Native American Students' Perceptions of the Manoomin STEM Camp

Thesis

Presented in Partial Fulfillment of the Requirements for

the Master of Education - Environmental Education in the

College of Education and Human Service Professions

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2013

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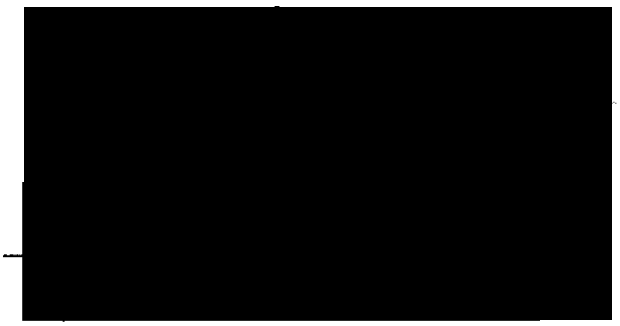

Abstract

Tribal governments are facing harsh realities as climate change, development, and economics threaten not only the sustainability of the natural resources but also their culture. There is a growing need to recruit Native American students into STEM fields to meet the needs of their tribal communities. Tribal communities are seeking educational interventions that will motivate their young people to go to college and pursue STEM fields that will benefit future generations.

The Manoomin ("wild rice" in the Ojibwe language) camp is a place-based American Indian youth science research program based in Cloquet, MN. This camp is a result of partnerships between University of Minnesota researchers, Fond du Lac Reservation natural resource managers, local teachers, Fond du Lac Tribal & Community College, and community members, working together to integrate meaningful research with emphasis on the cultural significance of wild rice on the Fond du Lac Reservation.

The study described how the students in the Manoomin STEM camp felt that camp impacted their sense of community, their academic success, opportunities for careers, connection with their culture, and influenced their attitudes and behavior. These results holds out hope that the Manoomin STEM camp model is an educational intervention that will lead to academic success and future generations of STEM professionals.

Acknowledgements

I would like to thank my committee members, Dr. Bruce Munson and Dr. Julie Ernst, on their incredible support and patience with a student that was the definition of procrastination.

I want to thank all the staff of the Manoomin camp. Their support, enthusiasm, and helpfulness made this thesis study possible. The camp staff and the wonderful kids are a source of inspirations and just plain fun to be around!

And last but not least I want to thank my family. My mother with her gentle prodding and cheerleading, my boys with their willingness to help out on the home front, and my husband who never questioned the long road that I was traveling.

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Chapter 1

Introduction

This study describes the Manoomin science camp based on Fond du Lac Reservation in Cloquet, Minnesota. This study will illustrate participants' perceptions of the impacts of a place-based Science Technology Engineering Math (STEM) focused camp, inclusive of Ojibwe culture, on their lives.

Tribal governments are facing harsh realities as climate change, development, and economics threaten not only the sustainability of natural resources but also their culture. In a 2009 report to the United States Environmental Protection Agency's Office of Air and Radiation, the National Tribal Air Association expressed concern about the impact of a changing environment on the decrease in traditional foods. Besides the danger of actually losing plants and animals with changing environmental conditions, climate change can result in shorter gathering seasons for traditional foods and medicines. These shorter growing seasons can push people to overharvest these resources and place further stress on culturally significant flora and fauna (National Tribal Air Association, 2009).

Fond du Lac Reservation (FDL), located in northern Minnesota, is very concerned that changing growing seasons and stronger rain events will cause the loss of very culturally important food sources such as wild rice. In 2012, a 500-year flood uprooted the vulnerable wild rice seedlings on the Fond du Lac Reservation, wiping out the wild rice for the year. According to weather predictions major storms such as the 2012 rain event, are expected to happen

more frequently. Industrial impacts such as mining and oil pipelines are causing degradation and loss of habitat on the Reservation. In addition to the over 101,000 acres of the Fond du Lac Reservation, the Band also helps manage the 1854 Ceded Territories. The 1854 Ceded Territories is approximately 3,061,501 acres in Northeastern Minnesota that are managed by Lake Superior Chippewa to "protect, preserve, and enhance hunting, fishing, and gathering rights" (1854 Treaty Authority, n.d.). Nation wide tribal governments oversee the management of millions of acres of land (Bureau of Indian Affairs, n.d.).

In the face of these challenges to tribal natural resources, tribal governments and federal agencies are looking to future Native American generations to be leaders in environmental fields. Currently there are many academic, societal, and cultural barriers to recruiting young Native Americans to environmental science fields (Armstrong, Berkowitz, Dyer, & Taylor, 2007; Demmert, 2001; Maughan, Bounds, Morales, & Villegas, 2001; Quimby, Seyala, & Wolfson, 2007). What educational strategies can be used to encourage young Native Americans to take on the role of caretaker of these lands at both the regional and national level?

In Minnesota the 2010-2011 graduation rates of Native American students from high school was 42% compared to 84% for Caucasian students. The Math proficiency in of Native American students was 38.9% compared to 69.1% of Caucasians (Minnesota State Snapshot, 2011). In an age with more and more agencies striving for diversity in their workforce and Native American tribes needing to have their young people come back to work as scientists in their

home communities, these academic gaps are alarming. As reported by Native News (2011) "American Indians, along with African Americans and Hispanics, lag behind non-Hispanic Whites and Asians in science, technology, engineering and math, commonly referred to as STEM, education and jobs" (Native News, 2011). The National Science Foundation found in 2010 that Native Americans held less than 1% of the country's STEM fields (National Science Foundation, 2013).

Research on the common components of successful STEM outreach for Native American students finds that hands-on, place-based curriculum is very important (Carroll, Mitchell, Tambe, & St. John, 2010; Riggs, 2004; Simpson, 2002). The parallels between the holistic and place-based nature of Native American learning and Environmental Education (EE) has resulted in studies looking at how EE could be used to improve academic success and increase Native American involvement in STEM (Riggs, 2004; Semken & Freeman, 2008; Simpson, 2002; Zwick & Miller, 1996). The importance of culturally integrated EE may be even more profound as indicated by Anishinaabeg educator Leanne Simpson (2002) when she states " Grounding programs in Indigenous Knowledge provides students with some of the wisdom and many of the skills needed to facilitate change in their communities and in the field of the environment" (p. 20). While there has been research on integrating indigenous culturally grounded curriculum in classroom settings there have not been many studies on the impact of non-formal educational outreach on student success. In particular there have been very few examples of the impacts of STEM focused

camps on Native American students (Blankenship, 2003; Gould, Gonzalez, Walker, & Ping, 2010; Marshall & Corella, 2005; Riggs, 2004).

What does a Native American STEM camp look like? There are anecdotal papers written about Native American STEM camps that ground campers in science and math principles while maintaining cultural integrity. These STEM camps illustrate how Western Science and Traditional Ecological Knowledge (TEK) can be melded to engage indigenous students (Boss, 2003; Blankenship, 2003; Marshall & Corella, 2005). Huntington (2000) defines TEK "to mean the knowledge and insights acquired through extensive observation of an area or a species. This may include knowledge passed down in an oral tradition, or shared among users of a resource" (p. 1270). The Elders in the indigenous communities usually contribute the TEK in these camps. As Riggs (2004) found when he examined field-based geoscience education for Native American students there were "three common qualities and features:

1. Major emphasis on place-based curricula, emphasizing experiential, outdoor learning in familiar environments within the traditional homelands of the indigenous groups
2. Inclusion of relevant indigenous scientific knowledge wherever possible and appropriate
3. Explicit involvement and cooperation of indigenous community members, elders, and educators in the design of the content, location, and delivery of curricula and programs." (p. 301)

An example of a Native American STEM Camp in Northern Minnesota is the Manoomin ("wild rice" in the Ojibwe language) camp. The Manoomin camp is a place-based American Indian youth science research program. The Manoomin project is a partnership between the Fond du Lac Tribal and Community College (FDLTCC), the University of Minnesota (UMN), the UMN's National Lacustrine Core Facility (LacCore) and the Fond du Lac Reservation Resource Management Division (FDLRM). This camp is a result of intense discussions on how to integrate a science camp with meaningful research that studies the past conditions of wild rice on the Fond du Lac Reservation. The Manoomin science camp was created to leverage the knowledge and skills of University professors, FDLRM staff, secondary school teachers, and community members around wild rice.

