Tribal Colleges: Influences on Native American Students Completing STEM Degrees

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Tribal Colleges: Influences on Native American Students

Completing STEM Degrees

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Concordia University–Portland
College of Education

Dissertation submitted to the Faculty of the College of Education
in partial fulfillment of the requirements for the degree of
Doctor of Education in
Higher Education

Brandy Kamm, Ph.D., Faculty Chair Dissertation Committee

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Concordia University–Portland

2019
Abstract

This qualitative case study explored the experiences of 13 Native American higher education students attending a Tribal College and University (TCU) and pursuing a degree in science, technology, engineering, and math (STEM). The case study also investigated a focus group of TCU faculty members who taught STEM courses. The case study also contains an observation of 13 Native American students during a bridge program activity at a TCU, used as a recruitment tool and preparation strategy for potential STEM students. The research was intended to explore the influence and strategies currently employed by TCUs to help Native American students successfully complete degrees in STEM-related subjects and what further approaches might be useful in the future to increase the numbers of Native American STEM professionals. Participant stories divulged positive and negative aspects of the TCUs the students attended and divulged their opinions on how the services at their TCUs could be improved. Data were collected by transcribing the audiorecordings of the interviews and focus group discussion and analyzing the information through coding into themes and patterns. The themes included family and friendly atmosphere, financial support, low cost, accessibility, helpfulness, culture, accountability, academic support, research, time management, nontraditional students (i.e., older than the usual college age), recruitment, and retention. This qualitative case study has found that successful Native American STEM graduates are failing at their Boards, thus preventing them from employment and becoming successful STEM professionals.

Keywords: Native American, tribal colleges and universities, STEM, American Indians, science, technology, engineering, math.
Dedication

This study is dedicated to my wife, Corrilyn, and our children, Brooklynn, Cody, Torance, and Connor. I would also like to dedicate this study to my parents, Larry and Kathy Henry, who have given me the greatest amount of support in whatever path I have chosen to take. It is because of my family’s love, support, and sacrifices that I was able to complete this wonderful journey. I also dedicate this study to the stakeholders, students, faculty, staff, and administrators of the Tribal Colleges who have allowed me to be a part of their loving and supportive families. Lastly, I give all praise and thanks to the Creator. Prayer and faith have guided me along this excursion and will continue to be my escort on whatever path I am directed to follow.
Acknowledgments

First, I would like to acknowledge the participants in this study and the administration and faculty of the Tribal Colleges that allowed me to use their facilities to complete the research needed to finish the study. I would also like to thank and acknowledge my dissertation chair, Dr. Brandy Kamm, for all the guidance given that allowed me to accomplish this challenging task. Without your motivation, patience, and expertise I would have given up many times along this trek.
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Chapter 1: Introduction

This qualitative case study investigated the experiences of Native American students enrolled in science, technology, engineering, and math (STEM) programs of study at a Tribal College and Universities (TCUs). This study also focused on faculty members at TCUs and the impact TCUs have on Native American students with a passion for STEM, including a nonparticipant observation of a STEM bridge program used for the recruitment of secondary education students. According to Babco (2005), Native Americans make up less than 1% of the U.S. population and represent even a smaller portion of the population in science and engineering. In the last decade, there has been a slight increase in Native Americans receiving degrees in STEM disciplines; unfortunately, this increase is considerably smaller than the growth in the national average during the same time period (Merner & Tyler, 2017).

Lack of preparation at the secondary level has prevented Native American students from pursuing STEM educational degrees and impeding their chances of entering scientific or technical careers (Cajete, 1987). According to Collaborating to Grow the Pathway of Native Americans in STEM (2016), Native American students do not receive adequate STEM education throughout their formative years, and those students who have had the opportunity to leave the reservation for STEM education rarely come back to the reservation because of lack of job opportunities in STEM professions. TCUs, because of beneficial support from numerous foundations and federal agencies, have developed strong STEM programs, allocating needed support for Native American students required to finish their degree of choice (Tribal Colleges: An Introduction, 2015).

Native American students find themselves at a disadvantage when enrolling at a mainstream university, as they tend to need more support, financial help, and cultural recognition.
(Deloria, 1994). TCUs were founded in order to give Native American students needed educational support and to prepare them to be proficient in the non-Native world as well (Warner & Gipp, 2009).

**Background, Context, History, and Conceptual Framework for the Study**

One of the earliest and most important manifestations of self-determination was the creation of tribally controlled colleges (Boyer, 2008). The establishments of TCUs came as a reaction to the higher education needs of American Indians and was envisioned in the late 1960s by Jack Forbes, who proposed to found and develop an American Indian university, inspired by the U.S. federal policy proposal of self-determination of American Indians (Warner & Gipp, 2009). In 1968, the Navajo Community College, now known as the Dine College, was established as the first tribally controlled college, followed by the founding of United Tribes Technical College, in 1969. In 1972, the creation of the American Indian Higher Education Consortium (AIHEC) facilitated an alliance between the first six tribal colleges. AIHEC’s (2014) mission is to support the work of these colleges and the national movement for tribal self-determination. AIHEC provides governance for TCUs and guides the policies put in place by TCU presidents that affect Native American higher education issues dealing with educational legislation, policy, rules, regulations, and budgets (AIHEC, 2006). There are currently 37 tribal colleges located in 14 states and one international tribal college, Red Crow Community College, located in the Canadian province of Alberta (AIHEC, 2014).

Since their induction over 40 years ago, TCUs have indeed made an impact on reservations nationwide. TCUs are unique institutions that combine personal attention with cultural relevance in a way that encourages American Indians to overcome the barriers in higher education (AIHEC, 2013). Marroquin (2019) expressed that tribal culture and language are
essential components and outcomes of a TCU education, and Native students who attended a TCU reported significantly higher perceptions of culture reciprocity and cultural resiliency. TCUs were founded in order to prepare students for 4-year institutions and to establish a supportive learning environment where the students felt culturally accepted and not stereotyped. The founding of TCUs gave Native Americans the chance to gain access to education beyond the secondary level and to help tribes promote and strengthen their traditional languages and cultures (AIHEC, 2006).

In the past, TCUs were only equipped to handle general requirements and lacked the classrooms, equipment, and qualified staff needed to teach STEM-related courses (Tribal Colleges: An Introduction, 2015). Traditionally, TCUs offered only 2-year degrees and vocational training, but with the push of STEM becoming nationwide, some TCUs are offering applied bachelor’s degrees in science (Corbyn, 2011). Today, because of foundation and federal funding partners, some TCUs are better equipped for STEM education and training than most state institutions (Tribal Colleges: An Introduction, 2015). According to Corbyn (2011), while enrollment at TCUs has shown a decrease, student enrollment in STEM programs at TCUs has risen by 70%. Babco (2005) explained that, while the population of Native Americans has risen in the 20th century, they still comprise less than 1% of the total U.S. population and represent an even smaller percentage in science and engineering. Minero (2019) clarified that educators have made an effort to confront the racial divide of young people entering STEM professions by holding discussions to encourage more female, Black, and Latino students to take STEM courses and enter STEM careers. Minero also explained that Native American students have been left out of these discussions and more than half of Native American students lack access to high school
science and math courses that are required for entering a STEM higher education program or a STEM career field.

The conceptual framework for studying the problem focuses on the theoretical concepts of the Native American college student transition theory by Schooler (2014) and Horse’s (2005) perspective on American Indian identity development. Native American college student transition theory (NACSTT) provides tribal college administrators and other institutions of higher educations administrators with a better understanding of the challenges Native American students are facing during their initial year of college (Schooler, 2014). The six stages of the NACSTT consist of remembering history, learning to navigate, moving toward independence, building trust and relationships, reestablishing identity and reaching out, and developing a vision for the future (Schooler, 2014). Horse’s (2005) perspective on American Indian identity development examines the character enhancements needed for American Indian students to grow, including Native language, genealogical heritage, tribal traditions, identifying as American Indian, and being enrolled in a federally recognized tribe. Horse recognized Native American identity as being complex and intricate and various issues affecting what it means to be Native American. Horse identified ethnic nomenclature, racial attitudes, legal and political status, cultural change, and personal sensibility as components of what being Native American means in today’s society.

**Statement of the Problem**

The problem that was addressed in this case study is that Native Americans are underrepresented in STEM courses; a need, therefore, exists for Native American scientists on tribal reservations and in the United States in general to encourage more students to be taught STEM courses. This case study focused on what TCU educators can do to exert their influence
and improve their strategies toward preparing, recruiting, and retaining more Native American students; encourage them to finish their STEM degree programs; and enter a STEM profession.

The existence of tribal colleges has given Native Americans an opportunity to achieve success in higher education, but the numbers of Native American students in undergraduate STEM programs at tribal colleges and mainstream universities are considerably lower when compared to those of non-Native students.

General research has been done in the past on why Native American students have failed to succeed at the higher education level, but not much research has been devoted to examining and finding remedies for the failing graduation rate of Native American STEM students. *Collaborating to Grow the Pathway of Native Americans in STEM* (2016) acknowledged that there are many issues barricading Native American students from being successful in STEM degree programs and entering the STEM workforce. One barrier is poverty. *Collaborating to Grow the Pathway* (2016) reported that seven of the 10 poorest counties in the United States are in Indian country, and 39% of Native Americans living on reservations are poverty stricken. Because most Native Americans are living in poverty, not many can afford proper Internet access, which puts Native American students at a disadvantage compared to students who have proper access to the Internet (*Collaborating to Grow the Pathway*, 2016). Other barriers, due to poverty, that keep Native American students from successfully finishing a degree in higher education include transportation, child care, lack of finances for school materials, and lack of finances for health care.

Reeves, Marin, Deerinwater, and Medin (2017) conducted a study on the factors that support success among Native Americans in STEM. The authors suggested that cultural dimensions of the choices that Native students make regarding what discipline or career path to
follow are of more importance than is generally reflected in the design of STEM participation initiatives. *Collaborating to Grow the Pathway* (2016) also mentioned that finding approaches to STEM fields within existing tribal cultures will make STEM fields resonate and meaningful. Another issue is being unprepared for college courses (Cajete, 1987). According to the results listed by the National Assessment of Educational Progress (as cited in Clarren, 2017), only 10% of Native American high school students are proficient in math and reading and are less likely to graduate in a 4-year span from a secondary school than any other racial group. Babco (2005) mentioned seeing an increase in Native American high school students taking more math and science courses than in the past; yet, as a group, they are still far behind all other racial or ethnic groups.

Figure 1 represents STEM bachelor’s degrees as a percentage of total number of bachelor’s degrees conferred by postsecondary institutions, by race/ethnicity for the academic year 2015–2016, according to a study by De Brey et al. (2019).

![Bar chart showing STEM bachelor's degrees by race/ethnicity](chart.png)

*Figure 1.* STEM bachelor’s degrees as a percentage of total bachelor’s degrees conferred by postsecondary institutions in 2015–2016.
This study focused on strategies TCU educators are executing in order to increase the preparedness of Native American students as they transition to higher education and enter college-level STEM programs. Having a strong background in math and reading is essential for completing a STEM program of study, but most Native American students entering higher education find themselves taking remedial mathematics or remedial composition courses to build a foundation in those areas. These courses often do not count toward a degree and are costly (Lee, 2014). Unfortunately, because the majority of Native American students enter higher education with weak math or reading skills, their ability to succeed in advanced science courses is diminished. Sandia National Laboratories (2018) reported that Native American students have the lowest graduation rate among any minority group and have less access to rigorous mathematics and science coursework in high school, compared to other racial or ethnic groups. Figure 2 represents the Native American students’ educational attainment, according to Sandia National Laboratories (2018).

![Figure 2. Native American students’ educational attainment.](image)

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Some problems related to the low number of Native Americans attending higher education institutions and finishing with a STEM-related degree, besides lack of preparation, is stereotyping and nonsupportive learning environments (Heck, 2013). TCUs will accept most students who apply, and over 70% of admitted students need developmental education. TCUs have the tools to integrate these students in credit-bearing coursework, while developing their academic needs to succeed (Lee, 2014). TCUs were created to help Native Americans achieve academic success rooted in their tribal cultures and have the ability to provide student support needed by Native American students to succeed in STEM education programs. Dameron (2014) explained that limited research exists regarding Native American STEM education, which makes it difficult for Native American student support services to find the necessary data to make proper adjustments and increase Native American student success in STEM. Reeves et al. (2017) explained that Native Americans continue to be significantly underrepresented in education and careers involving STEM and propose that Native underrepresentation in STEM requires the consideration of issues that have not been sufficiently addressed. The authors suggested programming that targets deficits in STEM curriculum and STEM knowledge, as well as deficits in social and other skills and educational and financial barriers. Figure 3 represents the percentage of Native Americans with science and engineering degrees (Sandia National Laboratories, 2018).
Native American students are the only racial or ethnic group that has not seen improvements in STEM participation since 1998. In the past 10 years, Native Americans have received less than 1% of all bachelor’s and higher degrees in science and engineering (Reeves et al., 2017).

