from creating structured opportunities for parents, students and teachers to dialogue about racism in the school, about cultural values and curriculum. McGregor (2014) discusses the positive impact of a program where educators became

members of learning communities that included elders and community members. The teachers grew as "allies" of the tribes they were working with and learned how to work more successfully with the communities to develop culturally sustaining curriculum. These conversations can happen informally as well, when teachers are mindful about being present in the community, building personal relationships with families outside of the classroom (Baskerville, 2009). The absence of a welcoming environment in the school and denial of the colonization of the classroom are barriers to community involvement in the school (Madden, Higgins & Kortweg, 2013).

Dominant culture and the desire for material gain.

Even during the development of this dissertation, I was reminded that the white Euro-centric definition of success is not necessarily aligned with the Indigenous definition and that can create tension in a learning environment founded on Euro-centric principles. My mentor in the tribal culture and language office wrote to me in an email:

> *We also need to redefine success from our point of view and not from what others determine what success is. We just buried a friend of mine today who by our terms was a success. She had a home her family and worked hard to feed and cloth them. From the non-native point of view she would have been defined as poor another non-Indian concept. Another European concept is to move away and be somebody, we are somebody even if we choose to stay here* (M. Whittaker, personal communication, September 8, 2014).

Indigenous Peoples occupy a liminal space

This tenet was most apparent in the conversations with students about their lived experiences with racism and in our discussions about their lives post high school. All of the

students expressed a desire to stay connected to family and friends on the reservation and continued to remain active in their community and cultural practices. Yet many of them struggled with wanting to sustain those connections and relationships while forging ahead at college or in a new job.

Indigenous peoples and self-identification

The Pit House reflected a part of the students' tribal identity. The curriculum and the construction of the house originated out of a community desire to establish a learning experience that allowed for students to learn from an Indigenous perspective rather than the dominant cultural perspective. This desire for self-identification is also rooted in Tribal desire for self-determination and sovereignty.

Culture, knowledge, and power

Doug and Jennifer both talked about how they noticed their history books failed to share their Tribal story or omitted the truth about how area Tribes were conquered. All of the students expressed their appreciation for the inclusion of culture in the science classroom and felt the Pit House curriculum was one of the most significant learning experiences for them in terms of the inclusion of culture in the classroom. They talked about how the Pit House helped them relate to the science more and to remember or learn it better. They reflected on how the curriculum helped them connect with their family and ancestors.

The Pit House curriculum privileged their Tribal knowledge and gave them a sense of power in the learning environment. Their connection to family and community and their identity as American Indians is an important aspect of their sense of success or agency. Jennifer continues to relate her learning in college to issues of culture and tribal sovereignty.

In many of her environmental science classes, she writes from the perspective of an American Indian, analyzing environmental issues from that lens.

Stories are not separate from theory

Sashia, Jennifer and Kaia shared powerful stories about challenging stereotypes about American Indians. Jennifer and Kaia both talked about being the "token Indian" in their classes and Sashia reflected on the ignorant questions she was asked by her white peers during her trip to England. All of the students shared stories about experiencing racism in athletics and reflected on the absence of their Tribal history or stories from textbooks. Their stories are powerful testimonies providing evidence of the endemic nature of colonization and the privileging of dominant culture over Indigenous culture.

Theory and practice are connected in deep and explicit ways

My interactions with the students and the development and implementation of the Pit House curriculum reflect the connection between theory and practice. I was mindful of my role as a non-Indian teacher and regularly reflected on the possible tension that could have emerged in the classroom as a result of my representing the dominant culture. The curriculum emerged as a result of me letting the elders and community members to step in as the experts. The Pit House represented a turning point in the relationship between the school and the community because the school relinquished control of the project.

Limitations

The results of this research speak only to the values of a handful of individuals within one community since it is limited to the perspectives of youth and adults in a small high school from one Indian reservation. It would be inappropriate to generalize the findings of this study to other groups of youth in other schools. I provide only one perspective and

interpretation of the data. As explained in chapter 3, the participants acted as collaborators in this project, increasing the validity of the results by confirming the meaning extracted from the interviews.

There is a risk that students' performance temporarily improved or that students were positively engaged in the curriculum during the study because of what researchers refer to as the Hawthorne Effect (Pope & Mays, 1995). In other words, the students may have reacted favorably because they are receiving more direct attention from the researcher rather than as a direct result of CSP. In addition, there was the potential for a power differential between the students and myself as the teacher researcher. In asking students questions about what they liked about the curriculum I may have intimidated them. Or they could have been fearful that their responses would be used against them when grades were posted. It was my intention that in telling the students that their participation was voluntary and was not connected to their grade in science class mitigated these risks. I also believe in my efforts to establish a rapport with my students; they may have felt a sense of comfort to fully disclose their thoughts and beliefs with me. I believe that they saw me as being genuine in my intentions and actions, thus allowing me full access to their stories and perceptions.

The methodology, findings and interpretations in this study should be considered in relation to a number of important limitations. Phenomenological research invites "participants to offer a rich, detailed, first person account of their experiences" (Smith, J., Flowers, P., & Larkin, M., 2010) which was in keeping with the goals of this study. However, lived experiences examined in this study offer only a brief and limited glimpse of American Indian education. The participants may have been more enthusiastic about the Pit House project because of their personal connection with me and their desire to please.

Phenomenological research does not claim to generalize or create grand theories that can be extrapolated to larger populations (Smith et al., 2010), but understanding the essence of individual lived experiences in relation to a phenomenon provides a space for cautious generalizations to be made. An increase in the body of work in this field is important. The participants are still young adults and their ideas about education and racism will shift, as they get older.