University researchers from the LacCore lab partnered with FDLRM to identify six key lakes on the reservation. These lakes had either had wild rice on them or had been storied to have grown wild rice in the past. FDLRM wanted to know the history of wild rice on these lakes in order to better understand the management strategies needed to preserve wild rice on the Reservation. Students were involved in the sampling of the six lakes, the processing of the lake cores, and the analysis and reporting of the lake core data. The UMN researchers led the students in the various stages of the research project while the secondary school teachers and community members rounded out the camp with additional hands-on classes on subjects such as climate change, water quality, wind energy, math, and traditional harvesting. In addition to working with

UMN and FDLRM scientists on the wild rice research, participating students were also working on obtaining an oral history of wild rice on the FDL Reservation from community elders.

Community members and Manoomin Camp elders have shared with students the history of wild rice and the Ojibwe in this region. In the last year of the Manoomin camp the students will be working with elders to record their stories. The camp is structured as one to three day camps that occur once a month for nine months of the year. Manoomin camp is in the fourth year of a five-year National Science Foundation and National Center for Earth Dynamics grant. Although the Manoomin camp was not designed with environmental education principles in mind, the very nature of the place-based program is well suited to achieve the goals of environmental education.

UNESCO (1977) stated that "Environmental education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action" (p.12). This working definition of environmental education stresses the need for environmental educators to work with individuals to build a relationship between themselves and the environmental in order to ensure that citizens will feel a responsibility towards the protection and/or restoration of natural resources. Several researchers however have pointed out that this viewpoint of environmental education often is couched in the western science view of

knowledge and skills and does not take in the indigenous view or relationship to their environment (Cole, 2007; Gruenewald, 2003; Marouli, 2002; Nordstrom, 2008). As Cole (2007) pointed out if we look beyond the narrow view of "the environment as a place where humans interact with ecological systems, the environmental becomes rich with dynamic cultural, social, economic, political, historical contexts and perspectives that frame and construct the ecological processes within them"(p.39). In order for environmental education to be truly relevant to the community it serves it must stretch itself to ensure that the knowledge, skills, and attitudes in the educational programs are inclusive of the culture of its students.

Problem Statement

While studies have been conducted on how different educational strategies in the formal classroom can affect Native American students' academically there has very little research on the effects of culturally relevant, non-formal place-based environmental educational outreach. There is a need to evaluate Native American STEM camps in order to understand what impacts this type of outreach has on student's lives.

The purpose of this study was to describe how students participating in a place-based Native American STEM camp perceive the impacts of camp on their lives. The current study used a qualitative approach to illustrate students' perceptions of the Manoomin STEM camp. This study used interviews collected

by the Manoomin camp staff to identify themes and perceptions of participating students in the Manoomin science camp.

Significance

Current research on Native American STEM camps has focused on strategies to improve the academic performance of students. There has been very little research on how the participating students feel about the role of STEM camps in their lives. This study can be used as an illustration of how STEM camps designed to be inclusive of Native American culture are perceived by participating students to affect their lives. This study also provides an example of how to create a place-based environmental education program that is culturally relevant to Ojibwe students.

Objectives

1. Describe the Manoomin camp participant's perceptions of how camp has affected their lives.
2. Relate the findings of the study with current research on STEM camps for Native American students.
3. Using the themes and outcomes identified by the Manoomin camp study, reflect on how environmental education outreach can be structured to better serve Native American students in non-formal settings.

Definition of Terms

Indigenous

Indigenous communities, peoples, and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system (Cabo, 1987).

Ojibwe

Today the Anishinaabe-Ojibwe, also known as Chippewa, people constitute the second largest tribe in North America. Ojibwe are spread out across five American States and three Canadian Provinces, a geographical area unmatched by any other tribe. The Anishinaabe-Ojibwe are primarily a woodlands people mainly in the Great Lakes region of the United States and Canada (Ojibwe Waasa-Inaabidaa, 2002).

STEM Education

STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise

enabling the development of STEM literacy and with it the ability to compete in the new economy (Tsupros, 2009).

Talking Circle

Talking circles are deeply rooted in the traditional practices of indigenous people. In North America, they are widely used among the First Nation people of Canada and most notably among the Ojibwe and Lakota in this region. The circle process establishes a very different style of communication than most from European tradition with the circle run as a safe non-hierarchical place in which all present have the opportunity to speak in turn without interruptions or judgment (Umbreit, 2003).

Delimitations of Study

This study was focused on the Manoomin STEM camp in Northeastern Minnesota with students that are mainly of Ojibwe heritage and from the Fond du Lac Band of Chippewa.

Limitations of Study

1. A large number of students have attended previous STEM focused camps organized by camp staff and so the Manoomin STEM camp wasn't the only camp experience for these students.
2. Other potential factors in student's lives such as family, school, and personal cultural identity were not investigated but may have affected how participants perceive their camp experience.

3. The researcher had been involved as a teacher and staff at the Manoomin camp since 2011 and may have unintentional bias towards stated goals of the program.

Assumptions About the Study

1. The Manoomin STEM camp was inclusive of Ojibwe culture and includes Native American learning styles.
2. The Manoomin camp through its place-based nature and hands-on outreach supported the aims of environmental education.

Chapter 2

Literature Review

The purpose of this literature review is to set the stage and provide background on research that is relevant to this study. An introduction to Native American learning styles, connections to environmental education, and involvement in STEM sciences will be discussed in both classroom and non-formal settings.

Native American Learning Styles

The academic struggles of Native American students have led researchers to investigate ways to improve performance in school. The study of Native American learning styles has been a major focus of current academic strategies. However, in order to begin a review of research of Native American learning styles you must take a step back and understand the shameful legacy of Native American boarding schools in the United States and its impact on today's Native American student.

The Civilization Fund Act of 1819 officially gave the federal government the power to control the education of Native American children (Demmert, 2001). The boarding school policy that came out of the 1819 Act was created to take Native American children away from their culture and indoctrinate them into the Euro-centric "American" culture (Adams, 1995; Demmert, 2001; Stokes, 1997). In most cases the children were taken involuntarily from their families at the young age of 5 or 6 years old and sent to boarding schools many miles away from their

homes. Their hair was cut; they were made to wear "white" clothes; and punished for using their native language. Noel (2002) states that effectively these boarding schools were organized to "eliminate the children's sense of Indian identity, their memory of their religion, language, and their sense of community"(as cited in Welsh, 2008, p. 2).

These Native American boarding schools were federally supported until the late 1960s. As a result of boarding schools there are generations of Native Americans that associate formal education with the oppression of the boarding school system. This painful legacy is reflected in the apathy towards schooling felt by many older Native Americans and the continued disparity between the academic achievement of Native American and Caucasian students (Cleary & Peacock, 1997; Stokes, 1997; Welsh, 2008). In the current school system some researchers feel that the process of "deculturalization" is still being unwittingly practiced because of the absence of knowledge of Native American culture and learning styles (Cleary & Peacock, 1997; Pewewardy, 2002; Stokes, 1997; Whitbeck, Hoyt, Stubben, & LaFromboise, 2001).