Research has also shown that lack of role models in STEM professions on reservations may be a negative factor in why Native Americans are not pursuing STEM careers. Deerinwater (as quoted in Minero, 2019) stated, “Due to chronic underrepresentation, Native students do not see themselves in STEM careers because they do not see relevant role models. And in STEM careers, the culture and climate often does not support or welcome Native people” (para. 4). Collaborating to Grow the Pathway (2016) mentioned the importance of Native Americans students seeing themselves in STEM fields; yet, even though some come from generations of scientists and engineers, they do not see themselves in that way.

**Purpose of the Study**

The purpose of this qualitative case study was to explore the perceptions of TCU STEM students and faculty members and describe the impact of TCUs in the elevation of the numbers of Native American students in STEM-related programs and professions. Native Americans have
the lowest numbers per population of working in a STEM profession in the United States (NACME, 2016), but TCUs have provided Native Americans with the opportunity to study and enter STEM-related programs with the hope of increasing the number of Native American STEM professionals. Although there have been studies on recruitment and retention of Native American students at TCUs (Guillory, 2002; Ressler & His Horse is Thunder, 2014), research on STEM education and promotion at TCUs is not, as yet, well-established. It is critical for students to become aware of the potential STEM occupations offer, and TCUs are equipped to bridge the gap toward such possibilities for Native American secondary and postsecondary students interested in a STEM career.

Collaborating to Grow the Pathway of Native Americans in STEM (2016) acknowledged existing barriers that limit Native American success in STEM and showed how these barriers can be overcome by increasing Native Americans students’ exposure to STEM fields and mentoring them throughout their college years, to enable them to apply their STEM skills after graduation. Williams and Shipley (2018) noted that many STEM instructors did not understand the historical experiences of Native Americans in higher education or how to incorporate the cultural beliefs of Native Americans into their STEM curriculum. This study intended to help those STEM instructors, Native and non-Native, to understand the importance of developing a cultural connection to the course curriculum to help their Native American students comprehend and retain the curriculum material.

Research Questions

The primary research question of the study asked: What influences, with respect to recruitment, student services, and STEM-related programs, do TCU educators exert to increase
Native American student numbers in STEM-related degrees? This question aligns with the following three subquestions:

**Subquestion 1.** What are the perceptions of TCU students regarding support systems and resources at their TCU? The purpose of this question was to explore the experiences of Native American students enrolled in a STEM program at a TCU and what types of support and resources are provided to increase their chances of succeeding.

**Subquestion 2.** What recruitment strategies and bridge programs do TCUs offer to middle school and high school students that will prepare them for higher education courses related to STEM? The purpose of this question was to find out what TCU educators are doing to prepare, not only their current students, but future students as well, for college-level STEM courses.

**Subquestion 3.** What outreach efforts do TCU educators use to improve STEM education at TCUs so that graduating students are prepared for STEM-related professions? The purpose of this question was to gain an understanding of the endeavors and strategies TCU educators are implementing in order for Native American students to succeed not only in their programs but to also at mainstream universities for undergraduate and graduate degrees in STEM.

**Rationale, Relevance, and Significance of the Study**

The rationale for this case study was to stress the importance TCUs have in developing unprepared Native American college students and giving them a chance to succeed in STEM education and as a STEM professional. It is the desire of this study to understand the stories and experiences of Native American STEM students attending TCUs that have made them either fail or succeed in their attempt to graduate with a STEM-related degree. The data have shown a very
marginal increase in Native Americans receiving a degree in STEM programs (Merner & Tyler, 2017), and many of those students started their higher education at a TCU. There are factors that prevent a Native American student from succeeding at a traditional higher education institution, including being unprepared, poverty stricken, culturally alienated, and having no support (Lee, 2014).

A compelling reason to undertake this case study was to increase awareness of the experiences, views, and insights TCU students and faculty members have regarding the successes and failures of Native American students in STEM degree programs. By interviewing and analyzing the collected data, this researcher expected to raise the general awareness of successful approaches and to eliminate some of the barriers in hopes of helping more Native Americans to graduate and succeed in STEM-related professions. It is hoped that this study will open the door for continued research on Native American STEM education and result in higher Native American STEM program graduates at TCUs. This study could be expanded upon for further research into the affiliation of Native Americans and STEM education. Further research could identify additional barriers that keep Native Americans from succeeding in STEM education and also aid in recognizing key components needed for Native Americans to prosper in STEM fields. The study can advise, based on student and faculty insights, on advancements of strategies used by TCUs to ensure increased success in their STEM programs leading to more Native American STEM professionals.

Definition of Terms

The following terms are defined as used in this study:

**American Indian Higher Education Consortium (AIHEC).** The AIHEC provides leadership and influences public policy on American Indian higher education issues through
advocacy, research, and program initiatives; promotes and strengthens indigenous languages, cultures, communities, and tribal nations; and, through its unique position, serves member institutions and emerging TCUs. AIHEC activities are supported by member dues, grants, and contracts. AIHEC is a 501(c)(3) organization, governed by a board of directors, which is composed of the presidents of the accredited U.S.-based TCUs. The board elects from its membership an executive committee to oversee the activities of the collective body and the AIHEC staff (AIHEC.org, 2014).

**Cultural integrity.** The maintenance of cultural traditions and cultural identity (Marroquin, 2019).

**Cultural reciprocity.** The perceptions of and learning about other cultures and sharing one’s own culture (Marroquin, 2019)

**Cultural resiliency.** The perceptions of overcoming adversity and maintaining a strong sense of one’s culture (Marroquin, 2019).

**Federally recognized tribes.** Five hundred-and-seventy-three (573) sovereign tribal nations (variously called tribes, nations, bands, pueblos, communities, and Native villages) have a formal nation-to-nation relationship with the U.S. government. These tribal governments are legally defined as *federally recognized tribes.* Two hundred-and-twenty-nine (229) of these tribal nations are located in Alaska; the remaining tribes are located in 35 other states. In total, tribal governments exercise jurisdiction over lands that would make Indian Country the fourth largest state in the nation (Tribal Congress of American Indians, 2019).

**Native Americans.** Refers to people whose heritage can be traced back to the indigenous people of North America before Columbus (Peralaz, 2014).

**Sacred.** A strong cultural veneration (Williams & Shipley, 2018).
Taboo. A strong cultural warning or prohibition against an action. Violating a taboo is an act of serious aberrance, which can result in feelings of guilt or shame, as well as direct or indirect social sanction (Williams & Shipley, 2018).

Tribal College and Universities (TCUs). Institutions of higher learning founded by Native Americans and chartered by tribes (Tribal Colleges: An Introduction, 2015).

Assumptions, Delimitations, and Limitations

Assumptions. Various assumptions were made in this case study. One assumption was that Native American students came from poverty areas and that they had poorer chances of succeeding in higher education than other students. Native American reservations are predominately poor and have high unemployment, making it a disadvantageous for Native students on reservations to get adequate educational tools such as technological devices, mentoring services, and access to the Internet. Native American students face cultural identity issues, limiting their ability to thrive at a non-Native institution. Having a strong grasp of tribal culture and having a secure cultural identity has been linked to the academic success of Native Americans in STEM participation. Native American students enter higher education unprepared and have difficulty in math- and science-related courses. It is documented that many Native American students are not given the chance to take high level math or science courses at their secondary schools. Another assumption of the study was that all participants, both students or faculty, would answer the interview questions truthfully and candidly.

Delimitations. Delimitations of the study included the small sample size of student and faculty participants. There were 13 student participants in the study and three faculty members in the focus group. The study was also delimited to a small number of TCUs: Of the 37 TCUs, two participated in this study. Another delimitation entailed narrowing the selection of interview
questions asked of students. The study focused on their observations of elements regarding enrollment, success, or failure in STEM programs at a TCU.

**Limitations.** Possible limitations of this research included the available time for the interview process. Thirteen student participants had to be interviewed over a 2-week period; thus, some of the data may be driven by participants’ talking with each other before and after their interviews. The study was limited to perceptions of a small sample of STEM students at a TCU. The small sample was composed of 13 students participants in individual interviews and three faculty members in the faculty focus group discussion. Although the initial goal was to recruit 15 students, this researcher was able to recruit only 13 student participants due to the academic calendar of the TCUs and the time scheduled for interviews. The sample featured diversity in gender, race, and program of study with an emphasis on being Native American and enrolled in a STEM program of study. Another limitation concerned two of the instruments: Both the interviews and focus groups were semistructured, so that open-ended questions could be asked to which the participants could freely respond.

**Chapter 1 Summary**

This chapter began with an introduction to the study, followed by the problem statement and an explanation of the purpose of the study. General research has been done in the past on why Native American students have not been successful at the higher levels of education, but not much research attention has been devoted to what might remedy the failing graduation rates for Native American STEM students. The purpose of this study was to explore the perceptions of TCU STEM students and faculty members regarding the impact of TCUs on elevating the numbers of Native American students in STEM-related programs and professions.
The next chapter contains a review of the literature and discussion of past research on the topic under study. Matters with applicability to the current study will be examined, and gaps in the current body of knowledge will be pointed out. In Chapter 3, I describe the research methods, and procedures of data collection and data analysis will be discussed. Chapter 4 presents the findings of the study. Chapter 5 draws conclusion based on the findings and offers recommendations for practical applications and further research on this topic. While the students were very satisfied with the services they received at their respective TCUs and were successful in graduating from STEM-related courses, this success did not seem to follow them into their post-CTU lives, specifically into being successful at passing their Boards and entering STEM professions.
Chapter 2: Literature Review

Introduction to the Literature Review

In this chapter, the conceptual framework, review of the research literature, review of the methodological literature and methodological issues, synthesis of the research findings, and critique of previous research are being discussed. The chapter begins by introducing the conceptual framework involving theories based on how and why identity and culture are important for Native American students to transition into the world of higher education. Next, I analyze the literature regarding Native Americans and STEM education practices at elementary, secondary, and postsecondary levels. The literature reviewed in this chapter focused on studies and research used to develop teaching, recruitment, and retention strategies utilized to help Native American students finish a STEM-related program of study. The chapter concludes with a critique of previous research on the topic under study.

The principal question of this study asked: What influences, with respect to recruitment, student services, and STEM-related programs, do TCU educators exert to increase Native American student numbers in STEM-related degrees? A search of the literature on Native American students and STEM education uncovered research studies and various journal articles, including issues on recruitment, retention, success rates, institutional support services, and factors concerning both positive and negative results for Native American students in STEM education. Little research on this topic was done in the past, but through a detailed and comprehensive inquiry various studies, papers, and articles were obtained.

Quality Education for Minorities (QEM; 2012) acknowledged that attracting more students into STEM fields would sustain America’s global competitiveness. QEM (2012) reported that there are four necessary approaches for improving student success at higher
education institutions such as TCUs, which include preparing students for college through summer-bridge and college-ready programs, providing targeted student support services to increase retention, finding ways to provide increased access to higher education, and instituting a shared cultural responsibility for degree completion. Foltz, Gannon, and Kirschmann (2014) found it critical that students be introduced to STEM at an early age, which may encourage them to take advanced math and science courses, preparing them for later success in college STEM degree programs. Smith, Cech, Metz, Huntoon, and Moyer (2014) found Native American students to be sensitive to the social and racial disparities at non-Native-serving institutions, making them believe that they do not belong at such institutions, which affects motivation and academic success.

Conceptual Framework

The conceptual framework of this study is based on the theoretical concepts of the Native American college student transition theory (Schooler, 2014) and Horse’s (2005) Perspective on American Indian Identity Development. Native American college student transition theory provides tribal colleges and other institutions of higher education with a better understanding of the challenges Native American students are facing during their initial year of college. Horse’s Perspective on American Indian Identity Development examines the character enhancements needed for American Indian students to grow, including Native language, genealogical heritage, tribal traditions, identifying as American Indian, and being enrolled in a federally recognized tribe.

Native American college student transition theory (NACSTT). Schooler (2014) explained that the stages of the NACSTT occur in a circular pattern, and the circle is a symbol of power in Native American culture. The first of the six stages in NACSTT is called remembering
history; it was developed to help Native American students overcome the negative views of higher education, passed down from generations past, and to help them develop an individual mindset before they enter an institution of higher education (Schooler, 2014). The last stage of the NACSTT, developing a vision for the future, helps Native American student envision a successful future in the career of their choice, which usually ties into giving back to their communities and incorporating their cultural values and beliefs (Schooler, 2014). The six stages of NACSTT are remembering history, learning to navigate, moving toward independence, building trust and relationships, reestablishing identity and reaching out, and developing a vision for the future (Schooler, 2014). Figure 4 represents the Native American College Student Transition Theory (Schooler, 2014).

Figure 4. Native American college student transitions theory (Schooler, 2014).