The qualitative methods used in this study were chosen because they aligned with Indigenous research methodologies. Phenomenology was chosen because the study was concerned with the essence of being American Indian in a science classroom. The goal of the study was to tell the stories of a small sample of students and subject those stories to detailed analysis, rather than developing broader theories that can be extrapolated to a general population. Clearly, one size fits all curricular and pedagogical models do not work.

I considered a variety of modes of data collection, which may have increased the depth and quality of the participants' narratives. I referred to recommendations by Indigenous research scholars such as Smith (2012), Kovach (2010) and Wilson (2008). I looked at prior studies to identify appropriate strategies for data collection. I used surveys in this study, which I later came to realize were not the most useful or appropriate tool. As a new researcher, I discovered that the surveys would have been more instructive in a context where I didn't already know the students or if I wanted to use mixed methods to collect quantitative data. The surveys did help me to validate my perceptions of the students, but they were not necessary. I used journaling with the students following a visualization and drawing exercise. The participants' journal entries were short and ideally, I would should have incorporated journaling through out the curriculum and then referred to several entries written over time.

Some might find fault in the students gathering in a talking circle, as this is similar to a focus group, which are hampered by group conformity. Focus groups can restrict the personal stories from emerging, but talking circles are culturally appropriate in this context, and story telling in a group context is something the students are accustomed to.

Researcher reflexivity is important in qualitative work. Phenomenology allows for reflexivity throughout the entire research process. I discussed some of the issues surrounding reflexivity in Chapter 3 and emphasized the need for the researcher to be reflexive as a means of understanding my own subjective experiences (Coolican, 2004) and assumptions (Barker, Pistrang, Elliott, 2002). This is important because my personal experiences and assumptions introduce bias when interpreting the lived experiences of my students. The reflexive process involved self-awareness throughout the study and an evaluation of my own values, experiences, preconceptions, assumptions and interests. My personal worldview is likely to have influenced the collection and interpretation of the data (Willig, 2001).

Future Research

There is much to be gained from additional qualitative studies that engage students and educators in a reflective process regarding the lived experiences of students of color in an education system dominated and designed by white people. There are a number of areas where future research could focus attention. Any research examining the experiences of minority populations should use research techniques that honor those cultures or reflect their values. In addition, the research should be mutually beneficial to the participants and the researcher. More asset-based research is needed to counter American Indians being defined as broken, defeated or unable to learn.

This study provided a narrow focus, given the fact that it focused on only 6 students from one small, rural school. In order for the findings of this study to be further substantiated, the lived experiences of other American Indian students in other communities would need to be studied. It would be illuminating to conduct similar research in schools off the reservation that have high populations of American Indian students, or comparing urban and rural populations. The perspectives of parents, elders and community members are also missing from this study but would provide a different angle on the impacts of CSP in the classroom. Conducting studies at the elementary or middle school level might also provide a different story. Exploring the lived experiences of the students as they age would also add to our understanding. It would be helpful to explore the participants' ideas about culture, race and education after they've graduated from college, have had children or have experienced more in life. Finally, it would be helpful to explore the teacher experience, particularly regarding teacher motivation in incorporating CSP, teacher efficacy and comfort with CSP, and professional develop of teachers using CSP.

Conclusion

The predominant focus of research regarding American Indian students and education has focused on curricular interventions and teacher preparation, however there is a need for research that examines American Indian education from a CRT or TribalCrit focus. The contributions of this study can be understood from both a practical and theoretical perspective. This study contributes to the emerging research literature by examining the lived experiences of American Indian students in a science classroom. In essence, this was a study of people living in tension between two cultures and worldviews.

The findings from this study reflect the results of similar studies in education, but have added further depth to some of the reported findings within the literature. The findings from this study demonstrate that CSP in the science classroom creates a context for American Indian students to be more engaged in the learning. In addition the use of CSP creates a space where students and teachers can deconstruct institutional racism and colonial policies in education.

The participants broadly experienced a sense of connection to culture and pride in which they were as American Indian students. They had positive accounts of their experiences in the classroom where culture was a central theme. They also shared common stories about racism, which account for a series of micro aggressions they've experienced in their young lives. I came to understand my students in terms of their resilience, their struggles, their dreams and their values.

The findings from this study suggest several important implications for teacher praxis and curriculum development as well as education research. Teachers, administrators and policy makers need to understand that the politics of identity for American Indian youth play a pivotal role in their success in Western education systems. In addition, ignoring his or her connection to family and community is a recipe for failure for everyone involved. But white educators face many challenges getting to a space where they no longer feel threatened by active resistance to colonial and racial practices embedded in the education system.

I did not simply wake up one day and decide that CSP was important. My sense of agency as a white educator teaching in an American Indian population grew out of years of life experience and training. My commitment to the Pit House curriculum started with a set of values about the role of education as a tool for social change. I saw CSP as a form of

social justice in education and understood that it was just the right thing to do. I'd participated in courses in college that emphasized political economics, social change and impacts of colonization. I was confronted with my privilege as a white woman at a young age. During my teacher preparation, I enrolled in classes where topics of multicultural education, working with families in poverty and transformational leadership were part of the syllabi.

As a new teacher, I embraced opportunities to learn about the culture of my community, to listen to the desires of elders and families and to try and create a space for learning that reflected those desires. I was constantly reflective about my teaching craft and what we did in the classroom. I was also given the freedom to be creative, to take risks and I was trusted with a body of sacred knowledge typically exploited by white people, particularly academia and scientists. This allowed me to be innovative in the classroom and provided me a space to develop culturally sustaining learning opportunities for my students. The Pit House project was a springboard for me developing additional lessons that utilized CSP.