Inside the classroom Native American students are sometimes mistakenly viewed as non-responsive or lazy because of a disconnect between the expectations of a non-native teacher grounded in European ideas of behavior and student's indigenous ideas of behavior (Allen & Crowley, 1998; Beck, 2004; Weeks, 2003). Researchers have found that the tendency of Native American students to take time to mull over a problem, to value cooperation over

competition, and to use non-verbal, creative ways to express their learning can lead to misunderstandings in the classroom (Demmert, 2001; Pewewardy, 2002).

In Cornel Pewewardy's (2002) literature research paper, he identified seven Native American (N.A.) learning style classifications. These classifications included: field-dependence or holistic thinking, visual learning, reflective learning, culturally appropriate classroom behavior, family, tribe and Elder connections, strong teacher – pupil relationships, and cooperation versus competition in the classroom. Many N.A. students demonstrate these learning styles by preferring to learn by observing, connecting knowledge in a more circular than linear fashion, and preferring social hands-on activities (Cajete, 2005; Demmert, 2001; Weeks, 2003). Grounding curriculum in Native American students' culture connects the student with the tribal community, which is important for their academic success (Cajete, 2005; Cleary & Peacock, 1997; Demmert, 2001; Pewewardy, 2002; Stokes, 1997; Weeks, 2003; Whitbeck et al., 2001). The Native American holistic style of learning, grounded in cultural and place-based values, is compared to environmental education (Boss, 2003; Cajete, 2005; Feinstein, 2004; Marouli, 2002; Simpson, 2002). As Gregory Cajete (2002) states "Essentially, tribal education worked as a cultural and life-sustaining process. It was a process of education that unfolded through reciprocal relationships between one's social group and the natural world. This relationship involved all dimensions of one's being while providing both personal development and technical skills through participation in the life of the community. It was essentially an integrated expression of environmental education" (p. 69-70).

Environmental Education

Environmental education has long been positioned as a major tool to use to sustain our environment. The 1977 environmental education definition formed in Tbilisi said that "Environmental education is a process aimed at developing a world population that is aware of the total environment and its associated problems, and has the attitudes, motivations, knowledge, commitment, and skills to work individually and collectively towards solutions of current problems and the prevention of new ones" (UNESCO, 1977, p.12). This definition of environmental education emphasizes the need of promoting environmental issue awareness, imparting basic environmental knowledge, encouraging attitudes of stewardship, teaching environmental skills, and encouraging participation in actions that protect or restore the environment. Instructors have practiced environmental education as an inclusive pedagogy with the environment and environmental issues seen as the uniting theme (Lewis & James, 1995). Some researchers point out that this viewpoint doesn't hold true.

Currently environmental education is mainly shaped by the dominant culture, which means nature is seen through a very Euro-centric lens (Agyeman, 2003; Allen & Crowley, 1998; Cole, 2007; Lewis & James, 1995; Marouli, 2002; Willow, 2010). This can particularly be seen in the use of place-based education. Place-based education emphasizes the use of local and regional environments to connect students and teachers with their community in an interdisciplinary way that not only explores nature but also cultural and social connections (Gruenewald, 2008; Semken & Freeman, 2008). Woodhouse and Knapp (2000)

found that "place-based educators believe that education should prepare people to live and work to sustain the cultural and ecological integrity of the places they inhabit" (p.4). However this place-based approach can highlight unintended cultural differences. When teaching about sustainability, especially ecological sustainability, the Euro-centric viewpoint often positions the participants as "custodians" or apart from nature, where in Native American culture people are part of the natural environment (Cajete, 2005; Lowan, 2009). Environmental education has to be very vigilant in scrutinizing its pedagogy because "In the face of unmitigated environmental degradation, it is critical that environmental education become inclusive in the audiences it serves and the issues it addresses"(Lewis & James, 1995, p.12).

Environmental education in the United States has very often used the motif of the "ecological Indian" in its programming (Willow, 2010). Many of the current environmental education curricula incorporate Native American imagery, stories, or ceremonies (ex. Project Learning Tree, Project WET). Unfortunately the Native Americans represented in these curricula are often stereotypical or idealized and don't reflect the current issues faced by indigenous peoples (Willow, 2010). Successfully integrated, Native American inclusive environmental education goes beyond the "mythological Indian" and engages with the issues of today. As Cajete (2005) said "a new circle of education is evolving that is founded on the roots of tribal education and reflective of the needs, values, and sociopolitical issues as Indian people themselves perceive them" (p. 77).

Indigenous Environmental Education

Indigenous Environmental Education is an authentic engagement with indigenous peoples with culture not seen as "other" but as fully incorporated into lessons. Lessons and programming are place-based and culturally relevant to the participants (Boss, 2003; Lane, 2012; Simpson, 2002; Weeks, 2003). Place-based teachings in Indigenous communities are especially critical as much of the spiritual and traditional identity of the community is tied to their ancestral history with the land. Tribal communities often experience immense pressure to exploit their natural resources so an integral piece of Indigenous EE is the discussion of environmental justice and the rights of tribal communities (Feinstein, 2004; Marouli, 2002; Nordstrom, 2002; Simpson, 2002). The support and guidance of the tribal community is an essential component of building a successful Indigenous EE program. Guidance from tribal elders on traditional ways, learning methodologies, and incorporation of native language is absolutely essential (Cajete, 2005; Demmert, 2001; Lane, 2012; Pewewardy, 2002; Riggs, 2004; Simpson, 2002).

Involvement of tribal elders and leaders in the EE programming ensures that the connection between the indigenous culture and the environment is a priority in the curriculum. The long-term relationship to the land and cultural wisdom has led to a growing respect and use of Traditional Ecological Knowledge (TEK) along side of mainstream western science in exploring ecological connections (Aikenhead, 1997; Gould et al., 2010; Huntington, 2000; Moller, Berkes, Lyver, & Kislalioglu, 2004). Indigenous EE can be especially

powerful in attracting Native American students to science fields because As Denise Weeks (2003) noted "…the creative participatory process of Native science—involving first insights, immersion, creativity, and reflection —doesn't seem that different from the process of Western scientific inquiry involving observing, hypothesizing, creating investigations, and reflecting on findings"(p. 4). The recognition of connection of cultural knowledge with western science is a way to entice Native American students into STEM fields (Aikenhead, 1997; Boss, 2003; Demmert, 2001; Riggs, 2004).

Native Americans and STEM

What factors have been identified to motivate Native Americans to pursue careers in environmental and other STEM fields? This is a crucial question, as we look at the percentage of Native Americans and other underrepresented minorities in our nation's current science and math jobs. The National Science Foundation found in 2010 that Native Americans held less than 1% of the country's STEM fields (National Science Foundation, 2013). The National Center for Earth Surface Dynamics (NCED) found in 2002 that only 2% of faculty, researchers, and students in geosciences were minorities (NCED, 2011). In their research paper on minorities in ecological fields, Armstrong (2007) and her fellow researchers looked at a 39 minority students involved with the Ecology Society of America (Armstrong et al., 2007). Armstrong and her colleagues wanted to track what had motivated these minority students to pursue an ecological field. What they found was that the support of family and mentors, the connection with

nature, and seeing the value of an ecological career were key factors in the academic pursuit of the students (Armstrong et al., 2007). These findings are supported by research on Native American students that also cite the importance of mentors, and family support in encouraging Native American students into environmental sciences (Maughan, Bounds, Morales, & Villegas, 2001). However for Native American students the cultural connection to the environment is also a key component in their motivation to pursue environmental fields (Blankenship, 2003; Marshall & Corella, 2005; Maughan et al., 2001; Quimby et al., 2007). These findings have researchers to look to informal outreach programs as a means to increase Native American participation in STEM careers.