The first NACSTT stage, remembering history, helps the Native American student to overcome any historical traumas associated with past federal policies on Native American education. According to the Native American Rights Fund (NARF, 2000), federal laws and policies have had a tremendous effect on Native American education. From the 1800s to the
1920s, the federal government had primary control of Indian education. From the 1920s to the 1970s, the federal government relinquished control of Indian education to the states, and from the 1970s to the present, Native American tribes held the control of the education of their young people (NARF, 2000). A particular time period of Native American educational history known to have had a harmful influence on Native Americans was the boarding school era. Recent investigation on Native American boarding schools have uncovered inhumane conditions comprising poor diets, hard labor for children, military conditions, and high mortality rates of Native American children (Longie, n.d.). Schooler (2014) encouraged any Native American student entering an institution of higher learning to take it upon him- or herself to develop an independent way of thinking, thus breaking free of the historically negative views of education.

The second NACSTT stage, learning to navigate, involves the Native American students’ discovering how to navigate through an independent culture, where the focus is on the self and not the group (Schooler, 2014). In this stage, it is necessary for the institution to have a support system in place for Native American students as they transition (Schooler, 2014). This stage is critical for the attitude that Native Americans culture emphasizes, which is that the-tribe-comes-first mentality, and it is why most Native American students stress “going back to help my people” when they receive their degree.

The third NACSTT stage, moving toward independence, sees the student adjusting to a new way of thinking. According to Schooler (2014), most Native American students grow up immersed in their own culture, and this stage of the NACSTT allows the student to think objectively and explore the cultural perspectives of others. This is a period where Native American students begin to follow mainstream culture or maintain their own cultural identity.
It is vital, in this stage, for the student and his or her family to support the practice of their cultural traditions.

The fourth NACSTT stage, building trust and relationships, includes the student’s developing a connection with his or her instructors and support staff (Schooler, 2014). Native American students have shown to achieve when they have a trusting relationship with their instructors. Schooler suggested that Native American students learn to coexist with the mainstream culture, while applying their cultural identity to their educational experience. It is also important for instructors and support staff to reach out to the students, attend cultural events, connect students with support resources, and help build a trusting relationship (Schooler, 2014).

The fifth NACSTT stage, reestablishing identity and reaching out, begins when Native American students have built trusting relationships with instructors and support staff and are ready to reach out to Native American student campus resources (Schooler, 2014).

The sixth and final stage, developing a vision for the future, entails Native American students making positive career decisions that will influence their future. Schooler (2014) acknowledged that some Native American students may have difficulty making career decisions, stemming from a negative outlook on future success. Native Americans are more likely to choose a career where they can incorporate cultural values and beliefs; hence, the giving-back-to-the-community and helping-the-tribe viewpoints (Schooler, 2014).

Schooler (2014) clarified that Native American student success depends on the student affairs department of their institutions and on faculty members’ implementation of programs that support both their academic and life pursuits. TCUs improve the transition into college life for Native American students because the students are not forced to follow dissimilar cultural norms. Partnering with their state institutions of higher education can assist in the conversion to that
particular college (Schooler, 2014). Tribal colleges and nontribal institutions can smooth the transition and help make Native American students comfortable at their institution by incorporating culture centers and integrating cultural practices into the campus culture (Schooler, 2014).

**Horse’s perspective on American Indian identity development.** Horse’s (2005) *Perspective on American Indian Identity Development* indicated how Native Americans developed their identity as Native Americans by incorporating their ancestral traditions and language in their everyday activities. Today’s Native American students enrolled at tribal colleges or other institutions of higher education find that they must work extra hard to advance in the world of higher education, while maintaining their diverse identity (Horse, 2005). Horse recognized Native American identity as being complex and intricate, and various issues affect what it means to be Native American. The author identified ethnic nomenclature, racial attitudes, legal and political status, cultural change, and personal sensibility as components of what being Native American means in today’s society. Sasso (2017) suggested that Horse (2005) focused on individual ethnic identity conceptualization as an indigenous person and the oppression of Native Americans and other ethnic minorities in a White culture was a key reason why identity development and support of that identity development in higher education was crucial for ethnic minority groups. Sasso (2017) also suggested that Horse’s (2005) *Perspective on American Indian Identity Development* could be adapted by campus-based professionals better to recognize the identity development of Native American students on their campuses, in an effort to understand why some Native American students may feel unsupported and invisible to staff and non-Native students.
According to Horse (2005), claiming to be American Indian or Native American is largely a matter of preference. One can argue the fact that most organizations dealing with American indigenous issues use the term American Indian, examples being the U.S. Bureau of Indian Affairs and the U.S. Indian Health Services. Horse clarified whether one uses American Indian or Native American to identify one’s ethnicity is merely a peculiarity of linguistic meaning as both expressions are interchangeable. Horse acknowledged that no culture or language remains static, and change is part of the natural order. Native American culture has made drastic changes since colonial times, as most tribal citizens have, in one way or another, adapted to Western culture. The author explained this adaption process as taking the characteristics, either consciously or unconsciously, of the oppressors. It is Horse’s recommendation that higher education administrators and faculty keep in mind that tribal identity is a personalized process, influenced by legal and political considerations. Horse also noted that it is important to staff the institutions with people who can steer Native American students with respect to identity and related issues.

Review of Research and Methodological Literature

The literature recognized for this paper supports the influences and impediments impacting Native American students in achieving success or failure in STEM education and in STEM professions. The studies conducted by past researchers will be discussed in this section providing explanation of the methodological tactics and findings. These studies have laid the groundwork for this paper and possible future research on the subject matter. Most of the studies examined Native American student perspectives on various STEM educational programs designed to increase Native American participation in STEM related professions.
STEM education among Native American students is of great interest, especially for TCUs, which have experienced growth through Native American students’ enrolling in STEM programs, thanks to the support from the National Science Foundation (NSF; *Tribal Colleges: An Introduction*, 2015). The Tribal College and University Program (TCUP), under the direction of the NSF, has been researching and developing curriculum, recruitment, and instructional strategies to increase the numbers of Native Americans studying, graduating, and working in STEM-related professions (QEM, 2012). The QEM (2012) formulated a report describing the favorable practices in STEM education and research at institutions supported through TCUP. The report collected data through surveys, written communication with principal investigators of NSF TCUP projects, as well as other faculty and administrators at TCUP institutions (QEM, 2012).

The QEM report described promising practices in STEM education at TCUs and included discussions in areas of reforming STEM curricula; engaging in faculty development; using technology in instruction, recruiting, and retaining students in STEM; and integrating research and education. The QEM explained that an important purpose of reforming the STEM curriculum was to effect positive changes in Native American students’ learning experiences. The QEM recognized that some TCUs had engaged in STEM curriculum reform such as introducing Native culture into course content. The report suggested that faculty development at TCUs was necessary to prepare the instructors for addressing the diverse learning needs of Native American students. The report also suggested that TCUs must provide hands-on research activities for their students, in order to give them first-hand experiences and understanding of the responsibilities of a scientist (QEM, 2012).
There has been a slight increase in minority participation in STEM, including Native American involvement, but not enough to make an impact. Stevens, Andrade, and Page (2016) shed light on the fact the percentage of women and minorities in STEM has shown little change over the past 13 years, although the demand for STEM talent is growing globally and specifically in the USA. Stevens et al. reported on the development, delivery, and outcomes of a culturally driven STEM program, aimed at increasing engagement in STEM-learning among Native American students in Grades 3 to 8, Stevens et al. found that data on Native Americans in STEM are not always reported separately from other minority groups. Stevens et al. (2016) indicated that effective practices that increase interest in STEM education needed the participation of caring adults; critical thinking, collaborations, and small-group work; content related to real-world applications; hands-on activities; and providing STEM opportunities.

Bridge programs, programs designed to help students make a transition from secondary education to higher education, have been a productive method in increasing Native American contribution in STEM. Dalbotten et al. (2014) wrote a collaborative study describing the curriculum and instruction of the Manoomin “wild rice” Science Camp Program, which is a partnership between the University of Minnesota, the Fond du Lac Tribal and Community College, and the Fond du Lac Band of Lake Superior Chippewa. This article is a primary example of how a community-based participatory research project can become the catalyst for STEM learning for a tribal community. The project aimed to provide community input to all aspects of researching the environmental history of the lakes producing wild rice on the Fond du Lac reservation. The program used the circle-of-learning model to combine Native American traditional educational methods with Western educational practices. The study reported a low level of Native American participation in STEM education, with Native American students
scoring lower on math and science tests and on college entrance exams. Dalbotten et al. declared that more Native American scientists would strengthen tribal communities and eliminate the need by tribes to hire outside entities. The study also showed an immediate need for cultural responsiveness.

*Gidaakiimanaaniwigamig*, which means “Our Earth Lodge” in the Ojibwe language is another bridge program succeeding in increasing Native American involvement. Paitrick (2016) conducted a qualitative study, designed to investigate the structures of the Gidaakiimanaaniwigamig STEM camp. The author found ample evidence that the camp’s curriculum and structure helped the participants in making the decision to enter STEM-related programs in postsecondary education. The camp was developed for Native American youth by providing culturally based STEM instruction and is a partnership between the University of Minnesota and the Fond du Lac Tribal College. The camp is a year-long program with participants spending one weekend a month during the academic year and one week during the summer, working on STEM-related activities that also incorporate the local tribal language and traditions. Katz, Oneal, and Paul (2011) researched culturally relevant factors affecting Native American secondary students' intention and ability to attend college and pursue a career in nursing. Native American bridge programs do incorporate the culture of the tribe they represent to help students comprehend subject matter by incorporating relative cultural experiences to the lessons. The theoretical framework in Katz et al.’s (2011) study, nursing in Native American culture, provided culturally based insights into Native American students’ perspectives on choosing a nursing career and entering college. The authors found seven themes—caring, traditions, respect, connection, holism, trust, and spirituality—to be principles used by Native American nurses.
Past studies have also included cultural relevance in the importance of recruiting and retaining Native American students in STEM related programs. Starks (2011) studied factors that influenced whether Native Americans enrolled in colleges or vocational schools. The theoretical framework in Starks’ study incorporated the circle-of-life theory since most Native American tribal philosophies use the circle in everyday life patterns. The purpose of the study involved determining if experiences comprising traditional beliefs and customs influenced the decision of Native Americans to attend or not to attend college or a vocational school. This study addressed cultural, social, economic, and educational experiences Native Americans acknowledged to factor into pursuing or not pursuing higher education. Williams and Shipley (2018) studied cultural taboos as a factor in participation rates of Native Americans in STEM and concluded that increasing Native American participation in STEM required that cultural concerns in STEM curricula be acknowledged and addressed. These researchers recognized that Native Americans were underrepresented in STEM and investigated whether the violation of cultural ideology may have been a factor in Native Americans’ not pursuing STEM careers. William and Shipley defended this statement of fact by conceding that many non-Native STEM faculty know very little about Native American historical experiences in the educational system and are not aware of the threat Native American students perceive from a curriculum that claims cultural neutrality, yet requires Native Americans to violate strongly held cultural beliefs.

Dameron (2014) explored the experiences of successful Native American students pursuing STEM degrees at Native-serving institutions. Dameron researched the influencing factors that made these students successful and receiving 4-year degrees. The study’s theoretical model incorporated Brayboy’s (2005) tribal critical theory throughout the research. The intent of the study was to investigate the educational experiences of Native American students attempting
to complete a STEM program of study in order to develop strategies better to serve Native American students in STEM degree programs.

Research into exploring study contributing factors to college persistence of minority students in STEM graduate programs. Foltz et al. (2014) asked the primary research question: What factors influenced the persistence of minority students currently enrolled in graduate STEM programs to earn a baccalaureate degree? The study found the gap between minority and nonminority students completing a STEM degree program to be rather large, with only 24% of minorities attaining the degree versus 40% of nonminorities. According to Foltz et al., the study used the general scholarly literature on undergraduate persistence for insight into the research linking social and academic integration as a key factor. Minority students who reported high levels of social activity and high levels of academic involvement were more likely to finish their program of study.

Smith et al. (2014) studied Native American students’ experiences in STEM education and the changes institutions of higher learning can make to promote Native American students’ retention in STEM programs. Smith et al. explained that Native Americans are underrepresented in STEM, and only one in 150 students who graduate with a bachelor’s degree in STEM education is Native American. The study also mentioned that Native Americans have the highest rate of poverty, when compared to all other ethnic groups. Increasing the attendance of Native Americans in STEM education programs is important to STEM. Goal congruency theory was the conceptual framework the study drew upon to predict experiences of Native American students in STEM. The researchers predicted that Native American students in STEM programs would have a greater shared goal of succeeding then Native American students in a non-STEM program of study.
Research has also included the position Western science and Western education has played in Native American STEM. Reeves et al. (2017) studied the success among Native Americans in STEM disciplines and careers. The investigation included how identities are negotiated as individuals navigated educational, professional, and community landscapes, as well as historical legacy of the detrimental way Western science has positioned Native culture. The study focused on understanding the identities that successful Native science professionals bring to their educational, career, and practical experience. Reeves et al. acknowledged that indigenous experiences are often invisible and indigenous perspectives and ways of knowing are underappreciated.