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APPENDICES

APPENDIX A: PIT HOUSE CURRICULUM

Grade Level: *Middle School or High School*

Subject Area: *Physical Science*

Duration: *1 day for field trip and brainstorming; 3 class periods for construction and reflection, 1 day for demolition.*

Technology: *Students use personal blogs to write their reflections on the activity. Smart boards can be used for brainstorming as well as mobile technology for gathering information in the field (photos, texting info) if cell service is available.*

Setting: *in the school and outside*

Strongest Pit House

Summary: Students explore the structure of Pit Houses and examine how models can be used in science to understand different concepts.
Students will examine forces at work on a model of a Pit House to understand the engineering and design of the real structure.

Learning Goals
Students will plan and design a model frame for a Pit House (9-12 APPB, 9-12 APPC) to examine the potential downward forces on the frame.
Students will work collaboratively to test and revise their models of the Pit House. (9-12 INQF
Students will reflect on the results of the experiment explaining their results. (9-12 INQC)
Students will communicate their results through posters they developed. (9-12 INQG)

Materials: journals, markers, butcher paper, camera, wooden dowels (3 different diameters, 1 of each thickness per group, white glue, small hand saws, thin twine, scissors

Making Connections: Students will begin to connect to their ancestor's traditional dwelling as well as the science and technology used to build it. The activity begins with a field trip to a historic Pit House site and concludes with students building models based on their own vision of what a Pit House should look like. This activity draws heavily on student prior knowledge of sweat lodge construction and materials. Following the field trip, students will be tasked with an engineering and design challenge. They will be responsible for designing and building a model Pit House frame. These frames will undergo a force test to examine the forces at work in the Pit House system.

Background: Pit Houses were the traditional dwellings of people from the Columbia Plateau region of the Pacific Northwestern United States for several thousand years. The houses were usually 20 feet in diameter with a domed roof made of timber and insulated with soil and local grasses. The house was usually dug about 3 feet down into the ground, with the entrance at the top accessible by a ladder. The houses were perfect for the climate of the region, providing

Warmth in the winter and remaining cool in the summer. See the student reading materials for more information.

Procedure:
Set up 1 hour. Set up the materials for each group and prepare the slides to show the students the historic diagrams and photos of Pit Houses. Pre-cut the dowels to desired length. Cut the dowels into about 3 pieces per original length of dowel.

During Class.
1) Display the diagrams and review what students learned about Pit Houses thus far in class. Ask the students to identify what types of forces are working on a Pit

House. Explain that they will be building models of Pit Houses and testing the strength of the frames by placing pre-weighed text books on the opt of the frames until the frames break.

2) Have the students plan a design for a Pit House frame. Once they've completed their design plan and you've approved it they can have their supplies.

3) They are allowed to use as much twine and glue as they want but no other materials will be provided. Several days will be needed to build the frames. Be aware of students who choose to do trial runs with their frames and ask them probing questions about the design process and changes they are making based on observation.

4) Once the frames are constructed, students will balance books on the top of the frames to determine the amount of force required to break the frame. This will require teamwork. After the frames have broken, students should complete the reflection questions.

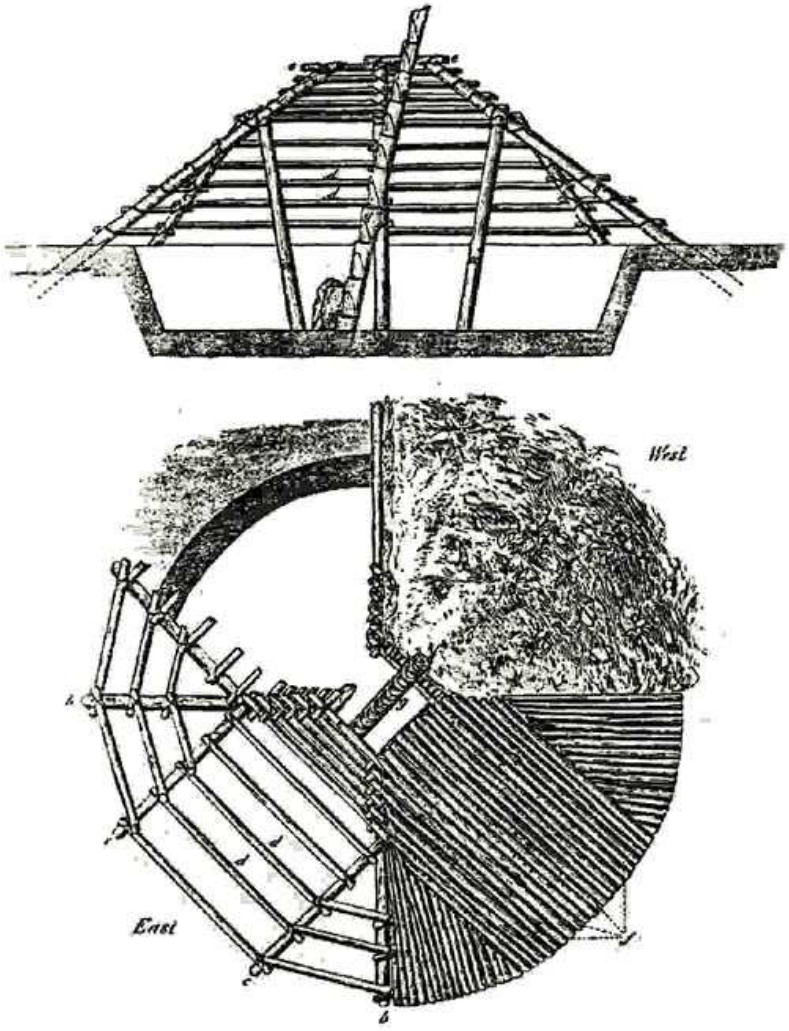
Assessment:
The reflection questions serve as a formative assessment for this activity. In addition, students should complete a formal lab report or poster display.
Students can also complete the student/teacher assessment rubric provided in this curriculum.