Informal Outreach for Native American Students

A close connection with the community wisdom within the formal classroom is very difficult to achieve (Cleary & Peacock, 1997; Haukoos, Bordeaux, LeBeau, & Gunhammer, 1995; Stokes, 1997). Afterschool and informal programs have the flexibility to be the inclusive, community driven educational outreach that is ideal for Native American students.

Informal programming on tribal lands give educators the chance to design field-work and hands-on learning that is driven by community knowledge, cultural connection to the land, and current environmental issues (Mack et al., 2012; Riggs, 2004). TEK and western science can be combined to get a holistic picture of the cultural and ecological impacts on the local environment. Learning can come from investigating environmental issues through traditional skills such as

canoe building, drum making, or game playing (Blankenship, 2003; Boss, 2003; Weeks, 2003). Chris Morganroth, a Quileute Elder, sees hope in this type of outreach. Morganroth notes that teaching canoe carving not only teaches math and science concepts but "helps our young people get stronger. They will have more desire in their hearts to carry on the culture" (Boss, 2003, p.9). These types of after school programs encourage long-term learning and relationship building among students, community members, and teachers. Elizabeth Mack (2012) and associates reported in their review of Native American informal science education programs that teachers involved outside their classrooms found "They were no longer teaching science as a subject; their role now included mentoring, guiding, and teaching values" (p. 65). The formation of mentoring relationships and ability to take the time to introduce traditional skills, culture, and tribal history is seen as a particular strength of these informal STEM educational programs (Blankenship, 2003; Boss, 2003; Gould et al., 2010; Marshall & Corella, 2005). As Eric Riggs stated "The field is one of the easiest teaching environments in which to make connections between scientific and indigenous knowledge, and it is also one of the best places to explore the interaction of Earth systems" (Riggs, 2004).

Summary

Academic disparities between the graduation rates and math comprehension of Native American students and their White classmates are significant (Minnesota State Snapshot, 2011). In order to overcome an historical

legacy of educational genocide to prepare Native Americans to advance in math and science fields researchers have identified several strategies that could improve academic performance (Cajete, 2005; Cleary & Peacock, 1997; Demmert, 2001; Pewewardy, 2002; Stokes, 1997; Weeks, 2003; Whitbeck et al., 2001).

Increasing teacher's understanding and accommodation of Native American (N.A.) learning styles has been shown to positively affect the success of students in the classroom. Curriculum with more observational, hands-on learning styles and inclusive of the local indigenous culture helps N.A. student performance (Cajete, 2005; Cleary & Peacock, 1997; Demmert, 2001; Pewewardy, 2002; Stokes, 1997; Weeks, 2003; Whitbeck et al., 2001). The characteristics of traditional N.A. learning with its emphasis on the reciprocal connection between people and the land are similar to environmental education (Boss, 2003; Cajete, 2005; Feinstein, 2004; Marouli, 2002; Simpson, 2002).

Environmental education outreach should be considered as an important strategy to prepare Native American (N.A.) students to pursue STEM careers (Boss, 2003; Lane, 2012; Simpson, 2002; Weeks, 2003). The EE programming must be connected to the local indigenous culture and relevant to the current tribal environmental issues (Feinstein, 2004; Marouli, 2002; Nordstrom, 2002; Simpson, 2002).

There is a critical need for Native American students to become leaders in STEM fields but there are many barriers to students pursuing careers in these fields such as lack of preparation in science and math, absence of family support,

economic hardship, and lack of a strong mentor (Armstrong et al.,2007; Blankenship, 2003; Marshall & Corella, 2005; Maughan et al. 2001; Quimby et al., 2007). Informal, after school programming gives instructors the greatest flexibility to fully engage the tribal community in creating and supporting culturally relevant EE (Boss, 2003; Mack et al., 2012; Riggs, 2004). This type of informal EE program builds positive relationships between instructors, students, the community and the culture that have shown to positively impact N.A. student success (Blankenship, 2003; Boss, 2003; Gould et al., 2010; Marshall & Corella, 2005).

Research has primarily focused on what strategies, in the classroom and out of it, can boost the academic success of Native American students. As more and more school and community groups are interested in creating informal STEM focused camps for indigenous youth it is important to understand the effects on the participating students. This study describes how the students in the Manoomin camp perceive the impacts of their camp experience.

Chapter 3

Methods

There is very little research on STEM focused non-formal education outreach from the participating student's point of view. Using Manoomin camp student interviews this study described how a culturally grounded place-based STEM camp was perceived by the participants to impact their lives. This study contributed to the literature on the effects of culturally relevant non-formal educational outreach on Native students.

Research Question

How do students participating in a place-based Native American STEM camp perceive the impacts of camp on their lives?

Design and Data Collection Method

This study used interviews that had already been conducted by Manoomin staff with participating students. In order to fully understand the breadth of perceptions of the Manoomin camp participants the qualitative method was chosen because "qualitative research is inductive in that the researcher builds abstractions, concepts, hypotheses, and theories form details" (Creswell, 1994). This inductive process was necessary to fully explore the themes expressed in the Manoomin participant interviews. The transcendental phenomenology approach was chosen because its purpose is to extract meaning and explain the

human experience around a phenomenon such as the Manoomin camp (Moerer-Urdahl & Creswell, 2004).

This research involved data analysis conducted on pre-existing interviews that were taken by Manoomin staff. Individual and group interviews were conducted with Manoomin camp participants. The individual interviews were conducted in 2011 and the talking circle interviews were conducted during the March 2013 Manoomin camp.

The 2011 interviews were taken by the Manoomin evaluator staff and were in a one-to-one fashion with sixteen Manoomin participants. Participants were asked approximately twenty questions with some follow-up questions (Appendix A). The transcripts of each of the sixteen individual interviews were approximately four pages each for a total of sixty-four pages of transcripts.

The 2011 interview questions were designed to evaluate the effect of the Manoomin camp on the campers in area of academics, satisfaction with the camp, and the effect on entering STEM fields. Manoomin evaluation staff used the 2011 student interviews to measure four main goals of the Manoomin camp. These goals were 1) Incorporation of the Seven Elements of Learning 2) Relevance of the Manoomin camp to students and their communities, 3) Incorporation of Communal, Place-based Learning, and 4) Interest in STEM fields. The Manoomin evaluation staff used Manoomin camp student interview responses, camp observations by Manoomin staff on camp activities, and the impression of college students that were involved in the summer Research Experiences for Undergraduates (REU). The Manoomin evaluation staff used

quotes from the 2011 interview data to support the observational data collected by Manoomin evaluators.

In March 2013 two different talking circles were conducted with a total of twenty-eight Manoomin students. In the Manoomin talking circles the camp Elder, Holly Pellerin, asked the participants to reflect on their time at Manoomin camp and what camp had meant to them. Each person in the talking circle answered in turn while the others in the talking circle respectfully listened. Holly Pellerin and Manoomin camp evaluator Hanife Cakici asked some follow-up questions to clarify or expand on the responses (Appendix B). Talking circle participants were then given a chance to respond to these questions in the same circular fashion. The two talking circles yielded fifteen pages of transcribed data.