Marroquin (2019) wrote a summary report on TCUs and their importance to Native nations’ educational systems in providing higher education, vocational training, and cultural preservation throughout tribal territories. Marroquin’s study included the culture-specific missions of TCUs and culturally relevant student outcomes, including institutional, faculty, staff, and social support—all needed for positive student experiences and educational success. According to the report, TCUs have done a tremendous job in creating an environment where Native students felt supported by their institution, faculty, and staff. The report also mentioned that, since the establishment of TCUs, the institutions have persevered through crises such as enrollment decline and decreased federal funding, and yet, Native students have received more support academically and financially at a TCU then at non-Native institutions.

**Review of Methodological Issues**

The methodology and design of a research study is important to the rationality and strength of the findings and results. The literature reviewed impacted the design and methodology used for this study. The literature reviewed included quantitative, qualitative, and
mixed methods of study focusing on STEM education and Native American students participating in STEM education. STEM training has become a major dynamic at TCUs for American Indian higher education students. Although Native Americans in STEM education research have been somewhat excluded during educational analyses during the last decade, noteworthy research has explored the kind of influences institutions of higher learning have exerted to support minorities and other nontraditional college students to succeed in STEM-related subjects. The present study focused on investigations related to Tribal college education, STEM education, and Native American students.

Qualitative methodologies like interviews, questionnaires, observations and case studies provide tactics for the researcher to understand their subject. Dalbotten et al. (2014) published a qualitative study examining a science-bridge camp partnered by a state institution of higher education and a Tribal college. The NSF-OEDG Manoomin Science Camp Project: A Model for Engaging American Indian Students in Science, Technology, Engineering, and Mathematics studied the partnership between the University of Minnesota and Fond Du Lac Community College, based on the Fond Du Lac Band of Lake Superior Chippewa reservation. The project researched how STEM learning could affect an entire community. The project provided learning opportunities for Grades 5 to 12 and undergraduate students, elementary and secondary school teachers, and scientists from the reservation and the TCUs. Outside evaluators collected questionnaires given to the students, instructors, and directors of the program. Those questionnaires were, then, analyzed along with interview notes. Outside evaluators analyzed the instructional methods used as well as how the participants responded to the methods. The researchers collected data on educational achievements the participants attained after the program as well. They found that all 36 camp participants graduated from high school, all 36
entered a postsecondary STEM program of study, and all participants, safe one, were retained after their first year of higher education.

The phenomenological study by Katz et al. (2011) on understanding Native American high school students’ opinions on going to college and becoming a nurse incorporated a descriptive qualitative design, which was believed to be useful for finding the relevant phenomenon of interest. Along with the descriptive qualitative design for data analysis, van Manen’s (1990) pedagogical research was included. The participants in the study were Native American high school students partaking in a residency program the purpose of which was to recruit students and enroll them in a college nursing program. Semistructured interviews were conducted, and all students attending the residency program were allowed to volunteer for the study. The individual interviews lasted about 1 hour and were taped and transcribed for data collection.

Also using a qualitative design was Paitrick (2016), who incorporated a qualitative design for her research on the benefits Native American students had received by participating in a weekend STEM camp. The research method consisted of conducting interviews as well as forming a focus group made up of camp participants. The participants in the study included Native American students aged 8 to 18 years, STEM instructors, and parents of the students. The analysis of the data collected through interviews and focus group discussions established key themes to answer the research question.

Like Katz et al. (2011), Starks (2011) used a qualitative research approach for his phenomenological study with electronic surveys and face-to-face interviews, along with observation and field notes, for data collection. The participants were Native American students, chosen through purposive sampling, to discover experiences concerning cultural values and
factors associated with making the decision to attend college or a vocational school. Starks interviewed the participants in a natural setting, selected by the participants; each interview lasted 45 minutes and was recorded and transcribed.

Dameron’s (2014) methodology included written responses, individual interviews, a small focus group, and member checking. The participants in this case study included nine Native American college juniors and seniors from Native American-serving institutions. The participants were chosen through recommendations from the institutions’ student support services departments and met the studies requirements for involvement. Each participant was given writing prompts, containing open-ended questions, with directions to bring them to their scheduled interview or e-mail them back to the researcher before the interview. The recorded interviews lasted 60 minutes and addressed experiences in STEM education.

Using individual interviews and a structured dialogue group session, Reeves et al.’s (2017) study was a collaborative ethnographic study between the University of New Mexico, the American Indian Science and Engineering Society, and Northwestern University. The participants were purposively selected based on their ability to provide information regarding experiences and perspectives about Native American success in STEM. The study used an ethnographically inspired approach in the analysis of the data, adopting a cultural analytic perspective to integrate recurrently structured and emergent patterns. Reeves et al. (2017) followed Gläser and Laudel’s (2013) framework for theory-driven qualitative analysis that integrated coding with interpretive content analysis. The data analysis procedure identified categories that led to finding themes and subthemes.

Williams and Shipley (2018) studied whether violating cultural taboos was a factor in the low participation rate of Native Americans in STEM. The study included reviewing literature on
the subject and surveying 96 Native American students from 42 different tribes and interviewing two STEM and two non-STEM faculty members from the Haskell Indian Nations University. The literature reviewed included actual tribal taboos of the Navajo and Cherokee tribes. The review of the literature helped the authors to develop and design the survey for data collection. The survey required approximately 30 minutes to complete and 96 out of the 125 potential participants filled out and returned the survey. The four faculty members were interviewed using open-ended questions; interviews were held on the Haskell Indian Nations University campus. The study was approved by the IRBs of the University of Kansas, Haskell Indian Nations University, and Johnson County Community College.

Foltz et al. (2014) authored an exploratory study that examined factors contributing to the college persistence of minority students in STEM graduate programs at LMCU (a pseudonym). Researchers used the National Science Foundation (NSF) definition of a minority student, which included Native-born “African Americans, Alaska Natives, American Indians, Hispanic Americans, Native Hawaiians, and Native Pacific Islanders” (National Science Foundation n.d., H1) and defined student persistence as attainment of a baccalaureate degree. The question formulated for the study asked: What factors influenced the persistence to a baccalaureate of minority students currently enrolled in graduate STEM programs? This qualitative study used interviews for data collection. Students interviews were accompanied by faculty and staff interviews and document analysis, which allowed triangulation the findings regarding the elements that facilitated college persistence of minority STEM students.

The mixed methods approach entails a researcher using a combination of a qualitative and a quantitative method providing the researcher with a more complete understanding of a research problem than either approach alone (Creswell, 2008). Steven et al. (2016) used a mixed-
methods design, incorporating formative and outcome evaluations. The participants in the study included mentors and student mentees of the integrated STEM (iSTEM) project. The iSTEM project was a collaboration between the University of Arizona, StrengthBuilding Partners, the Pascua Yaqui Tribe, and public schools that serve Native American youth. The mentors were hired through a partnership team, consisting of tribal members and tribal employees and committed to serving for 1 academic year. The student mentees were eligible for iSTEM if they attended one of the public schools and were in Grades 3 through 8. Data were collected through student mentee/mentor observations, and end-of-the-year surveys were analyzed.

Also using a mixed-method approach, Marroquin (2019) explored the experiences of Native American students who attended both Native and non-Native educational institutions. Marroquin analyzed data from his Native American college student study in which Native American students had participated in a survey-instrument and validation study. The purpose of the study was to find out whether perceptions of support from one’s family, tribe, institution, faculty, staff, and peers affected cultural integrity. The study also examined if high levels of cultural integrity influenced cultural reciprocity, cultural resiliency, grade-point average, and persistence.

Quantitative research methods normally have large sample size and consist of surveys and close-ended questionnaires allowing the researcher to represent data from various groups (Creswell, 2008). Smith et al.’s (2014) quantitative study was based on finding Native American undergraduate students’ experiences in their STEM major as a function of their communal and individualistic work goals. The study collected data by surveying Native American and non-Native American students majoring in a STEM programs. Three surveys were conducted during the study. One survey was established for just Native American students before they began their
program of study. Another survey included non-Native American and Native American students, and the third survey was a follow-up with the first survey participants.

**Synthesis of Research Findings**

The articles reviewed mostly agreed that Native American students pursuing a career in STEM needed encouragement and support to engender a feeling of belonging at the educational institution they were attending. The research findings of the included studies included institutional and family support, cultural integration and self-identity, and academic readiness. For example, Smith et al. (2014) explained that a correlation existed between success and failure of minority students who did or did not have a sense of belonging at their institution and who were particularly sensitive to the social and racial disparities within the dominant culture.

Lack of support is a major barrier found to keep Native American students from having success in higher education. Katz et al. (2011) found that Native American students who participated in their study expected to attend college and were interested in pursuing a career in health care. The researchers noted that two key factors interfering with the students’ ability to finish their program of study were substance abuse and unstable living conditions or arrangements. The participants acknowledged that family support was crucial in attaining their educational and career goals. Some of the concerns the students reported hindering their educational goals involved grades, money, and family obligations. Foltz et al. (2014) found that minority students had a better chance of being successful in STEM education when they had strong family and institutional support, a strong commitment to finish their program of study, and were academically prepared for higher education. The authors emphasized the participants’ awareness and appreciation of the faculty’s instilling a love for discipline, inspiring the students’ desire to learn, and keeping up their motivation to graduate. The study emphasized the need to
expose minority students to STEM at a young age and to prepare them for STEM courses in college, especially math and science. Steven et al. declared that using culturally relevant activities increased the comprehension of the students as well as self-efficacy and pride in their culture. Family involvement and support also contributed to the success of keeping Native American students participating in their STEM education, especially younger siblings whose interests toward STEM education was heightened.

Institutions that encompass Native American culture, especially for those students leaving the reservation, is very important for Native American students in transitioning to a new environment. Dameron (2014) found that issues concerning family support, connection with the institutional community, institutional resources, faculty and advisor influences, social economic issues, and academic preparedness all played a part in the success or failure of Native American student in STEM education. Dameron (2014) expressed the need for institutions catering to Native Americans to incorporate the cultural traditions and values of those students to improve their retention and graduation rates. The author further recommended that institutions communicate and follow their policies on diversity, commit to equality, and create an environment in which Native American students could feel welcome and appreciated. Paitrick (2016) determined that Native American youths participating in culturally appropriate STEM camps and bridge programs received many benefits such as learning about their culture, forming a positive Native American identity, and developing skills applicable to 21st-century needs. The youths who participated, acknowledged having a desire to pursue a STEM education and work in a STEM-related field. Paitrick explained that activities involving culture and STEM instructional material helped Native American youth to develop an understanding of their own identity and purpose.
Marroquin (2019) found that an important component in providing a positive and thriving learning environment for Native American students was for TCUs to include and implement aspects of their culture. Marroquin suggested for TCUs to create a culture of support, including faculty, staff, and institutional social support. Institutional support, according to Marroquin, included having culturally relevant initiatives in place to help students feel welcome and have a sense of belonging. Faculty and staff support must include showing respect for the students’ tribal culture. Marroquin found that Native American students who attended TCUs had a significantly higher level of cultural respect for and educational expectations of their faculty and staff, compared to Native American students who attended non-Native higher educational institutions. The study also discovered that TCUs not only made students feel culturally supported by their institution, but also were compensating them better financially with lower student loan costs, compared to the costs at traditional universities.

STEM education stresses the need for programs to go beyond building excitement for content knowledge and to make sure that support is extended to help students move from one step to the next in their academic and career lives (Dalbotten et al., 2014). It is also important to note that Native American students who showed success in STEM education felt comfortable in their surroundings and fit in with their non-Native peers and instructors, while the nonintegrated Native American students experienced negative consequences regarding motivation and persistence in their education (Smith et al., 2014). Stevens et al. (2016) found that programs engaging Native American youth in STEM were vital for raising the percentage of Native Americans in STEM education and STEM careers. Their study advocated using historical perspectives and current life context during STEM activities to keep Native American students involved. Reeves et al. (2017) found strength in self-identity to be a common factor in the
experiences of Native STEM professionals, despite their having a different background, different locations, and working in dissimilar disciplines.

The literature reviewed showed Native American students, who had a strong sense of their Native identity, were able to build a foundation for success in STEM. According to Reeves et al., seven core identity-related themes emerged in their study, namely, Native identity, embracing STEM identity and finding strength in Native identity, finding balance, belonging and giving back, fitting into STEM, rejecting colonial confinement, and being and becoming a STEM professional. Reeves et al. determined that the participants embraced their multidimensional identities and found a synthetic relationship between their Native culture and their careers as scientists. Reeves et al. also explained that the participants sought to balance the values defined by their Native culture with conflicts arising from a non-Native work environment by using their Native identity to find a belonging in the STEM community. The findings of the Reeves et al. study successfully challenged the negative assumptions that Native Americans are unable to be successful in mainstream education and that STEM expertise requires a Western sensibility.