Extensions:
Try using branches gathered from outside to build the frames. Relate the Pit Houses to current construction design issues or other challenges like accounting for snowfall and force of snow on a roof.

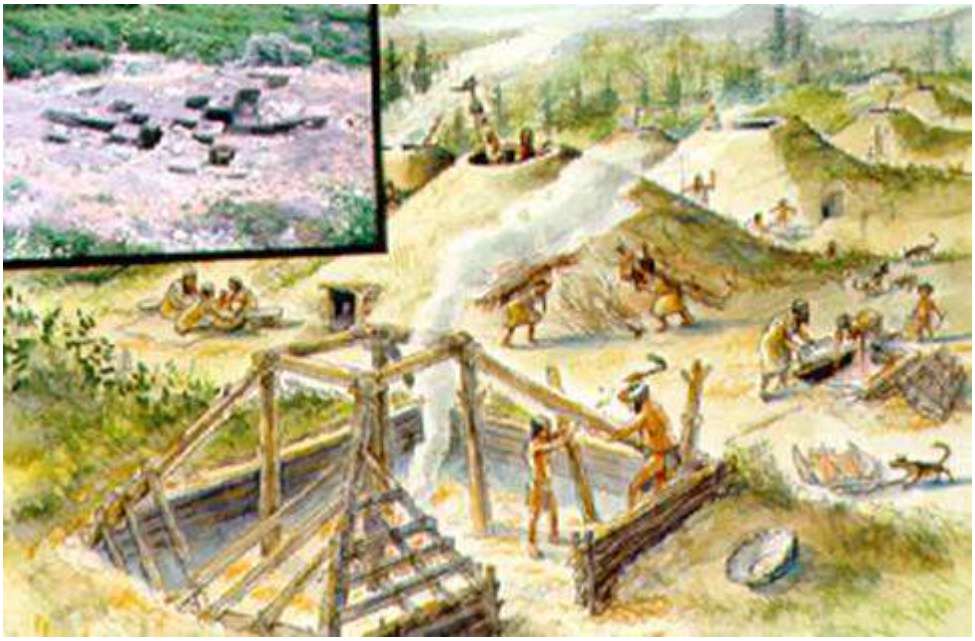
Plateau Indians Pit House Information

By Jack Nesbit

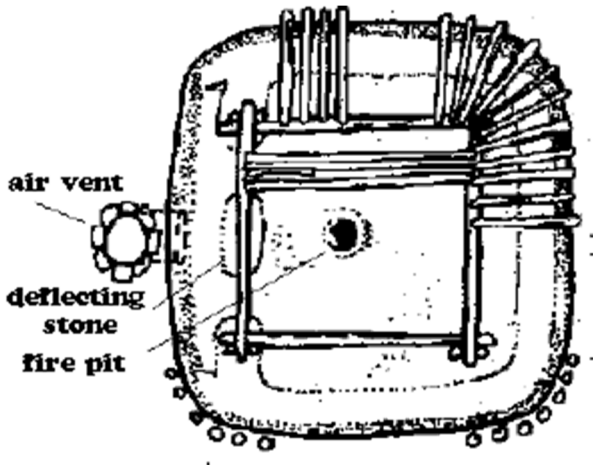
House types found on the Plateau were the semi subterranean Pit House, the later tule-mat lodge and the long lodge. The Pit House, the oldest type of dwelling) most often consisted of a circular or squarish excavated pit protected by a conical roof of poles covered with brush and earth. Variation was found from area to area - the pit could be circular or square, the roof conical, pyramidical or almost flat, and the entrance either a hole (which also served as an exit for smoke) in the center of the roof or a door at the side of the roof. Although Pit Houses were most commonly used as winter dwellings, recent information suggests they were sometimes used at other times of the year.



Archaeologist James Teit drew this plan and cross section of a Pit House built by the Thompson Indians in the Nicola Valley during the 1890s. Note the successive layers of logs and sod used to cover the roof (courtesy American Museum of Natural History).



Artist's recreation - Courtesy: National Film Board of Canada and Canadian Museum of Civilization National Museums of Canada



In the winter, it is documented that the Spokane lived in permanent villages of Pit Houses, which were typically located at the eastern flanks of river valleys where mountain slopes

offered protection from the prevailing winds. Pit House sites have been recorded all along the Spokane and Columbia Rivers on both sides. These buildings represented a distinctive and highly effective architectural form that was widely used throughout this region for at least 3500 years.

The Pit House is broadly characterized by a log-framed structure built over an excavated floor and covered with an insulating layer of earth. The Pit House is regarded as perhaps North America's oldest house type, and it was widely used throughout the plateau region until its eventual disappearance in the late 19th century and the pressure from the U.S. Government for the Indian people to live in "civilized houses".