Participants

The participants in the interviews were students involved in the Manoomin camp. These students ranged from middle school to college age and had spent varying time in STEM focused camps. Of the Manoomin students interviewed over sixty percent had participated in previous "gidakiimanaaniwigamig" camps that met during the summer, fall, and winter of each year from 2005-2009. These "gida" camps were funded by NCED and created in conjunction with University of Minnesota and Fond du Lac Tribal and Community College. The "gida" camps were structured as day or weeklong camps that used guest scientists and field trips to investigate various STEM topics.

The 2011 individual interviews were conducted during the November Manoomin camp. The sixteen students involved in those interviews were 56% male and 44% female. They were predominately students that had attended "gida" camp before joining the Manoomin camp. The Manoomin project was into its second year and the attendance rates of the interviewed students were fairly high.

The twenty-eight 2013 talking circle students were evenly split between males and females. The Manoomin evaluators decided to have two different talking circles during the March 2013 camp. The talking circles were structured so that all the students, whether new to the program or veteran participants, would feel comfortable sharing their insights. Talking circle students also represented students that were regular participants in the camp.

Table 1

Interview Breakdown of Participant Attendance at 2010-2013 Manoomin Camps and student participation in previous STEM "gida" camp.

Interview Type	Total #	Attendance < 50%	Attendance >50%	Attendance >75%	Attended "gida"
Individual	16	3	5	8	12
Talking Circles	28	6	10	12	18
Total	44	9	15	20	30

For this study the researcher combined all the talking circle data together. The data was analyzed to discover themes in the students' responses from the

individual and talking circle interviews and combined to capture the overall themes that emerge from the data.

Data Collection Procedures

Approval from the University of Minnesota Institutional Review Board was obtained for the researcher to use the previously collected data for this research. Transcripts of the sixteen 2011 individual interviews were provided to the researcher. The two 2013 talking circle interview audio recordings were made available to the researcher for transcription. Each of the audio recordings were approximately thirty minutes long with a total of twenty-eight students involved in the talking circles. The researcher transcribed the talking circles within two weeks of receiving the audio recordings. The names and identifying details of individuals were coded in order to protect the privacy of the students. Audio and transcripts were located on a password-protected computer to ensure the student's privacy.

Data Analysis

The phenomenological approach used an inductive analysis of the interviews to fully understand the perceived impacts of the Manoomin camp. Inductive analysis allows themes to emerge out of the data "rather than being decided prior to data collection and analysis" (Patton, 1990). This analysis strategy worked best for this study since the researcher wanted to look at all of the student feedback from both the 2011 and 2013 interviews. The researcher

was interested in understanding all the perceived impacts of the Manoomin camp on the students not just the program's stated goals.

As the first step in the phenomenological data analysis process the researcher must set aside past experiences and personal feelings about the subject (Moustakas, 1994). Any preconceived ideas should be recognized and "bracketed" by the researcher in order to limit bias in the study (Moerer-Urdahl & Creswell, 2004).

The researcher had been involved in the Manoomin camp for two years as either a teacher or staff. The researcher did not have any influence on program goals or evaluation practice but did have personal relationships with both teachers and students. The researcher recognized that this personal knowledge of the camp needed to be "bracketed" so that the study would not be influenced by past experiences. In order to protect student privacy and further limit researcher bias the students' names on the interview transcripts were replaced with a code. For example for the first male participant interviewed, the code was M1, and the first female participant was F1.

All of the transcripts were printed, and notes taken on initial impressions of the researcher (Creswell, 1998). The next step was to re-read the transcripts and expand the original impressions until the researcher felt comfortable that all participant statements on camp impacts were captured. These statements from the transcripts were then listed. These statements were sorted into categories (Tesch, 1990). At this point of the process the researcher did not try to clump categories and instead tried to create enough categories to capture the student

statements. The researcher then looked at these categories to check if the statements were relevant to the category or if the statements needed to be moved to another category or even if a new category should be created. The researcher then looked at these categories to determine if there were linking threads of meaning. Five overarching themes emerged out of the relationships between these identified categories. Only one theme, Influence on academics, had identifiable subthemes that described different aspects of academic impacts. These subthemes emerged from multiple statements that supported each nuanced perspective. Quotes were taken from both the interviews and the talking circles to illustrate each identified theme and subtheme. Using these themes the researcher then described the experience/ perceptions of the Manoomin camp participant (Moerer-Urdahl & Creswell, 2004; Moustakas, 1994).

Chapter 4

Results

The following chapter contains the results of this study, which was guided by the following research question: How do students participating in a place-based Native American STEM camp perceive the impacts of camp on their lives?

The Manoomin camp was a STEM focused camp that worked with University researchers, tribal resource managers, local educators, and tribal Elders. Students, from middle school to college age, participated in wild rice research in a camp that was inclusive of Ojibwe culture. Manoomin camp staff and evaluators solicited feedback from participating students in 2011 and 2013.

There were five overall themes that arose from the responses of the students. These themes are listed in no particular order and don't represent any type of frequency of response by the students.

Sense of Community

Students expressed the importance of the community aspect of the Manoomin camp. The importance of friends, meeting new people, and the feeling of family were seen as an essential part of camp. Several students expressed the feeling of inclusiveness of the camp.

> I was an outcast when I was young. I'm not so much an outcast now but its only because I had a family here. (M21)

> I thought it [camp] would be hard for me, but I've come to realize… or I didn't think it would be this much of an experience, so it turned out great. I really like it. We get to do so much and Holly [camp Elder] just loves us all around her. She's a strong person. (F4)

> [Manoomin camp] It's kind of just like school, but everybody knows one another. Yeah, they all like each other here. (M3)

Another student talked about the continuity of the community feeling throughout camp.

> I feel that we're a big family that is always changing and stuff, you know. Cause a lot people that have been coming here have been coming for years and years. And we always get new kids which is really awesome because that means that this camp can continue. (F13)

And simply stated by multiple camp participants when asked, "What do you look forward to (at camp)?" were variations of the statement:

> I get to see my friends. (F1)

Influence on Academics

There were many ways in which the students described how camp influenced their school performance, understanding, and skills.

Learning in camp. The students saw learning in camp as different from how they learned in school. The aspects of camp that were mentioned were the fun, hands-on learning, interactive aspect, and more in-depth exploration of the topics.

> I think it gives a different of learning math and science than school. They teach it in a different way, than a teacher would teach it from a book. We get more fun and understandable way of learning. (F11)

> Every time we go into our diatom, macrofossil, and phytoliths groups I get excited to count diatoms through a microscope. I get excited to all these (science) posters and kind of stuff. Same stuff you do in school but being here makes it fun cause its more hands-on and you get into it in more depth. (F13)

> …[camp] gives people a chance to learn some of the stuff we don't get to learn in school.. (F21)

> There is usually the activity, like building those giant towers we put on the shake tables or building the catapults or building those hydraulic pets. Those things stick in my mind because those are really fun projects. Any class that goes: here's a water table. Now pour water on it and see where the water goes. It's doing something different that really stands out. (M1)

> It kind of helps you stay more focused. You want to learn because you're more involved, and you also realize the opportunities you have after school. (F3)

> Hands-on. Its more hands-on than it is at school. (F12)

Influence on school performance. Over and over the students mentioned how attending camp had changed how they felt in school. In particular students mentioned how camp gave them an edge in the classroom.