Starks (2011) found various themes pertaining to whether Native Americans attended college or a vocational school. Those themes included social difficulties, cultural values, decision making, and acculturation. Substance abuse, physical and emotional abuse, poverty, lack of academic preparedness, and racism were subthemes emerging in the study that stopped some of the participants from attending college or a vocational school. On the other hand, some students used those obstacles to overcome unwanted conditions by attending an institution of higher learning and bolster their motivation to complete a program of study. Starks found that institutions would have a better chance of recruiting Native American students if they developed a Native American mentorship program, held cultural competency training for staff and faculty,
and added additional support services for Native Americans by adding additional Native American content to courses.

**Critique of Previous Research**

All though there has been a slight increase in Native American contribution in STEM education and STEM professions over the years, there is still diminutive research on what higher learning educators can do to increase Native American enrollment in STEM degree programs. Earlier research has determined what is needed for Native Americans students to have success in higher education, including family and institutional support, financial security, and pre-college preparedness. The researchers examined for this study have pin-pointed key barriers keeping Native American students from success in STEM education and STEM professions, and future research needs to develop strategies for higher learning educators to help Native Americans become a important demographic in STEM.

Smith et al. (2014) examined the mismatch between student emphasis on communal work goals and the noncommunal culture of STEM. The study showed a resulting correlation between Native American academic success and adjustment to their institutional surroundings. The study included Native American students who grew up on tribal reservations and others that did not. Smith et al.’s study contains findings with relevance to the findings of the current study because they show how Native American students can succeed in STEM education if they are given the needed support to make them feel comfortable in their institutional environment. The only drawback of this study was the fact that students at TCUs were not included in the interview process. It would have been interesting to see cross-references to any of the data the authors had collected concerning Native American STEM students by presenting data obtained from actual
TCU students. This lack of TCU students’ participation, however, validated the need for the present study.

Dalbotten et al.’s (2014) study provides support for the present report, as it includes evidence of the need for Native American students to have a trusting relationship with their instructors and fellow researchers to be successful in STEM education and as a STEM professional. In examination of the research finding, the failure of Native American students to succeed at Board exams and enter STEM professions, does not seem to be enough for after TCU success. The study incorporated the circle of learning, a conceptual framework emphasizing trust and relationship building between researchers, teachers, students, and Native American community members, which was pertinent to the missions of TCUs providing a quality education for Native American students (AIHEC, 2014). Dalbotten et al.’s (2014) emphasis on using a culturally appropriate approach with all STEM-related activities has been proven successful through the Manoomin science camps. It would be beneficial for any TCU with a STEM-based program of study to incorporate a culturally relevant STEM bridge program for elementary, middle school, and high school students not only for recruitment purposes, but also to engage, motivate, and develop those students toward a career in STEM.

Foltz et al.’s (2014) exploratory research included other minority students as well as Native American students. The study showed that minority students who had proper academic preparedness before entering higher education had a greater chance of success. This is crucial to the research of this study, emphasizing the need for TCUs to develop bridge programs between their local school systems to give Native American students the proper foundation to succeed in STEM education programs. Foltz et al. expressed that social integration was a factor in the success of minority students at an institution. TCUs were founded to strengthen and preserve the
cultural integrity of the Tribe(s) they serve. The experiences of the eight students in the study and their success was used as guidance for other Native American students’ success in STEM education. The researchers recommended that institutions create more programs to enhance minority academic integration such as mentoring and faculty research projects. This recommendation was important for TCUs as well as to other institutions serving non-Native students.

Stevens et al. (2016) researched the use of culturally relevant science programs to motivate young Native Americans to pursue a STEM education. The Stevens et al. research highlighted the importance of incorporating culturally relevant activities into the curriculum to engage Native American youth in pursuing careers in STEM. TCUs have been incorporating summer STEM camps for Native American youth as bridge programs to pique their interest and increased enrollment in STEM programs. The QEM (2012) stated that TCUs are engaged in curricular reform efforts through the NSF’s TCUP and other funding sources that were introducing Native culture into STEM education. Some of the TCUs using this method of STEM engagement include Lac Courte Oreilles Ojibwa Community College, Northwest Indian College, Kapi’olani Community College, Fond Du Lac Tribal and Community College, Leech Lake Community College, Turtle Mountain Community College, and Southwestern Indian Polytechnic Institute (QEM, 2012).

Patrick’s (2016) study emphasized the importance of including culturally relevant activities to involve and motivate Native American students in STEM. This research validated the findings of Stevens et al. (2016) and showed that exposing Native American youths to STEM was a way of connecting STEM education with their traditions and identity and raise their chances of continuing their STEM education toward a STEM career. The QEM (2012)
recognized one of the four principal strategies for improving student success at institutions that primarily serve low-income and minority students such as the TCUs is to prepare students for college through summer-bridge and college-readiness programs.

Katz et al. (2011) identified culturally relevant factors that affected Native American high school students and moved them either toward enrolling or not enrolling in a college to pursue a degree in nursing. This study exemplified the themes found throughout most of the literature reviewed and analyzed, including financial support, family and institutional support, and adequate academic preparation to enter higher education. The study focused on only one discipline of STEM, nursing, but it still aids in clarifying the total picture of STEM education and Native American students throughout all STEM-related programs.

Starks (2011) also identified themes that either limited or helped Native American students to attend an institution of higher learning. The themes in this study were particularly interesting in that they did not focus on financial support and academic preparedness, but concentrated instead on social difficulties, cultural values, decision making, and the acculturation of Native American students. This study reinforced the fact that more research on Native Americans in higher education is needed involving these very influential aspects affecting their success. Native American higher education research in the past centered on recruitment and retention; new research now needs to spotlight helping these Native American students finish their programs of study and enter the workforce.

Dameron’s (2014) study on American Indian students’ experiences in STEM at Native-serving institutions came fairly close to the research conducted in the current study. Dameron’s work, like most of the reviewed literature, showed important emerging factors that influenced the success of Native American students such as family support, connection with the institutional
community, institutional resources, faculty and advisor influences, socioeconomic issues, and academic preparedness. These factors influencing Native American students’ success or failure were confirmed by the results of the present study; they also justified the need for more exploration of Native American higher education strategies to help TCUs in leading greater numbers of students toward graduation from STEM programs.

Reeves et al.’s (2017) study on Native identity and STEM success was ground breaking and quite similar to the present study. Reeves et al. uncovered underlying themes associated with the success of Native Americans in STEM educational disciplines and STEM-related professions. The study itself built on past research regarding Native Americans and was determined to discover key factors that were persistently associated with the success of Native Americans in Western society, education, and the professions. The Reeves et al. study, however, focused only on Native Americans who had finished their programs of study and were working in STEM-related professions. It might have been helpful to see the contrast if the authors had been able to include participants who were not successful in their endeavor to graduate and become professional scientists. It is the researcher’s recommendation that a study on this topic be done in the near future.

Chapter 2 Summary

This chapter featured a review of the literature regarding Native American students receiving STEM degrees and entering a STEM profession. The literature comprised studies designed to understanding recruitment, retention, and experiences of Native Americans in STEM education and STEM professions; disclosing academic barriers and improvement strategies; and evaluating failure and success stories. The chapter included an introduction to the literature, a conceptual framework for the study, a review of research and methodological literature, a
discussion of methodological issues, a synthesis of research findings, critique of previous research, and a chapter summary. A search of the literature on Native American students and STEM education discovered research studies and various journal articles featuring issues on recruitment, retention, success rates, institutional support services, and factors concerning both positive and negative outcomes for Native American students and their STEM education. The conceptual framework of the study was based on the theoretical concepts of *Native American College Student Transition Theory* by Schooler (2014) and Horse’s (2005) perspectives on American Indian identity development. In Chapter 3, I explain the research methods set for the study, including research design, data collection data analysis procedures, and expected findings.
Chapter 3: Methodology

Introduction

This chapter begins with a brief explanation of the purpose and the research questions posed for the study, followed by a description of the research design and data collection and data analysis strategies. The intent of this study was to investigate influences TCU s have on increasing the numbers of Native American STEM education graduates and, thereby, increasing the number of Native American STEM professionals in the workforce. According to Williams and Shipley (2018), Native Americans are underrepresented in the STEM disciplines. The number of Native American students attending college and graduating from college with a STEM-related degree has increased over the last 25 years, but Native Americans are still very much underrepresented in the STEM professions (Reeves et al., 2017). Native Americans are 1.7% of the U.S. population, but account for only 0.6% of bachelor’s degree recipients, 0.4% of master’s degree recipients, and 0.2% of doctoral degree holders in science and engineering (Williams & Shipley, 2018).

While the numbers of Native Americans in STEM education and the STEM professions are beginning to grow, they still amount to less than 1% of the nation’s STEM professionals (NACME, 2016). According to Reeves et al. (2017), the number of Native American students interested in STEM is lower than that of all racial and ethnic groups. TCU s are beginning to utilize their services to provide Native American students majoring in STEM-related programs adequate accommodation; yet, the numbers of Native Americans finishing STEM degrees at mainstream universities and TCU s is still seriously lagging behind (AIHEC, 2017). The intention of this qualitative case study was to uncover the opinions, experiences, and perceptions of
students and faculty in STEM education at TCUs in order to give Native American students the best educational support and lead them toward graduation.

Research Questions

Focus group members and individual student participants were presented with open-ended questions to find answers for the research questions posed for the study. A TCU STEM bridge program was observed and analyzed to gain a better understanding of the impact TCU educators have on preparing secondary students for higher education STEM programs. The primary research question of the study was: What influences, with respect to recruitment, student services, and STEM-related programs, do TCU educators exert to increase Native American student numbers in STEM-related degrees? This question aligned with the following sub questions:

Subquestion 1. What are the perceptions of TCU students regarding support systems and resources at their TCU?

Subquestion 2. What recruitment strategies and bridge programs do TCUs offer to middle school and high school students that will prepare them for higher education courses related to STEM?

Subquestion 3. What outreach efforts do TCU educators use to improve STEM education at TCUs so that graduating students are prepared for STEM-related professions?

The purpose of subquestion 1 was to understand the experiences Native American students enrolled in a STEM program at a TCU and what types of support and resources are provided to increase their chances of succeeding. The purpose of subquestion 2 was to find out what TCUs are doing to prepare, not only their current students, but future students as well, for college-level STEM courses. The purpose of subquestion 3 was to gain an understanding of the
endeavors and strategies TCU s are implementing in order for Native American students to succeed not only in their programs but to also at mainstream universities for undergraduate and graduate degrees in STEM.

**Purpose and Design of the Study**

The purpose of this qualitative case study was to explore the perceptions of TCU STEM students and faculty members and the impact of TCU s on elevating the numbers of Native American students in STEM-related programs and professions. Native Americans have the lowest numbers per population working in a STEM profession (NACME, 2016), and TCU s have endeavored to provide Native Americans with the opportunity to study and enter STEM-related programs and professions. Although there have been studies on recruitment and retention of Native American students at TCU s in the past (Guillory, 2002; Ressler & His Horse is Thunder, 2014), research on STEM education and promotion at TCU s is not as well established. It is critical for students to become aware of the possibilities STEM occupations can offer, and TCU s are equipped to bridge those possibilities for Native American secondary and postsecondary students interested in a STEM career.

The research design is the epicenter of the study, noted Smagorinskhy (2008). A qualitative approach using the case study design was chosen to conduct the research. The case study incorporated the interview process, allowing for constructing predictive statements about the experiences of the individuals participating in the study (Creswell, 2008). This case study used interviews with 13 students enrolled in STEM courses at two TCU s. A focus group consisting of STEM faculty members at those TCU s was also interviewed. In qualitative interviews, human experiences are investigated to provide a better understanding of the perceptions and viewpoints of the participants (Creswell, 2008). The interviews gave a voice to
the students and faculty members, allowing them to discuss their situations in their own words (Kvale, 1996). This researcher also observed a STEM bridge program, designed to prepare Native American secondary students for higher education STEM programs.