The most fully documented Pit Houses were those constructed by the Thompson Indians of the Nicola Valley in southern British Columbia, and closely associated in pre-contact times with the people of the Spokane, Sanpoil, Nespelem and others in the region. During the 1890s ethnologist James Teit (see sketch above) carefully recorded the design, construction techniques and beliefs associated with the Pit Houses of the Thompson people. Construction began with the careful measurement of the pit circumference, which ranged from 7.5 (25 foot) to 12 m (40 foot) in diameter and was excavated to a depth of about 1 m 3.5 foot) with outward-sloping sidewalls. Four logs were then inserted in holes in the floor at an angle parallel to the excavation walls. Their tops were notched to support the four main roof beams, which were sunk into the topsoil at steep angles. A webbing of spaced rafters was then lashed in concentric circles from the outer circumference to the central smoke hole at the apex of the substructure. The rafters supported a snug layer of poles that was thickly padded with pine needles or grass. In the upper Plateau (now Canada), where rainfall is heavy, cedar bark with the curved side up was laid at this stage. Finally, the excavated earth was spread over the roof and stamped down, and a notched-log ladder was lowered through the smoke hole. The following spring grass sprouted on the roof and, except for the protruding ladder, the dwelling seemed to be a living part of the landscape.

The Pit House ladder was once the object of artistic attention among the Canadian Plateau. Its top might be carved into the head of a bird or animal and painted to represent the guardian spirit of the head of the household though this practice has not been recorded with in the Spokane.

A central hearth was located near the foot of the ladder - usually on its north side - and a stone slab protected the ladder from burning. When covered with a layer of snow, the insulating efficiency of the Pit House meant that only a small fire was required to warm the interior.

Winter communities in the early 1900s typically had three or four Pit Houses, with between 15 and 30 people occupying each one. Earlier pre-contact communities were frequently much larger, containing 100 or more individual houses. Pit Houses varied considerably in size, configuration and construction methods among the various peoples of the Plateau. Some, like those of the Thompson Indians, were circular, others were elongated or square, and some had secondary entrances in the side. The Shuswap living in the Thompson River valley near present-day Kamloops sometimes used six principal posts and beams rather than four,

producing a more conical profile. Only cursory study has been done on the shape and construction details regarding Spokane construction but the above description would certainly fit within the parameters of what was used by the Spokane, regional and family variances aside.

Reflection Questions

Student Name_____ Date_____

Answer the following questions in preparation for your final presentation about the Pit House project. You will need to have all of these questions completed before you can start making your poster on the computer.

1. On the cards provided, write down the definitions for the words below, draw a picture and write about how the word relates to what we did to the frames. See example. These will be taped onto the left side of your notebook on the next available blank page (after the data from smashing the frames).

Energy
Work
Newton's First Law of Motion
Newton's Second Law of Motion
Newton's Third Law of Motion
Force
Mass
Gravity
Energy Transfer

2. In terms of the Pit House frame, explain when the forces were balanced and when they were unbalanced.

3. Newton's second law of motion states that the amount of force required is directly related to the amount of mass. Justify how this law applies to the frames that were built, the type of wood that was used, and how the mass was spread out or distributed through the frame (think about the physical structure and what parts of the frame helped distribute mass more evenly in an upward direction).

4. If a 100lb student stands on the frame and nothing happens, is work being done? (Think about the definition of work, is the frame moving?)

5. Reflect back to the lab where we determined the amount of force required to break different samples of wood. Which types of wood required more work to break?

6. Apply Newton's First and Third Law of motion to justifying why the force of gravity and the force of the frame are balanced.

7. Work can be described as the amount of force required to move an object a specific distance. Explain the relationship between force and work and the Pit House frame. We didn't measure how tall the models were, but what direction did they move?

8. If a Pit House was 0.25 meters tall and 1000 Newtons were required to collapse the frame, how much work was done in Joules?

9. Imagine the transfer of energy in this experiment. From what objects did the energy transfer? Draw a picture demonstrating this.

Standard	Activities	Student Score				Teacher Score				Comments
		totally get it	get some of it	get a little bit	don't get it at all	complete mastery	Almost complete mastery	partial mastery	Little mastery	Student comments
										Teacher comments
		4	3	2	1	4	3	2	1	
9-11 PS1C An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force.	Given specific scenarios, compare the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces.									
9-11 PS1E Whenever one object exerts a force on another object, a force of equal magnitude is exerted on the first object in the opposite direction.	Predict how the gravitational force between two bodies would differ for bodies of different masses or different distances apart.*d Explain how the weight of an object can change while its mass remains constant.									

Standard	Activities	Student Score				Teacher Score				Comments
		totally get it	get some of it	get a little bit	don't get it at all	complete mastery	Almost complete mastery	partial mastery	Little mastery	Student comments
		4	3	2	1	4	3	2	1	Teacher comments
9-11 PS3A Although energy can be transferred from one object to another and can be transforme d from one form of energy to another form, the total energy in a closed system is constant and can neither be created nor destroyed. (Conservati on of Energy)	Describe a situation in which energy is transferred from one place to another and explain how energy is conserved.*a Describe a situation in which energy is transformed from one form to another and explain how energy is conserved.*a									

Insulated Pit House

ts will make predictions about the transfer of . They will build models of insulated Pit e transfer of heat energy in the system.

Grade Level: *Middle School or High School*

Subject Area: *Physical Science*

Duration: *1 day to plan and design the model. 1 day to build the model. 1 day to test the model.*

Technology: *Students use personal blogs to write their reflections on the activity. Smart boards can be used for brainstorming as well as mobile technology for gathering information in the field (photos, texting info) if cell service is available.*

Setting: *in the school*

Learning Goals
Students will plan and design a model of a Pit House using different materials for insulation. (9-12 APPB, 9-12 APPC)

Students will use the model of a Pit House to investigate the role of insulation materials in modifying the transfer of energy in a system. (9-12 SYSC)

Materials: balloons, paper mache materials (flour and water work well), new print, scissors, repurposed items to use a insulation (students' choice), temperature probes, glue, 8 oz. Styrofoam cups, ice cubes (10 per cup), graduated cylinder

Making Connections: Students will continue to connect to their ancestor's traditional dwelling as well as the science and technology used to build it. The activity begins with a discussion about the role of insulation in structures and the transfer of heat. The students will design models of Pit Houses that apply different types of insulation to examine how certain materials can slow down the transfer of heat energy. They will examine the materials that their ancestors used to do the same thing.