> A lot of stuff I learned in school, I learned here first and so by learning it at camp first I was able to do better in school. My grades were higher and I'm pretty sure my grades were higher than they would have been if I didn't come here first. (F13)

> …it gave me an advantage over most kids in the class and I felt a lot better knowing more than what we did in class. (F8)

> …made me feel smart in science class (F17)

> Um, camp has actually helped me a lot cause when you get to the first year of college, you learn a bunch of the stuff, if you have a little bit of understanding of it before you go in to like your upper divisional math and science classes…it helps a lot. (M20)

> I think honestly about this camp, without this camp I don't think I would have the love that I have for science. (F15)

> The whole camp thing its great for kids that are having trouble with their maths and all that, their writing and science. Helped me in science, it got me better at science fair and I was always good at math, so. (M22)

> … I learn more math and science [here at camp], cause those are my worst subjects. It helps me understand it better than I used too. (M12)

> Even though I want to do music, even having the science background, it well-rounded me a lot because I normally wouldn't like science, and I'm not very good at it in school, but working with the university gave me such a better understanding of it than at high school. (M9)

One Manoomin camper even credited attending camp with finishing high school.

> If it wasn't for camp I probably would have dropped out by now. So camp was pretty much the only reason that I went to school. Got me interested in school and science. (F18)

Skills. A number of students reflected on other things that they learned at camp that they felt helped them in their education. All the Manoomin camp students participate in oral reports at the end of each three-day camp. The ability to express themselves was mentioned as a skill learned because of camp participation.

> I communicate with many people and I communicate better because of camp. (F16)

> I can easily talk in front of a huge group if need be, and I can other people what to do. I can lead and I can also follow. (M2)

Other students mentioned specific skills that they felt they had acquired through attending camp.

> ...really, like writing here and taking notes actually helped me with writing papers, and um public speaking, so that actually helped me. (F19)

> I learned how to take better notes. Holly (Manoomin camp Elder) says A-students sit up front and I've been doing that and have been able to hear

> everything. It's little things that you pick up from here that make a huge difference when you are back at school. (M1)
>
> I mean by the time I graduate I am going to have 35 credits from PSEO (Post Secondary Enrollment Option) and CITS (College in The Schools) and the only reason that I ever successfully occurred was because we had to take notes [in camp] and we had to take consistently good notes ever since, well for me, 5th grade. And I started taking college classes my junior year and oh gosh there is no way I could have done. There is a reason why kids failed out and I didn't. (M21)

Opportunities for careers

For many students the opportunities offered through camp was a major component of the experience. In particular the students see camp as a way to continue education through college.

> [camp is] Paving the way. Like when I said I wanted to find a career, this is helping me with options, giving me a path in some sort because it's more hands on and without that I wouldn't really know. I would be with a job that I'm not happy with, so I'm glad I have chances, opportunities, and choices. (F2)
>
> …finding new career paths that I would like to follow. Um, half of the careers that I actually want to do I got from this camp which is environmental sciences and botany. (M14)
>
> Camp has really helped me decide like what I want to do in life. And introduced me to a lot of programs and a lot of people that I wouldn't never have otherwise met. (F18)
>
> ..since I have been coming to camp my liking of astronomy and astrophysics has been growing. And I hope to take that as a career path. (M16)
>
> …teachers here inspired me to go into education..(M21)

> ..it also gave me an internship opportunity for the innovative engineering program at the University of xxx and that's what kinda spurred me on to pursue my bachelors and hopefully Masters in xxxx. (M20)

> …without this camp and without Holly [camp Elder] pushing science fair on me and saying you should do a science fair project, I wouldn't have a clue about medicinal research what so ever. And it's really interesting. And I don't know, the experiments and how the kids are so engaged with research and everything that is being done. It's a really great thing and its inspiring.. (F15)

> I guess my favorite thing about camp is how many people I've met. Getting to go to AISES (American Indian Science and Engineering Society) and internships and everything. Like at AISES last year I had so many people pulling me aside saying how are you doing? (F18)

Culture

Many of the students participating in Manoomin camp mentioned culture as a part of camp that they appreciated. When they where asked "Why did you come to camp?" The students made several statements about how they perceive culture as a part of camp.

> I guess I came to camp to learn more about the whole traditional ways and more about my culture because I didn't know that much. (F8)

> I learned a lot of culture here and um, just being close to that. And I keep being reminded every time that I come here that it is like, yeah culture is a big part of everything and tradition and all that. You get the stuff is really important and you just go to remember that so being here just helps me remember it. (F13)

> And not only do you learn different things about it [wild rice] but you also learn significant, like, I never learned how significant wild rice was to us as a people before like this whole project started. I just thought it was one of our like staple foods, it was important in that sense but like I didn't know the stories behind it and everything. (F15)

> I always wanted to learn more about wild rice but I could never ask my parents cause neither of them know much. And I never got the chance to ask my grandmother. I didn't see her much. So coming here I learned a lot about it. (F11)

> ..here we learn about how natives lived and gathered food and stuff. (M5)

> It helps me in my language because we're doing Ojibwe, so it's helped me with that. (F14)

> I learned more about the wild rice, like different things it takes in and what it needs to grow. And I didn't really learn that traditionally from a parent or grandparent. (F8)

Influence on Attitudes and Behavior

Students also spoke of how they connected their experiences at Manoomin camp with the rest of their lives. Some students spoke of their understanding and feelings about wild rice issues on the Fond du Lac reservation.

> And I didn't think there was current issues with the rice. I thought it was just there and it was fine. There's a lot of bad stuff going on with it and its got a big chance of just going away and it makes me want to get out there and just help it stay here. (F13)

> It really taught me that to get to people you need to use math and science as your language….we can't just say manoomin is sacred but they might not understand that. We have to really support it, like with science, like how manoomin only grows in this area and how it so picky and stuff like that. (F15)

> Well, I would say that the cores tell us about the lake's history, and when wild rice came to be in that lake, and how it changed over time. We can use what we find in the cores to either help wild rice grow more, or stop it from being extinct. We can predict what will happen and if it's bad, like all the wild rice will ruin. We can at least try to make it so it'll last longer. (M3)

> Lowanna [tribal community member] told us about this wild rice community that used to go out and take care of the lakes, and if we were to continue that instead of our generations being lazy, we wouldn't even be doing this, because our lakes would be good. (F3)

Other students related what they learned at camp with how they viewed environmental issues.

> I look at what we do in our learning a lot differently. When people say there's that new factory coming up, you start looking at that a lot differently. You start understanding that may not be the best placement for it, what will they be producing and what will they be doing with their waste? You also look at your own like: we throw out a lot of trash. Maybe we could start recycling more; maybe we can cut down on our own footprint. Stuff they say is happening all around the globe you can find happening right outside your front door. (M1)

> When I go out in the woods, I think about what we talked about, and what I'm doing and stuff. It brings back memories. (M6)

> I don't know, its fun to learn about all these different things. And see the effects we've done as a community and try to find ways to help, and I don't know, turn those effects around, the bad ones that is, and I like to learn a lot more about where I came from. (F15)

Students also mentioned the camp as an influence on the way they feel about themselves and behavior.

> I just kind of felt like I accomplished something, like I did something good—kind of that kind of feeling. (M6)

> …its had a really positive influence on my life. (F13)

> it [camp] definitely teaches me new perspectives and to see things in different ways and to really think deeply and difficult aspects like that. (F15)

> Here I learn to bite my tongue. In certain subjects, you know how you're having days when you just want to be difficult? Everyone has those days and I know they do. You may deny it, but we all do. I've learned to bite my

> tongue down and just shut up and accept it. But I also learned to opinionate myself here. The teachers are like counselors and advisors and they ask your opinion here. Before I came here, I didn't have one. But here they force you to have a voice, whether you like it or not. (F6)

> I'm proud about being a part of this whole thing. It's a really big project that's going on. I suppose it's being proud of everything that's go on here. (M1)

Summary

The findings in this chapter were themes that emerged from the interview and talking circle discussions with students that participated in Manoomin camp. The five themes that emerged from the data were 1) Sense of Community; 2) Influence on Academics; 3) Opportunities for Careers; 4) Culture; 5) Influence on attitudes and behavior. Only under the theme, Influence on Academics, did the researcher identify subthemes. These three subthemes - learning in camp, influence on school, and skills - all represented different ways that the students perceived how camp had impacted their academic success. These themes and subthemes were supported by direct quotes taken from both the 2011 and 2013 interviews.