**Research Population and Sampling Method**

The target population for this study were Native students attending TCUs. The study sample included 13 students and three faculty members involved in STEM education at two TCUs located in North Dakota. These TCUs provide an enlightening community in which Native Americans could acquire an education and obtain employment. The TCUs have various STEM-related educational programs, including Practical Nursing, Preengineering, Computer Information Technology, Secondary Science, Phlebotomy, and Environmental Science and Research. The participants were selected using purposeful sampling in order to collect useful information to help in understanding the central phenomenon. In purposeful sampling, researchers intentionally select individuals and sites to learn or understand the central phenomenon (Creswell, 2008). Participation criteria included being a STEM education faculty member at a TCU or being a Native American student enrolled in a STEM program of study at a TCU. The participants for this study were purposively chosen because their information and experiences could best help to shed light upon the phenomenon under study. There were 16 participants in the study: 13 TCU students were interviewed, and a focus group of three TCU faculty members took part in discussions. Table 1 describes the demographics of the student sample \((n = 13)\). Table 2 describes the demographics of the faculty sample \((n = 3)\).
Table 1

Demographics of the Student Participants (n = 13)

<table>
<thead>
<tr>
<th>Student</th>
<th>Gender</th>
<th>Race/Ethnicity</th>
<th>Type of College</th>
<th>Type of Degree Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Secondary Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Biology)</td>
</tr>
<tr>
<td>ST2</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Secondary Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Biology)</td>
</tr>
<tr>
<td>ST3</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Secondary Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Chemistry)</td>
</tr>
<tr>
<td>ST4</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Medical Lab Technician</td>
</tr>
<tr>
<td>ST5</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Secondary Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Biology)</td>
</tr>
<tr>
<td>ST6</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Secondary Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Chemistry)</td>
</tr>
<tr>
<td>ST7</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Medical Lab Technician</td>
</tr>
<tr>
<td>ST8</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Medical Lab Technician</td>
</tr>
<tr>
<td>ST9</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Preengineering</td>
</tr>
<tr>
<td>ST10</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Computer Science</td>
</tr>
<tr>
<td>ST11</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Computer Science</td>
</tr>
<tr>
<td>ST12</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Environmental Science and</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Sustainable Technology</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Management</td>
</tr>
<tr>
<td>ST13</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Environmental Science</td>
</tr>
</tbody>
</table>

Table 2

Demographics of the Faculty Participants (n = 3)

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Gender</th>
<th>Race/Ethnicity</th>
<th>Type of College</th>
<th>Type of Degree Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP1</td>
<td>f</td>
<td>Native American</td>
<td>TCU</td>
<td>Natural Resources and Science</td>
</tr>
<tr>
<td>FP2</td>
<td>m</td>
<td>Native American</td>
<td>TCU</td>
<td>Medical Lab Technology</td>
</tr>
<tr>
<td>FP3</td>
<td>m</td>
<td>Caucasian</td>
<td>TCU</td>
<td>Secondary Science Education</td>
</tr>
</tbody>
</table>

The participants were informed of the opportunity to join the focus group and participate in the interview process by e-mail. They were given a brief summary of the study and were asked to fill out a form with contact information if they were interested in participating. Potential
participants were then notified of their selection by phone and e-mail. The study also included observing Native American secondary education students as they participated in STEM activities for an academic bridge program at a TCU. The setting and the participants in the observation exercise fit the inclusions criteria set for a STEM-related bridge program serving Native American high school students at a TCU.

**Instrumentation**

Three types of instruments were used in the study: personal interviews, group discussion of the focus groups, and nonparticipant observation. Kvale (2006) wrote, “The interview is an instrument for providing the interviewer with descriptions, narratives, and texts, which the researcher, then, interprets and reports, according to his or her research interests” (p. 484). A qualitative interview occurs when the researcher asks one or more participants general, open-ended questions and records their answers, and then transcribes and types up the data into a computer file for analysis (Creswell, 2008). Qualitative research uses the natural setting as the source of data, and the researcher acts as the “human instrument” of data collection (Hoepfl, 1997). An interview protocol was used as instrumentation for questioning both students and faculty. Since the study required both TCU students and instructors to be interviewed, two lists of questions were prepared: one list for the students (see Appendix B), and another list for the focus group of instructors (see Appendix C).

Thirteen one-on-one interviews were conducted with the student participants at the selected TCUs. The one-on-one interview is a data collection process in which the researcher asks questions and records answers from only one participant at a time (Creswell, 2008). The interviews lasted anywhere from 30 to 45 minutes and consisted of 20 questions, designed to gather reports of personal of experiences and ascertain specific demographics of the participating
students. Each interview was held in a room provided by the institutions to assure the participants’ comfort and get them to provide candid and prolonged answers. The participant interviews were recorded by the researcher, with the written permission of the interviewee, using audiorecording equipment, and the dialogue of each interview was, then, transcribed by the researcher. The transcribed interviews were reviewed and analyzed multiple times by the researcher. The interview instruments were utilized to uncover the opinions, observations, and experiences of the participants during their time at the TCU.

Three faculty members took part in the faculty focus group interview. Five potential faculty members were asked to take part in the focus group, but only three were able to attend the discussion. A focus group interview is the process of collecting data through interviews with a group of people (Creswell, 2008). The discussion lasted 45 minutes and revolved around 20 questions. The group discussion took place in a science lab/classroom at one of the participating TCU’s and generally used by one of the participating faculty members. The group discussion was recorded, with the written permission of the interviewees, using audiorecording equipment and was, then, transcribed by the researcher. The transcription was reviewed and analyzed for data collection purposes. The faculty focus group discussion was used to discover the opinions, observations, experiences, recruiting practices, retention strategies, and instructional methods of the faculty during their TCU employment. Creswell (2008) explained that focus groups are advantageous when the interaction among interviewees will likely yield the best information and when interviewees are similar to and cooperative with each other.

A nonparticipant observation form (see Appendix D) was used to examine the TCU STEM bridge program. Nonparticipant observation was the chosen method to allow this researcher to record detailed field notes, while not manipulating the activity of the participants
A nonparticipant observer is an observer who visits a site and records notes without becoming involved in the activities, but remaining an “outsider” who sits on the periphery or some advantageous place, like the back of the classroom, to watch and record the phenomenon under study (Creswell, 2008). The nonparticipant observation took place at one of the participating TCUs and involved secondary and middle school Native American students taking part in activities of a STEM bridge program, designed to recruit and prepare Native American students for higher educational STEM programs. The nonparticipant observation instrument created for this part of the study was used by the researcher to comment on what he witnessed during the investigation of the bridge program, including faculty involvement, student involvement, activity instructions, and activity participation. The written comments were, then, reviewed and analyzed to find imperative data critical to the research questions posed for the study.

Data Collection

The collected qualitative data aided in finding answers for the research questions (Creswell, 2008). The qualitative data collection method used in the study entailed semistructured interviews. The interviews were audiorecorded and transcribed into hand-written documentation. The interviews lasted anywhere from 30 to 45 minutes and were conducted on a TCU campus. Twenty questions were asked of each student participant with no time limit set for answering. The interview process was completed in two weeks. Each participant was asked to give permission to be recorded and provided with an explanation for the purpose of the recording in support of the study. The researcher asked the questions, recorded the answers, and then documented the interview with hand-written notes. The researcher categorized the data to acquire important themes and patterns used for data analysis. The themes identified during the
coding process of the student interviews were as follows: family and friendly atmosphere, financial support, low cost, accessibility, helpfulness, culture, accountability, academic support, research, and time management.

The focus group, consisting of three TCU STEM faculty members, met at a secure setting where they were asked to share their perceptions and experiences. The discussion took place at a science lab/classroom at one of the participating TCUs. Each participant in the focus group was given as much time as needed to answer the questions. The focus group consisted of three faculty members: one female and two male. There was one non-Native American in the focus group, but he had grown up near a reservation and had taught Native American students for many years prior to this discussion. The focus group meeting was recorded and transcribed into notes. The transcriptions were inspected multiple times, and the data were categorized into themes and patterns used for data analysis. The themes identified during the faculty focus group coding process were as follows: nontraditional students (i.e., generally older than normal student age), recruitment, and retention.

The observation of the STEM bridge program took place at one of the participating TCUs. The researcher observed secondary and middle school Native American students and TCU faculty during their monthly STEM academy. Permission to observe the STEM academy was granted by the vice president, the academic dean, and the academy director of one of the participating TCUs. The researcher developed an observation tool (see Appendix C) that was used to take detailed notes of the day’s activities, including subject matter content, instructor-student rapport, instructional methods, and student involvement. The data collected during the observation also entailed recorded information (just as it occurred during the academy such as
actual student and instructor behavior) and the study of individuals who had a hard time verbalizing their ideas such as middle school and secondary education students (Creswell, 2008).

**Identification of Attributes**

To identify specific characteristics from the matter of human communications, the researcher explores verbal, visual, behavioral patterns, themes, or biases (Williams, 2011). The method of data collection was devised to explore and witness Native American students and TCU faculty in a personal and professional manner. The interviews focused on the perceptions of the students and faculty members of TCU STEM programs. The observation protocol concentrated on the activities and involvement TCUs engaged in to prepare Native American students for higher education STEM programs. The participants in this study were Native American students attending college at a TCU; they were enrolled in a STEM degree program. The faculty members were STEM instructors or STEM program directors at a TCU.

**Data Analysis Procedures**

Qualitative data analysis is a systematic search for meaning in order to communicate to others what was learned; it is also a way of organizing and interrogating data to allow researchers to see patterns, identify themes, and generate theories (Hatch, 2002). According to Creswell (2008), “in qualitative research, typically you gather a text database, so the data analysis of text consists of dividing it into groups of sentences, called text segments, and determining the meaning of each group of sentences” (p. 18). The initial data in the study comprised interview responses, focus group discussions, and bridge program observations and were organized into hand-written notes. The data were investigated and coded, using the codes to develop a general picture of the data to help interpret the findings (Creswell, 2008).
Coding of the data started with coding categories such as male, female, Native American, or non-Native American. The coding categories used were all-inclusive, meaning, the set had to include the entire range of relevant response categories in a particular dimension (Creswell, 2008). Next, symbols were created to execute the task of summarizing, condensing, and storing concrete examples that fell into certain coding categories (Creswell, 2008). For example, Question 2 asked: Are you Native American? If the participant answered Yes, the symbol would be Q2-y; if the participant answered No, then the symbol would be Q2-n. Once the symbols were established, relevant information was classified.

Classification of relevant information depends on the nature of the information, the interviewing method used, the proportion of irrelevant information, the size of the verbal units being classified, and the level of abstraction of the coding categories (Creswell, 2008). The transcripts were classified by underlying key words or phrases; then, an address was assigned to those words or phrases, as well as a line number and letter, which allowed the researcher to enter them into a special coding sheet. To carry out the classification process, the researcher used a special coding sheet in which the column and row headings represented the categories of defined relevant information (Creswell, 2008).

**Limitations of the Research Design**

Limitations help readers judge to what extent the findings can or cannot be generalized to other people and situations (Creswell, 2008). A limitation of this research was the time taken to finish the interview process. The interviews were spread out over a 2-week period, during which some of the data may have been affected by participants visiting with each other and exchanging information before and after their interviews. Another limitation of the study was sample size; 13 student participants would be considered a small sample when compared to the number of all
Native American STEM students attending the 37 TCUs. A third limitation of the study was that the participants were interviewed only once, whereas multiple interviews might have been beneficial toward producing more data.

Validation

According to Creswell (2008), “the intent of validation is to have participants, external reviewers, or the data sources themselves provide evidence of the accuracy of the information in the qualitative report” (p. 262). The two validation strategies used in this study were member checking and triangulation. Several validation practices such as member checking and triangulation used with the data sources are useful for establishing accuracy and credibility of a narrative account (Creswell, 2008).

Member checking. Member checking is a process in which the researcher asks one or more of the participants to check the accuracy of the account (Creswell, 2008). This researcher used member checking to confirm that the perceptions of the participants were accurately rendered. Each interview was listened to multiple times until the whole dialog was accurately transcribed. Secure emails, with their transcriptions attached, were sent to each participant asking if any changes were needed to their interview transcription. No changes were made to the transcriptions by any of the participants, and all gave permission for transcriptions to be used in the study. The interview transcriptions were, then, examined multiple times by this researcher to find themes and relating them to the research questions.

Triangulation. Triangulation is the process of corroborating evidence from different individuals, types of data sources, or methods of data collection in descriptions and themes in qualitative research (Creswell, 2008). This researcher used the data collected and analyzed in the research to triangulate for dependability and validity of the study. The data were collected in
several ways, using various methods to meet relevance and needs of the study. These methods included audiorecording the interviews of Native American TCU STEM students, note taking during the focus group meeting of TCU STEM faculty members, and note taking during the observation at a TCU STEM bridge program activity. By applying the triangulation strategy, the study inquiries progress by the collecting and integrating of different kinds of data bearing on the same phenomenon (Creswell, 2008).

Expected Findings

By expanding on the scarce research currently in existence, I expected to find the perceptions of the student participants at variance with previous reports, when they described their experiences at a TCU. As expected, all students participating in the individual interviews had both diverse and comparable experiences at their respective TCUs. In this case study, I also expected to discover what TCUs have done in the past, what they are currently doing, and what they envision doing in the future to recruit, prepare, retain, and graduate Native American students in STEM subjects. This includes any successful recruitment and retention strategies TCUs have adopted to increase graduation rates and curricula developed to assist in STEM education success. In this case study, I also expected to find cultural connections used to enhance higher education experiences that led to Native American success in STEM education. I further expected to find the services and support needed for Native American students to be successful in STEM education in order to complete their course of study and obtain a professional position in their field of expertise.