Background: Pit Houses were the traditional dwellings of people from the Columbia Plateau region of the Pacific Northwestern United States for several thousand years. The houses were usually 20 feet in diameter with a domed roof made of timber and insulated with soil and local grasses. The house was usually dug about 3 feet down into the ground, with the entrance at the top accessible by a ladder. The houses were perfect for the climate of the region, providing
warmth in the winter and remaining cool in the summer. See the student reading materials for more information.

Procedure:

Set up 1 hour. Prepare the paper mache glue and tear the newsprint into manageable pieces and strips. Start collecting insulation materials several days prior to class. Have some on hand incase students don't collect anything from home.

During Class.
1) Students need to use text or the Internet to research insulative properties and the transfer of heat energy. They will use that information to make

decisions about what types of materials to use to insulate their paper mache model Pit House. After they've done some research they need to make a plan for building their Pit House.

2) Students will build their models using balloons and paper mache. They will need to put several coats of paper to make it sturdy enough to stand up. It will need to dry over night before gluing insulation into it. Once it is dry, the edges should be trimmed to make a dome. The students need to decide how thick the insulation should be and whether or not to place it on the outside of the model or the inside. A hole large enough for the temperature probe needs to be cut into the top of the model.

3) During the experiment, students will record the temperature change in the dome as a cup of ice cubes melts over a 20 min period. At the end of the 20 minutes, students should use a graduated cylinder to measure the amount of melt water in their cup of ice. The lower the amount of melt water, the better the insulation.

4) Using a projected spread sheet or white board, students should compare their results and discuss the different materials that were used.

Assessment:
Students should complete a formal lab report for this assignment or a poster presentation to demonstrate their understanding of the concepts as well as to practice communicating their ideas.

Extensions:
Research the R-value of store bought insulation. Build models of tule reed tipis and conduct the same experiment with ice cubes.

Ecology of the Pit House

S examine the built environment of a Pit H ystem surrounding the house. Students w identify ideal plant species to introduce t louse.

Grade Level: *Middle School or High School*

Subject Area: *Life Science*

Duration: *1 day to plan and design the model. 1 day to build the model. 1 day to test the model.*

Technology: *Students use personal blogs to write their reflections on the activity. Smart boards can be used for brainstorming as well as mobile technology for gathering information in the field (photos, texting info) if cell service is available.*

Setting: *in the school and outside*

Learning Goals

Students will generate and evaluate questions about plants in the ecosystem around the Pit House. (9-12 INQA)

Students will plan and conduct a field experiment, using transects on the roof of the Pit House, evaluating which types of plants are ideal for that system. (9-12 APPB, 9-12 APPC)

Students will examine the interactions of light, water, slope, soils and plants in an ecosystem. (9-12 SYSC)

Students will analyze and report their results to help the school in making decisions about what types of plants to grow. (9-12 INQB)

Materials: notebooks, twine, scissors, small hand trowels, plant starts, water and watering devices, cameras, field guides

Making Connections: Students will continue to connect to their ancestor's traditional dwelling as well as the science and technology used to build it. The activity begins with a walk through the woods around the Pit House. Students will be asked to describe the characteristics of the ecosystem where the Pit House is located. The students will work on identifying native plants growing near the house. They will transect the roof into triangles and will plant a variety of starts chosen according to the amount of light, water, soil depth and slope of the roof. Over several weeks, students will return to the Pit House to make observations about their plants' growth.

Background: Pit Houses were the traditional dwellings of people from the Columbia Plateau region of the Pacific Northwestern United States for several thousand years. The houses were usually 20 feet in diameter with a domed roof made of timber and insulated with soil and local grasses. The house was usually dug about 3 feet down into the ground, with the entrance at the top accessible by a ladder. The houses were perfect for the climate of the region, providing
warmth in the winter and remaining cool in the summer. See the student reading materials for more information.

Procedure:

Set up 1 hour. The teacher will need to make contact with local nurseries or other resources for plant starts. Copied excerpts from plant field guides or books should be gathered for the students to use. Prior to class, identify where the nearest water source is and what the most feasible schedule will be for watering and monitoring the plant transects.

During Class.

1) Students will begin this lesson by making observations in the field about the ecosystem surrounding the Pit House. They need to identify the types of plants, the amount of sunlight, sources of water, and what types of other organisms live there. They should also make observations about the slope of the roof and the depth of soil on the roof.

2) Students will use the field guides to identify the different types of plants growing around the Pit House. This will help them determine what types of plants should be planted on the roof.

3) Students need to develop a plan for what they want to plant and how many plants they will need. They need to diagram it in their notebooks. Once their plan is completed they will need to also create a schedule for watering and monitoring the plants' growth.

4) Provide students with their plants and give them time to plant them in their transect. Take pictures if possible. Continue to monitor plant growth over several weeks (may only need a quick 5 minute walk through).

5) At the end of 3 or 4 weeks, students should compare notes and decide which plants were best suited for the Pit House roof. They will need to agree on criteria for this determination. They should make a recommendation to the school regarding plant requisition and maintenance of the roof of the Pit House.

Assessment:

Students should complete formal report of their findings and recommendations to the school administration and Culture and Language Office. Use the state's released test item on plant growth as an assessment tool.

Extensions:

Design further experiments examining other properties of plants or interactions in the environment.

APPENDIX B: SURVEY INSTRUMENTS AND INTERVIEW QUESTIONS

1.