Chapter 5

Discussion

The themes that emerged out of the student data suggested that students that participated in the Manoomin camps perceived the impacts of the camp went beyond the STEM experience that was the central purpose of the camp. This chapter discusses in more detail how the student perceptions captured in this study agreed with current research on creating informal STEM focused camps for indigenous youth and the unique results that came out of this research. These results sheds light on how informal EE outreach can be structured to be welcoming to Native American youth.

Reflection on Current Research and Results

The literature search for the Manoomin Camp study highlighted the importance of the structure of non-formal outreach program on its effectiveness at reaching Native American students. Eric Riggs (2004) summed up the research nicely when he concluded that field-based geoscience education for Native American students had "three common qualities and features:

1. Major emphasis on place-based curricula, emphasizing experiential, outdoor learning in familiar environments within the traditional homelands of the indigenous groups
2. Inclusion of relevant indigenous scientific knowledge wherever possible and appropriate

3. Explicit involvement and cooperation of indigenous community members, elders, and education in the design of the content, location, and delivery of curricula and programs" (p.301).

Native American learning styles, an important component of learning success, is incorporated within these common features.

Using phenomenological methodology, the researcher used just the statements of the camp students to describe what Manoomin camp meant to them. The five themes that arose from interview data from forty-four students were:

1. Sense of community
2. Influence on academics
3. Opportunities for careers
4. Culture
5. Influence on attitudes and behavior

The following sections explore the Manoomin camp themes in comparison to previous research.

Discussion of Manoomin Themes

Sense of community. Cajete (2005) stated "The life of the community, as well as the individuals of that community, is the primary focus of tribal education"(p. 75). Looking at a more narrow sense of community, the community of the camp, the responses from the Manoomin students spoke to the importance of the relationships created through participation in the camp. Camp was seen as

place of acceptance, friendship, and a surrogate family. While almost every interviewed student mentioned seeing friends as a favorite part of camp, for some campers the sense of belonging went deeper. Manoomin camp for some students became a place of belonging that they did not experience in school or among their peers. Manoomin camp utilized multigenerational group learning, strong mentoring relationships, and the presence of a tribal community "Grandma" to foster the sense of connection among the campers. Those Manoomin camp practices were consistent with Pewewardy's (2002) indigenous learning styles literature review findings on the importance of family and of Elders, the need for strong teacher/pupil relationships, and the preference of cooperative learning. While it is difficult to make a direct correlation, the feeling of community might have contributed to the consistently high attendance rates of the Manoomin camp students (Table 1).

Influence on academics. It was very clear from the Manoomin student responses that they felt camp had helped them with school. This theme has three subthemes:

a) Learning in camp
b) Influence on school performance
c) Skills

These subthemes illustrated different student perspectives on exactly how the Manoomin camp had influenced academic success.

Learning in camp*.* Camp learning was seen as "hands-on", "fun", and more in-depth then school. Manoomin camp activities and lessons were structured to be very hands-on and interactive. Most lessons were related to the wild rice research as well as regional concerns. Group and team learning was encouraged with mentors participating in the activities along with the students. Cooperation was modeled, as older students were encouraged to help younger students understand the concepts being learned. These methods agreed with Pewewardy's (2002) findings on cooperative versus competitive learning and using visual, auditory and kinesthetic learning styles that the majority of Native Americans prefer when learning new concepts. As one of the Manoomin camp student's stated "I guess to me its that you don't just sit around learning. You actually get up, do stuff, and go around to different places. I learn different aspects and points of view. Not like a classroom where you have to sit there, take notes, and watch as the teacher does everything for you." (F11)

Influence on school performance. Manoomin students felt that camp gave them an advantage in school by exposing them to math and science concepts before they learned them in school. The students' statements indicated that not only did they feel that learning math and science concepts at camp helped their grades but also made them feel more confident in school. As one student stated " [camp] made me feel smart in science class…yeah, it helped me in school. I like coming here all the time, I'm excited." (F17)

Skills. One interesting subtheme that emerged from the data is the recognition that skills, such as note-taking, organization, and public speaking,

taught at camp translated to academic success. Students found that practicing skills at camp made a difference in class success. As one student said "..really, like writing here and taking notes actually helped me with writing papers, and um public speaking, so that actually helped me."(F19)

This particular finding adds a richer layer to the discussion on what students feel is important to academic success.

Opportunities for careers. Manoomin camp was seen as "paving the way" as one student stated, to higher learning and career opportunities. Internships, travel to scientific conferences, and professional connections were a valued piece of the Manoomin camp. Exposure to different career paths was also valued. One student illustrated this point by saying "[without this camp experience] I think my future goals would be very generic, like I would like to be a nurse instead of wanting to be a medical researcher". (F15) This particular theme was very interesting and new to the discussion of Native American STEM camps. The Manoomin camp staff worked with the University of Minnesota and other partners to connect students with research internships across the nation. The Manoomin camp created opportunities for students and staff to travel together to professional conferences to present the wild rice project findings. Students had the chance to experience presenting a scientific poster to professional audiences and the opportunity to connect with University faculty from across the United States. Research suggested that for minority students, role models and mentors are very important factors that motivate minority students to pursue environmental fields (Armstrong et al., 2007; Maughan et al., 2001). Purposeful

inclusion of these opportunities to meet role models and mentors is a fairly unique aspect of the Manoomin STEM camp.

Culture. Students viewed the inclusion of culture in the Manoomin camp as a meaningful aspect of the camp. The students spoke of connection to tradition, language, and knowledge. Often they expressed that this knowledge only came from the Manoomin camp since they did not have family that could pass down traditional knowledge. Current research overwhelming agreed on the importance of inclusion of tribal culture as an essential component in educational outreach for Indigenous students (Boss, 2003; Cajete, 2005; Lane, 2012; Simpson, 2002; Weeks, 2003). The Manoomin camp was place-based learning centered around research on the Fond du Lac Reservation's wild rice lakes. Tribal members shared their knowledge around wild rice, the traditions, and history with the students. The data from the Manoomin camp students corroborated the significance of including culture into STEM learning but it also pointed out another aspect of cultural inclusion. There are an increasing number of Native Americans that can't pass down traditional knowledge and skills. There seems to be a generational gap between Elders that are keepers of TEK and the young people of today. This finding from the Manoomin camp highlights that in some cases this type of non-formal outreach is the only resource for young people to learn traditional ways.

Influence on attitudes and behavior. Students credited Manoomin camp with instilling a sense of stewardship towards wild rice and the environment. A few mentioned the need to "do something" to protect the wild rice. Others thought

of how they could individually alter their behavior to make positive changes either in the environment or within themselves. How did the structure of the Manoomin camp contribute to these statements? As Gregory Cajete (2002) states "Essentially, tribal education worked as a cultural and life-sustaining process. It was a process of education that unfolded through reciprocal relationships between one's social group and the natural world (p. 69). Manoomin camp taught STEM concepts but also provided the cultural context of the subject. Usually a tribal community member provided the cultural context from the history and traditions to the current issues. The student was allowed to build that reciprocal relationship between the student, the student's culture, and the natural world. Benjamin Feinstein (2004) found that combining STEM concepts with traditional ecological knowledge (TEK) in the context of local indigenous issues led college students, both native and non-native, to shift their views on either environmental issues and/or self identity. The Manoomin camp through its melding of western science with TEK may be influencing students to make similar attitude and behavioral changes.