Ethical Issues

Ethical practices at all steps of the research process must be followed, including respecting the site in which the research takes place and respecting the audiences who read and
use information from the study (Creswell, 2008). Creswell (2008) wrote, “Practicing ethics is a complex matter that involves much more than merely following a set of static guidelines such as those from professional associations or conforming to guidelines from campus institutional review boards” (p. 23). This researcher followed the Institutional Review Board (IRB) guidelines of Concordia University, both TCUs participating in the study, and those of the research boards of their respective reservations.

**Conflict of interest assessment.** The researcher acquired approval from the Concordia University–Portland’s IRB and from the participating TCUs before the study was performed. The researcher developed proper consent forms that were accepted by the researcher’s institution and signed a letter of assurance with the institution as well. The researcher is not financially vested nor obliged to this study or outcome. The researcher is a former administrator at a fellow TCU and did not conduct the study for increased positional status or any professional advantages. The researcher does not have any influential status with the participating institutions or any individual participants.

**Researcher’s position.** As a former TCU administrator, the researcher had professional relationships with one of the institutions involved in the study. The researcher exercised all necessary procedures to prevent the possibility of preferential treatment in the study. The researcher allowed the cooperating institutions select participants for all aspects of the study, including faculty group discussion and individual student interviews. The researcher was also known to a few of the students participating in the individual interviews and to all of the faculty participating in the faculty discussion group. The researcher conducted the individual interviews and faculty group discussion and nobody else was privy to the data collected and confidentiality of all participants was kept.
**Ethical issues in the study.** The researcher followed informed consent requirements according to participating institutions IRB’s. All participants were given written consent forms to sign explaining the purpose of the study. Participants were informed that participation was voluntary and they were told they could retract from the study at any time. All participants were identified by a code name to ensure confidentiality. Data from the study was stored in a secured code locked computer, which only the researcher had access to. Once the study was completed, data was destroyed. Recordings from the interviews were deleted as soon as participants confirmed transcripts.

**Chapter 3 Summary**

This chapter was designed to complement the conceptual and theoretical reviews found in the study and too explain the research design. The chapter included an introduction, summary of the research questions, purpose and design of the study, research population and sampling method, instruments used, data collection methods, data analysis procedures, identification of attributes, limitations of the research design, validation, expected findings, ethical issues, and a chapter summary. The study focused on influences with respect to recruitment, student services, and STEM-related programs at the United Tribes Technical College (UTTC) that appeared to boost the numbers of Native Americans in STEM-related professions. A qualitative approach using the narrative research design was chosen to conduct the research, incorporating interviews with study participants in order to collect and analyze data. In Chapter 4, I provide a description of the sample, the research methodology, and data analysis, and I discuss the results of the study.
Chapter 4: Data Analysis and Results

Introduction

The purpose of this qualitative case study was to explore the perceptions of TCU STEM students and faculty members on the impact TCUs have on elevating the numbers of Native American students in STEM-related programs and professions. The research consisted of face-to-face interviews with Native American students enrolled in STEM degree programs at a TCU, a focus group discussion with TCU faculty members, and a nonparticipant observation of a STEM secondary education bridge program at a TCU. Scholarly research on this topic is scarce, creating an urgent need for more studies to identify the influence TCUs exercise on the outcomes of Native American students’ completion of STEM degree programs. This chapter provides a description of the sample, the research methodology and data analysis, and a summary of the findings.

Thirteen student participants, who were currently enrolled in a TCU STEM program of study, were recruited. Three TCU faculty members who directed, instructed, and advised for a STEM program of study were also recruited as participants in a focus group. This study focused on strategies TCUs are executing in order to increase the preparedness of Native American students as they transition to higher education and enter college-level STEM programs. A semistructured interview process was developed that used open-ended interview questions for data collection. The study also included a faculty focus group discussion based on 20 open-ended interview questions. A nonparticipant observational tool was created to summarize a STEM activity designed to recruit potential TCU STEM students.

Description of the Sample

The study focused on two North Dakota TCUs because of their comparable demographics, equivalent STEM degrees of study, and proximity to the primary researcher. The
TCUs chosen for the study were both private not-for-profit institutions with over 80% Native American enrollment in STEM majors and programs such as Computer Science, Pre-Engineering, Natural Resources, Environmental Science, Secondary Science, Clinical Medical Technology, and Phlebotomy Technician. The study sample included 13 Native American students enrolled in a STEM program of study at a TCU who were interviewed, and an additional 13 Native American students who were viewed during the non-participant observation. The interview sample was composed of seven male and six female Native American students. Each selected student was advised by a faculty member to communicate his or her intent to participate in the study to the researcher via e-mail. Once the students had accepted the offer to participate in the study, they were given a date and time to be interviewed at their institution of higher learning. Each student was given a brief description of the study and was asked to sign an informed consent form, before the interview process could begin. Each student participant was given a code name that would be used throughout the study to preserve the participants’ confidentiality. The code names referred to Student-1, Student-2, Student-3, and so on. as ST1, ST2, ST3.

**Student Participant 1.** ST1 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up on his tribal reservation. He graduated from a tribal high school, is currently concentrating on Biology, and enrolled in a Secondary Science Education program of study.

**Student Participant 2.** ST2 is a Native American female and enrolled at a TCU. She is an enrolled member of a federal recognized tribe and grew up on her tribal reservation. She graduated from high school, is currently concentrating on Biology, and enrolled in a Secondary Science Education program of study.
**Student Participant 3.** ST3 is a Native American female and enrolled at a TCU. She is an enrolled member of a federally recognized tribe and grew up on and off her tribal reservation. She graduated from high school, is currently concentrating on Chemistry, and enrolled in a Secondary Science Education program of study.

**Student Participant 4.** ST4 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up off his tribal reservation. He did not graduate from high school, but did earn his G.E.D. He is currently enrolled in a Medical Lab Technician program of study.

**Student Participant 5.** ST5 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up on his tribal reservation. He did not graduate from high school, but did earn his G.E.D. He is currently enrolled in a Secondary Science Education program of study.

**Student Participant 6.** ST6 is Native American male and enrolled at a TCU. He is not an enrolled member of a federally recognized tribe but is a descendent and grew up on his tribal reservation. He did graduate from high school and is enrolled in a Secondary Science Education program of study.

**Student Participant 7.** ST7 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up on his tribal reservation. He graduated from high school and is enrolled in a Medical Lab Technician program of study.

**Student Participant 8.** ST8 is a Native American female and enrolled at a TCU. She is an enrolled member of a federally recognized tribe and grew up on and off her tribal reservation. She graduated from high school and is enrolled in a Medical Lab Technician program of study.
**Student Participant 9.** ST9 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up off his tribal reservation. He is a high school graduate and is enrolled in a Pre-Engineering program of study.

**Student Participant 10.** ST10 is Native American female and enrolled at a TCU. She is an enrolled member of a federally recognized tribe and grew up off her tribal reservation. She is a high school graduate and is enrolled in a Computer Science program of study.

**Student Participant 11.** ST11 is a Native American female and enrolled at a TCU. She is a descendent member of a federally recognized tribe and grew up off her tribal reservation. She is a high school graduate and enrolled in a Computer Science program and an Environmental Science program of study.

**Student Participant 12.** ST12 is a Native American female and enrolled at a TCU. She is an enrolled member of a federally recognized tribe and did grow up on her tribal reservation. She did not graduate from high school, but she did earn her G.E.D. She is enrolled in an Environmental Science program and a Sustainable Technology Management program of study.

**Student Participant 13.** ST13 is a Native American male and enrolled at a TCU. He is an enrolled member of a federally recognized tribe and grew up on his tribal reservation. He is a high school graduate and enrolled in an Environmental Science program of study.

The study also included a faculty focus group. The faculty focus group consisted of two Native Americans, one male and one female, and one non-Native American male. The faculty members were also given a brief description of the study and signed an informed consent form before data collection began. The nonparticipant observation of the STEM secondary education bridge activity took place on Sunday afternoon at one of the tribal colleges in the Fall of 2018.
Each faculty participant was given a code name as well that was used throughout the study to preserve confidentiality. Faculty members were referred to as FP1, FP2, and FP3.

**Faculty Participant 1.** FP1 is a Native American female and an instructor of STEM-related courses at a TCU. She is an enrolled member of a federally recognized tribe and grew up on her tribal reservation. She also attended a TCU during her undergraduate career.

**Faculty Participant 2.** FP2 is a Native American male and an instructor of STEM-related courses at a TCU. He is an enrolled member of a federally recognized tribe and grew up on his tribal reservation. He also attended a TCU during his undergraduate career.

**Faculty Participant 3.** FP3 is a non-Native American male and an instructor of STEM-related courses at a TCU. He is not an enrolled member of a federally recognized tribe, but he did grow up near a reservation. He did not attend a TCU during his undergraduate career.

The study also used nonparticipant observation of a STEM recruitment bridge program at one of the TCUs. This nonparticipant observation included 13 Native American secondary students, including eight females and five males, as well as three Native American faculty members, consisting of two males and one female. The students were aged 13 to 18 years and enrolled in various high schools located near the TCUs. The students and faculty were observed for data collection and evaluation of activities, and their experiences of the bridge program were recorded. TCUs are tribal colleges set on tribal reservations; participating students were enrolled members of the tribe where the TCU was located. The activity observed involved the STEM curriculum with a Native American cultural connection tied into the lesson plan. Table 3 describes the demographics of the student participants. Table 4 describes the demographics of the faculty participants.

Table 3
**Demographics of Student Participants**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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Table 4

**Demographics of Faculty Participants**

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<td>Tribally enrolled</td>
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</table>

**Research Methodology and Analysis**

In this qualitative design, three data sets were used to find the perceptions of students and faculty members of TCUs. Student interviews consisted of 20 questions; they were recorded, with the students’ written permission, and later transcribed by hand. A focus group consisting of three STEM faculty members at a TCU, was also interviewed. The faculty focus group discussion was also based on 20 questions, was recorded, and later transcribed by hand. A nonparticipant observation of a STEM bridge program, designed to prepare Native American secondary students for higher education in STEM programs, was also conducted.
The interview protocols, developed to learn from the participants in the study, posed general questions to be answered (Creswell, 2008). An observation protocol was also developed in order to record notes about the behaviors of the participants (Creswell, 2008). Two forms of interview questions, based on the study’s research questions, were created for the inquiry: one set for the student participants and another for the faculty focus group. The student and faculty focus group interviews occurred at the participants’ institutions for purposes of comfort and security in order to get straightforward and honest answers from the participants. Interview, focus group, and observation data were gathered, analyzed, and coded, using emerging themes taken from the responses of the participants.

Coding of the data included coding categories such as male, female, Native American, or non-Native American. The coding categories were all-inclusive, meaning, the set had to include the entire range of relevant response categories in a particular dimension (Creswell, 2008). Next, symbols were created to execute the task of summarizing, condensing, and storing concrete examples that fell into certain coding categories (Creswell, 2008). Once the symbols were created, relevant information was classified from the transcripts underlying key words or phrases and, then, assigned an address, line number, and letter. Codes were acclimated after several examinations of the transcripts, resulting in the uncovering of themes produced by analyzing the data.

The data were collected through semistructured student interviews, a faculty focus group discussion, and a nonparticipant observation of a STEM recruitment bridge activity program. First, semistructured interviews with students from one of the participating TCUs were conducted. Second, a focus group discussion with faculty members from one of the participating TCUs was held. Third, more semistructured interviews with students from the second
participating TCU were held. Last, an observation of a STEM recruitment bridge activity at one of the participating TCUs was completed.

Data from semistructured interviews were collected from 13 participants at two different tribal colleges. Each student participant was asked 20 questions that had been formulated prior to the interviews (see Appendix B). These interviews were conducted at the respective institutions of the students in a room provided by the colleges for comfort and convenience to the participants. Interviews took place face-to-face and were recorded, with the interviewees’ permission, with an audiorecorder. The audiorecordings were, then, transcribed by hand and, finally, typed into a Word document.

The data from the faculty focus group discussion was collected from three participants from one of the participating TCUs. The focus group also was asked 20 questions that had been formulated prior to the discussion (see Appendix C). This group discussion took place in a science lab/classroom provided by the participating institution to provide faculty members with a feeling of relaxation and reassurance at being in an area in which they felt comfortable. The focus group occurred face-to-face with each participant taking a turn at answering the questions, with discussion following each question. The group discussion was recorded, with the participants’ permission, using an audiorecorder, and then transcribed by hand and, finally, typed into a Word document.

Data from the nonparticipant observation was collected at one of the participating institutions. The activity observed was STEM related for high school and middle school Native American students interested in STEM and wanting to attend a TCU. The activity was observed and reporting, using an observation tool that was formulated prior to the event (see Appendix D).
The activity was observed, and notes were taken with the observation tool formulated specifically for this event.