Grade_____ Male_____ Female_____

Ethnicity_____

Thank you for taking the time to complete this survey. The purpose of this survey is to determine your overall interest and connection to your ethnic culture. This survey is voluntary and your responses are anonymous. This means your privacy is protected and no one, including your teachers, will know how you answered the questions. You may choose not to take the survey or quit at anytime with out penalty. This is not graded and there are no "wrong answers". Please reflect on the questions and answer based on your own personal opinion or perspective.

1. For the following statements, please decide how much you agree or disagree with the statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
A language other than English is spoken in my home on a regular basis	◯	◯	◯	◯
I can speak my Native language with some proficiency	◯	◯	◯	◯
I participate in cultural events (hunting, dancing, sweat, drumming, etc) at least 3 times a month	◯	◯	◯	◯
I don't think Culture Week represents my culture	◯	◯	◯	◯
I prefer listening to traditional music over what's on the radio	◯	◯	◯	◯
I learn better when my culture is part of the activity	◯	◯	◯	◯
I am more interested in movies about my culture than what's at the theater	◯	◯	◯	◯
I would prefer living on the reservation (or in my cultural community)	◯	◯	◯	◯
My family uses traditional healing and ceremonies on a regular basis	◯	◯	◯	◯
I prefer traditional foods over stuff from the store	◯	◯	◯	◯
I think learning about my culture is important	◯	◯	◯	◯
I enjoy activities at school that involve my culture	◯	◯	◯	◯
I look forward to culture week and always participate in activities during the week.	◯	◯	◯	◯

1. Default Section

1. Current Science Class

- ◯ Physical Science
- ◯ Biology 1
- ◯ Biology 2
- ◯ Chemistry
- ◯ AP Environmental Science
- ◯ AP Biology
- ◯ Natural Resources

2. Gender

***3. Current grade**

4. attitudes about science

	disagree strongly	disagree	sometimes agree/sometimes disagree	agree	agree strongly
I enjoy learning science	◯	◯	◯	◯	◯
science is important to everyone's life	◯	◯	◯	◯	◯
doing science often makes me feel nervous	◯	◯	◯	◯	◯
science challenges me to use my mind	◯	◯	◯	◯	◯
I am good at science	◯	◯	◯	◯	◯
I enjoy learning math	◯	◯	◯	◯	◯
math is important to everyone's life	◯	◯	◯	◯	◯
doing math often makes me feel nervous	◯	◯	◯	◯	◯
math challenges me to use my mind	◯	◯	◯	◯	◯
I am good at math	◯	◯	◯	◯	◯
Science and math will help me in the future	◯	◯	◯	◯	◯
Science and math have improved the way we live today	◯	◯	◯	◯	◯
Knowing science and math won't help me to get a job	◯	◯	◯	◯	◯
Learning science is difficult for me	◯	◯	◯	◯	◯
Learning math is difficult for me	◯	◯	◯	◯	◯
Even without a strong background in math and science, I will probably end up with the kind of job I want	◯	◯	◯	◯	◯
Overall, science and mathematics have caused more good than harm in our lives	◯	◯	◯	◯	◯
My parents expect me to go to college	◯	◯	◯	◯	◯
My parents think that science and math are important subjects	◯	◯	◯	◯	◯
I would like a job that involves science, mathematics and/or engineering	◯	◯	◯	◯	◯

Additional information

TALKING CIRCLE GUIDELINES AND INTERVIEW QUESTIONS

Say to the group:
Thank you for coming today. You may all be aware that I am a graduate student at the University of Idaho. I am studying the use of cultural activities when teaching science. I would like to write about your experiences learning science when we used the Pit House as a model. I know that it has been awhile for some of you so I wanted us to gather here in the Pit House to center our thoughts and to focus on those specific memories.

I also want to be clear that your participation is voluntary and at any time you can opt out of the study. You have already taken a couple of surveys. Your response on the surveys will not be shared with anyone in this group or with any other people in the community. Your identity will be changes as well. Your participation will benefit your tribe and community by informing how we teach different subjects in the school.

This session will not be recorded but the individual interviews will be recorded. I will not share the recording with anyone and will only be using it to document specific memories, comments or ideas you share.

I would like you to take a moment to walk around the room and look at the pictures hanging on the walls.

(Allow about 5 minutes for students to wander around the Pit House looking at the pictures of the construction of the house as well as pictures of the student projects in the science classes. Observe their comments, utterances, facial expressions, body language, etc.)

Say this:

What pictures stood out to you the most? Why?

Okay, I would like all of us to try and describe what the Pit House is or means to us as a group. I am going to record your words on this paper. Can you think of metaphors for the Pit House or words that describe its purpose in the community?

Now, I would like you to choose one of the metaphors or phrases on the list. Using the notebooks provided, I would like you to write for 3 minutes. This is a free write, which means no one is checking for grammar or spelling. You are writing what ever comes to mind.

(After 3 minutes) Please stop writing, finish up your last thought or idea. Now re-read what you wrote and underline any sentences or phrases that jump out at you. In other words, look for sections in your writing where you think “wow! I wrote that?” Copy what you underlined onto a strip of paper.

(After all of them have copied their statements). We are going to combine your statements and create a poem. Everyone may contribute to the arrangement of the strips of paper.

Next, I would like you to each take a piece of paper and box of colored pencils. I would like you to close your eyes and picture this Pit House. Imagine the beams holding up the roof and the soil on top of that, picture the plants growing in that direct and their roots reaching through the soil. Now imagine the forest around the Pit House, the stream down below, the different plants and animals living her. Picture the community of Wellpinit, the Reservation and your family and friends. Imagine this space being used by the community. Who is here? What are they doing? How do they feel in this space?