Implications for the Field of Environmental Education

This study can be a best practices guide for environmental educators that would like to improve or create EE programs that are meaningful for Native American students. Environmental education outreach is considered an important strategy to help Native American students succeed at academics and motivate them to pursue a STEM career (Boss, 2003; Lane, 2012; Simpson,

2002; Weeks, 2003). EE practitioners, especially those that work in the upper Midwest, will most likely work in or near a tribal community. The importance of becoming culturally sensitive and rigorous in applying best practices towards any EE outreach is critical in order to best serve a diverse audience. Simple misunderstandings such as having Native American students dissect owl pellets for a feeding study can be highly offensive to people that consider the owl a harbinger of death. The main strength of the Manoomin Camp was the guidance of tribal community elders and leaders on content and delivery of the program. Tribal community members worked with University researchers to build a program that melded the "western science" of the researchers with the TEK of the community. The student statements showed how inclusion of culture enriched the student's perceptions of the Manoomin camp beyond just a STEM camp. EE practitioners should connect with tribal Elders and tribal leaders to seek guidance on outreach programs. It is important to realize that there is a traditional, respectful way to ask for this guidance. For an EE practitioner that is unfamiliar with the indigenous culture one of first steps is to seek out Native American educators at the college or K-12 level to ask their advice on how and who to contact. Taking the time to ask for advice will ensure that the relationship built between the EE practitioner and the local tribal community is a positive one.

The interview data showed how some Manoomin camp students have taken the concepts and skills learned from culturally grounded research on wild rice to take environmental stewardship action. The EE practitioner should take the time to learn about current issues that are facing indigenous communities.

Issues such as climate change, loss of traditional natural resources, and environmental justice are topics that are both timely and critical to many tribal communities. The impact of centering educational outreach on a culturally significant issue was illustrated by this student quote "Well, I would say that the cores tell us about the lake's history, and when wild rice came to be in that lake, and how it changed over time. We can use what we find in the cores to either help wild rice grow more, or stop it from being extinct. We can predict what will happen and if it's bad, like all the wild rice will ruin. We can at least try to make it so it'll last longer." (M3) This process of moving from knowledge to action is the goal of Environmental Education (Stapp et al., 1969). These results should motivate EE practitioners, especially those that work near tribal lands, to incorporate program elements that are inclusive of indigenous culture.

Significance

This research is significant in that it has added to the literature of non-formal STEM outreach for Native American students. There has been little previous research on how participants feel Native American STEM camps impact their lives. New insights on the importance of community, culture, and curriculum on how participants feel about the camp experience is useful for EE practitioners, researchers, and tribal professionals that wish to start a successful Native American STEM camp. This research is also useful for the Manoomin camp staff to consider as they evaluate how successfully the Manoomin camp has achieved the program's stated goals.

Future Research

This study was meant to capture the student's perceptions of how the Manoomin STEM camp impacted their lives. While the data revealed a deeper understanding of how incorporation of Native American learning styles and Indigenous EE program components influenced the perceptions of the students it did not use any quantitative data to flesh out the perceptions stated by the students. It would be helpful for future research to be able to track the academic changes for each student to verify if attending camp seemed to have any effect on student's grades. Tracking the high school graduation, internships, college attendance, and career paths would also paint a more complete picture of the effects of participation in a Native American STEM camp. An interesting aspect of this study was the implication that the Manoomin camp actually changed attitudes and behaviors of the students towards environmental issues and personal growth. I would suggest that future research would conduct pre and post surveys/interviews of new students to track any changes in attitudes or behaviors over the course of the camp.

Conclusion

The themes that emerged from this study helped corroborate and expand on current research on Indigenous non-formal STEM outreach. The data showed that the inclusion of culture and tradition in the Manoomin camp was a significant factor for the students. The students felt closer to their culture and their tribal community. Experiential, hands-on lessons, grounded in place-based wild rice

research, made the student feel that they learned more and it was "fun", even though some students feel that math and science are their worst subjects. The inclusion of traditional learning styles such as group learning and multi-generational mentoring made students feel included and part of a family. The focus on a research project that was both place-based and culturally significant made students feel that "you know that what you are doing in this camp is going to mean something." (F15) It also may be a reason why students were motivated to take action to protect the wild rice resource.

There were a few themes that expanded on how Native American STEM camps impact the participating students. The Manoomin STEM camp offered opportunities through conference presentations, and internships for students to meet STEM professionals from across the United States. Students perceived these opportunities as a way that new career paths were opened to them that would not have happened without camp. Another interesting theme that emerged from the data was the potential influence of the Manoomin camp on changing student attitudes and behaviors not only towards environmental issues, but also in the area of feelings about themselves. While current literature talks about factors that can motivate Native American students to pursue STEM fields very little has been written on how a Native American STEM camp motivates students to take environmentally responsible behavior.

This study started with a description of the challenges of today's tribal communities in handling the environmental and societal pressures that threaten their culturally significant resources and in turn their culture. Recruiting Native

American students to pursue STEM fields is very difficult. Native American students in Minnesota are statistically almost 50% more likely to drop out of high school than their White counterparts. Tribal communities are seeking educational interventions that will motivate their young people to go to college and pursue STEM fields that will benefit future generations. This preliminary study on the perceptions of students that attend the Manoomin STEM camp holds out hope that this is an educational intervention that will lead to academic success and future generations of STEM professionals.

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APPPENDIX A

2011 INDIVIDUAL INTERVIEW QUESTIONS

2011 Individual Interview Questions

1. How did you start coming to camp?
2. What do you look forward to here?
3. What things stand out for you?
4. How was your first year of manoomin similar or different from you expected?
5. Is there anything that youre especially proud of or feel good about?
6. How does it fit in with other things in your life?
7. What do you tell your family about your time here?
8. What do you tell your friends about camp?
9. What adults do you feel comfortable talking to, asking questions of?
10. How do you feel about school?
11. What are your favorite subjects?
12. Is anything you do at manoomin similar to anything you do at school?
13. Is anything different?
14. Are there ways that you think being at manoomin helped you in school?
15. What do you think working as a scientist or researcher would be like?
16. Do you see yourself doing any of the activities that you do at manoomin, later on?
17. Do you feel that being part of manoomin, you know what to bring?
18. Is there anything you wished you had known before starting camp?
19. Is there you think differently, now that you have been part of manoomin?

20. Is there anything you would like to add or feel that I should have asked you?

APPENDIX B

2013 TALKING CIRCLE QUESTIONS

2013 Talking Circle Questions

March 8, 2013 Talking Circle Questions for Older Students

1. Tell us who you are, what grade you are in, and how many years that you have been coming to camp.
2. Has camp helped you with your career choice?
3. What does camp mean to you?

March 9, 2013 Talking Circle Questions for New Students

1. Why do you come to camp?
2. Has camp helped you in school?
3. Would you recommend camp to friends or family?
4. What have you learned about your culture that you didn't know before you came to camp?
5. Would you like to be a scientist?
6. What are somethings that you would tell someone or you remember about camp?
7. What do you want other people to know about camp?
8. Are you going to use the information that you learned here to potentially do something in your future?