Now open your eyes. Take a moment to create a sacred map of the Pit House. Think about all that you imagined and incorporate those visions into your drawing.

(After several minutes). If you would like to share your map with the group, I would like to encourage you to do that now. Please share what you drew and why you drew it.

(After the students share). What were some common themes or ideas you all had in your maps?

I want to thank you all for being here today and participating in this activity. In closing I would like o give each of you an opportunity to ask me any questions have or to tell me about your experience today.

Interview Questions Time 1

What do you remember about the Pit House project?

What was most challenging?

What did you like most about the Pit House project?

What science were we learning?

Are there other science activities that you enjoyed? Why?

Tell what your plans are for after high school?

Do you plan on taking more science or math classes?

Is culture important in school?

How are you involved in the community and your tribe?

Interview Questions Time 2

Tell me what you've been doing since the last time we saw each other.

What science classes did you take?

What college classes are you taking now or where are you working?

What do you do in your job?

How is school going? What have you found most challenging?

What was it like applying to college?

How did it feel to graduate?

Can you tell me of a time where you thought of the Pit House or an activity that was similar to what we did in the science classroom?

Can you tell me about a time you experienced racism?

Can you give me an example of when culture was integrated into the classroom other than the Pit House assignment?

How did that experience make you feel?

APPENDIX C: PARENTAL AND STUDENT ASSENT/CONSENT FORMS

Consent to Participate in the Pit House Study

The University of Idaho Institutional Review Board has approved this project. The purpose of this study is to gather student stories about their experiences learning science using the pit house as part of the activities in the classroom. You previously participated in interviews about the pit house. This is a follow up interview to see how your perspective has changed and to learn more about your life experiences since the original interviews.

Your participation is voluntary. The study should take approximately 1hour total over a three week period. Although there are no or minimal risks associated with the project, some people may find it awkward to answer questions in an interview.

Your involvement in this project will benefit your community, documenting learning experiences that include Spokane Tribal culture. If we find the interview is creating stress or emotional difficulty for you, we will stop the interview. All information you provide will be placed in a locked file cabinet with access only available by the myself and my faculty sponsor (Dr. Kern). Your name will be changed in the writing of the study as well.

If you have questions about the study or interview, you can ask the investigator during the interview, when the interview is complete, or at a time you feel is appropriate.

Contact information:

Investigator
Bree Reynolds
630 US Hwy 1 Suite 500
North Brunswick, NJ 08902

Ph. (767) 275-5475

Faculty Sponsor
Anne Kern, PhD
University of Idaho
Department of Curriculum and Instruction
Moscow, ID 83844
Ph. (208) 885-6587

During the course of this study, you may stop at any time with no penalty. All you need to say is, "I, no longer wish to participate." Your identification associated with this study will but kept confidential and any data collected will be kept in locked file cabinets and password protected computers and servers. All data will be destroyed at the point all research dissemination has been exhausted or within six years, which ever occurs soonest.

I have reviewed this consent form and understand and agree to its contents.

Participant Name _____ Date _____

Parent or Witness name (if appropriate) _____

Date of Birth _____

Experimenter Name _____

The University of Idaho Institutional Review Board has approved this project. The purpose of this study is to gather student stories about their experiences learning science using the pit house as part of the activities in the classroom. You previously participated in interviews about the pit house. This is a follow up interview to see how your perspective has changed and to learn more about your life experiences since the original interviews. Your participation is voluntary. The study should take approximately 1hour total over a three week period. Although there are no or minimal risks associated with the project, some people may find it awkward to answer questions in an interview. Your involvement in this project will benefit your community, documenting learning experiences that include Spokane Tribal culture. If we find the interview is creating stress or emotional difficulty for you, we will stop the interview.

All information you provide will be placed in a locked file cabinet with access only available by myself and my faculty sponsor (Dr. Kern). Your name will be changed in the writing of the study as well. If you have questions about the study or interview, you can ask the investigator during the interview, when the interview is complete, or at a time you feel is appropriate. Contact information:

Investigator Faculty Sponsor Bree Reynolds Anne Kern, PhD 630 US Hwy 1 Suite 500 University of Idaho North Brunswick, NJ 08902 Department of Curriculum and Instruction Moscow, ID 83844 Ph. (767) 275-5475 Ph. (208) 885-6587

During the course of this study, you may stop at any time with no penalty. All you need to say is, "I, no longer wish to participate." Your identification associated with this study will but kept confidential and any data collected will be kept in locked file cabinets and password protected computers and servers. All data will be destroyed at the point all research dissemination has been exhausted or within six year, which ever occurs soonest. I have reviewed this consent form and understand and agree to its contents.

Name: -

2. Date

3. Date of Birth

4. Parent/Guardian/Witness (if appropriate)

5. Your Initials as your Signature.

APPENDIX D: IRB APPROVAL

University of Idaho

Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010

Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

April 10, 2014

To: Kern, Anne

Cc: Reynolds, Bree

From: Traci Craig
Chair, University of Idaho Institutional Review Board
University Research Office
Moscow, ID 83844-3010

Title: 'Shared experiences in the creation of a pithouse: A Phenomenological Study'

Project: 12-197
Approved: 04/30/14
Expires: 04/29/15

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the **second-year extension** of your proposal is approved as offering no significant risk to human subjects as no changes in protocol have been made on this project.

This is a second year extension of approval and is valid until the date listed above at which time a new protocol will need to be requested if you are still working on this project. If not, please advise the IRB committee when you are completed. Should there be any significant changes in your proposal within the year, it will be necessary for you to resubmit it for review.

Thank you for submitting your extension request.

Traci Craig