Thematic coding was used to determine the influence TCUs had on Native American students finishing a program of study in the STEM field. Once the student interviews and the faculty focus group discussion were transcribed and coded, certain themes emerged. The themes identified during the student interview coding process were family and friendly atmosphere, financial support, low cost, accessibility, helpfulness, culture, accountability, academic support, research, and time management. The themes identified during the faculty focus group coding process were nontraditional students (i.e., older than the usual college age), recruitment, and retention. Table 5 shows the analysis procedures applied to interviews, the focus group discussion, and the bridge program observation.
Table 5

*Analysis Procedures of Interviews, Focus Group Discussion, and Bridge Program Observation*

<table>
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<th>Explanation</th>
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<td>Memos</td>
<td>• Highlighting significant declarations</td>
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<tr>
<td>Categories</td>
<td>• Categories created through memos</td>
</tr>
<tr>
<td></td>
<td>• Placing words, phrases, and statements under categories</td>
</tr>
<tr>
<td>Categories continued</td>
<td>• Reexamine categories for additions or elimination</td>
</tr>
<tr>
<td>Themes</td>
<td>• Identify themes from the categories</td>
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<tr>
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<td>• Identify themes from each individual interview</td>
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<tr>
<td></td>
<td>• Relate themes to research questions</td>
</tr>
<tr>
<td>Themes, all data</td>
<td>• Identify themes from all the interviews</td>
</tr>
<tr>
<td></td>
<td>• Relate themes to research questions</td>
</tr>
<tr>
<td>Observe bridge program</td>
<td>• Take notes of observation</td>
</tr>
<tr>
<td></td>
<td>• Examine themes emerging from notes</td>
</tr>
<tr>
<td></td>
<td>• Relate themes to research questions</td>
</tr>
</tbody>
</table>

**Summary of the Findings**

The findings of the study showed that both students and faculty participants acknowledged the crucial part played by TCUs in influencing the success of Native American students in STEM programs. Ten themes were uncovered during the analysis of the student interviews and two more themes were discovered during the analysis of the faculty focus group discussion. The 12 themes detected included family and friendly atmosphere, financial support, low cost, accessibility, helpfulness and accommodation, culture, accountability, academic support, research, time management, nontraditional students (i.e., older than the usual college age), recruitment, and retention. Notes taken during observation of the bridge program showed not only the enthusiasm of the students but also the passion of the instructors. The participants were observed enjoying the lesson taught to them and all partook in the activities without any
extra push from the instructors. In the end, the interview questions were thoroughly answered, and the observation notes were inspected and searched for essential results.

In general, this study found that the students revealed that their success was directly related to the TCUs’ staff and faculty devotion to serving their students with any and all accommodations to satisfy the needs required to flourish in STEM higher education. Students expressed that attendance and time management were key to finishing the program successfully. Students also found that the friendly and culturally sensitive atmosphere at their TCU contributed hugely to their decision to enroll at their tribal college. Low cost and accessibility were also found to be key factor in the students’ decisions to attend a TCU. The students were overall happy with the support and incentives they received at their institution, but a majority of the students acknowledged that they would like to see their institution implement child care facilities and better transportation options. The implementation of a child care center and better transportation methods was determined, by the students, to increase attendance and graduation rates.

The faculty members conveyed that their approach to recruitment and retention was a factor in the success of their students. They felt that a positive component leading to the success of their program was the mission of the institution and policies put in place by the administration that allowed them to blend tribal culture and traditions with Western higher education methods. All three faculty members agreed that improved attendance would raise graduation rates. They also noted that students who were not prepared for college were struggling and contributed to the drop-out rate of the institution.

The observation demonstrated the use of bridge programs as a means of recruitment and preparing STEM interested students for the rigorous courses in STEM education. The students
observed were engaged throughout the activities and appeared attentive during the daily undertakings. The faculty taught with excitement and allowed the students to participate, ask questions, and problem solve. All in all, the observation of the bridge program illustrated the ambition of both faculty and students desires for teaching, learning, and practicing STEM material.

**Presentation of the Data and Results**

The study sought to answer the main research question, which asked: What influences, with respect to recruitment, student services, and STEM-related programs, do TCUs exert to increase Native American student numbers in STEM-related degrees? Data analysis and results from the student interviews and faculty focus group discussion revealed themes that ran through the information provided by the participants. Emerging themes from the collected data answered the research questions of the study and displayed an understanding of the participants’ experiences and opinions while they attended or worked at a TCU. The student and faculty interviews identified the support, available resources, and efforts that the TCUs provided to Native American students, thereby increasing their chances of succeeding in a STEM-related program of study. The observation of the STEM bridge program showed the determination TCUs have in preparing Native American secondary students for college STEM programs.

The themes identified during the coding process of the student interviews were family and friendly atmosphere, financial support, low cost, accessibility, helpfulness and accommodation, culture, accountability, academic support, research, and time management. The themes identified during the coding process of the faculty focus group data were nontraditional students (i.e., older than the usual college age), recruitment, and retention. The themes were used to answer the primary and subquestions for this study and helped the researcher gain insight to to
the students and faculty members impressions and real life experiences at their institution of higher learning. Table 6 below shows the themes and categories revealed in the data analysis.

Table 6

*Themes and Categories*

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
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</thead>
<tbody>
<tr>
<td>Family and friendly atmosphere</td>
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<tr>
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<td>• Personal</td>
</tr>
<tr>
<td></td>
<td>• Approachable</td>
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<tr>
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<td>• Scholarships</td>
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<td>• Work study</td>
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</tr>
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<td>• On-task</td>
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<tr>
<td>Nontraditional students</td>
<td>• Older than average college age</td>
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<tr>
<td>Recruitment and retention</td>
<td>• Bridge programs</td>
</tr>
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Research Question 1. RQ 1 asked: What are the perceptions of TCU students regarding support systems and resources at their TCU? The purpose of this question was to understand the experiences Native American students enrolled in a STEM program at a TCU and what types of support and resources they are provided to have a chance of succeeding. The following themes were discovered during the student and faculty interviewing activity.

Family and a friendly atmosphere. The participants discussed the sense of family atmosphere at their respective TCUs. They expressed the feeling of being welcomed as a family member by the faculty, staff, administration, and fellow classmates. ST4 conveyed his appreciation by stating, “This is where I found myself to fit in and they treat us like one big family.” When asked if he enjoyed attending his TCU, ST5 mentioned, “Yes, it’s a friendly atmosphere, and people will bend over backwards here to help you with your education. They try to make it as accommodating as possible. There is nothing I dislike about this school.” When asked if he would recommend to others to start their educational career at a TCU, ST5 replied, “Yes, there is more than one and Native students feel more comfortable being around their own people, their family, and it is cheaper than a state university.” ST8 stated, “Yes, I like that everybody treats you like family,” when asked what she liked about the school. When asked why he decided to attend a TCU, ST9 replied, “It’s close to home, family works there, and it’s affordable.”

When asked: What supports have you or your classmates received from the institution to help in your progress, ST9 simply stated, “Feels like family.” Not only did the participants explain how their TCUs are very family orientated, they also spoke about the friendly ambience of their institution. ST6 indicated that he liked the fact that he could talk to his instructor as a friend, not just as a student to his teacher. When asked why he liked his TCU, ST1 replied,
“They are friendly and easy-going when you need information or things done.” He continued, “They have a friendly approach and if you are serious about getting a degree, they understand that education is important.” In his interview, ST4 was asked if he would recommend his TCU to others and he said, “Definitely, this TCU is so nice, and they get you ready for taking your classes.”

Financial support. The participants reported that the financial support given by the TCUs was extremely important to their success in higher education. The financial support reported by the participants included scholarships, grants, and emergency funds used for transportation, food, or any debts the students needed to pay off in order to stay in school. ST1 described an emergency with transportation that his TCU helped him resolve; he stated, “I was in a car accident and my vehicle was totaled. I had another vehicle in another city that needed tires in order to be driven, and the college gave me money to purchase the tires from their angel fund. I was able to have a vehicle really quick, instead of waiting 3 weeks for funding, and I was able not to miss any classes.” ST1 also mentioned, “The college has been good at making sure that we fill out and apply for scholarships, and that’s a big help.” ST2 also mentioned financial help when discussing support from her program; she stated, “The Secondary Science and Elementary programs offer stipends, and that helps out a lot.”

When asked why she wanted to attend a TCU, ST3 explained, “Because they have a partnership with a University that gives us incentives and a scholarship, and in return, we get to teach at a Native school.” Many students at one TCU talked about a program, the Health Education Access through Rural Training Project (HEART Project), which helped them out tremendously with extra funding for gas, food, or materials needed for on the job training. ST4 said, “The HEART project gives you options to do projects and helps out with giving weekly
money for food and gas.” ST4 also added, “It is a really good thing to get that gas and food money.” ST7 also testified on the great help the HEART Project has been by mentioning, “Some other program they have here is the HEART project that helps out a lot of students.” He continued by saying, “They provide clothing, materials like backpacks and any clothing for work, like scrubs.” ST7 also conveyed that he received a tuition waiver from his TCU because his mother was an employee, and by receiving other TCU scholarships, he was good financially, which was one less worry he had on his plate. ST8 informed, “The HEART program is very supportive; they give us babysitting money and gas. If it came to it, they would help us with rent and utility bills.” ST8 also related that the TCU and tribal scholarships “help out a lot.” ST13 explained in the interview that some of the support the students get at their institution include tutoring, internships, assistance for child care, transportation, and help with bills and groceries. ST4 included in the interview that his TCU helped by supplying a computer for class research and expressed his thanks to the scholarship technician who, “lets us know the types of scholarships we can apply for.”

When asked what types of support they would like to see their institution provide, a majority of the students responded with wanting to see more help with child care and transportation. ST1 explained, “A day care is one of the assistances we do not have and that I hear others wanting. One of the main reasons that I have noticed students having trouble with and why they miss classes is because they do not have someone to watch their children.” ST2 also answered this question by stating, “Day care, child care. I know mothers who would come to this school if they had a child care center.” ST3 simple stated, “Reliable transportation.” ST3 also replied, “Child care. There really is no child care after school hours. The college is closed down on most weekends, so all these resources on campus are not available.” ST4, when asked
the same question, said, “I have been pushing them to open a day care, because if there is a day
care, they can implement students as teachers and they can do a work study, plus get their CPR
certificate, first-aid training to watch the kids.” ST4, also mentioned “Maybe a bus line, not the
Turtle Mountain transit, but our own bus, because you see people walking to school in zero or
below weather and that would help them get to class.” ST8 mentioned, “Maybe a day care, that
would be awesome. It takes a lot to get something like that in place.” ST7 also expressed child
care being an issue and would like to see a day care at his institution. He stated, “Child care is
huge. Students have a hard time finding someone to watch their kids.” ST6 mentions
transportation being a problem in his educational history; he mentioned, “Transportation is a
factor. My first semester here I was late a lot because I had to find transportation and I see a lot
of students with the same problem.”

**Academic support.** Academic support was mentioned quite often by the participants as a
reason for their success so far at their TCUs. When asked what type of help her TCU provides
academically, ST2 explained, “We have a student service area we can go to study and mingle
with other students. We have a library and lots of computers here at the college and lots of
academic resources.” ST1 claimed, “One of the biggest advantages is that they make sure you
are prepared before taking the classes. They make you take a placement test for math to make
sure you start at the course needed to finish Algebra.” ST3 liked the fact that the instructor-to-
student ratio was small, making it easier to get the academic help she needed, “Because we have
a smaller population compared to large universities, the teachers have more time to help us one-
on-one.” ST1 also explained, “Academically, they are always more than willing to offer help.
You might need help finding funding for books, or you might need a tutor of some sort, and they
always send out e-mails for people that can help any student academically during school and that
is what is nice about coming to school here.” ST4 mentioned in his interview, “Academically, we have a lot of tutors, like I said they are offering me a position, we have three math tutors, which is great because I was struggling for a while, but pretty much have the gist of math now, thanks to the tutors, not so much the teacher, but the tutors.” ST5 said, “There is always someone to help with academics if you run into trouble, and personally, I only attend school when I can. I usually have car or transportation trouble, that is why it is taking me so long to finish.” ST11 explained, “Academically, they have several knowledgeable people I can ask almost any question. Personally, it’s a venue for growth and self-determination.”

When asked what type of assistance the institution provides for academic success, FP 1 reported, “Now, that we are in our second year of Natural Resources, I have the opportunity to create a computer lab for our students. For scholarships, we had a donation given to us who wanted to help our students in an environmental program.” FP1 also declared, “Also, we have education materials, lab equipment and field equipment for the students to use like boots, gloves, and jackets.” When asked the same question, FP2 replied, “The MLT program is fully funded, which helps with scholarship funding, mileage, and even lunch. We have a fully functional lab in our area, so our students get hands-on experience with the actual equipment they would use at their job.”

**Nontraditional students.** In the faculty focus group discussion, the instructors made mention of the fact that the more successful students to come out of their programs have been nontraditionally characterized students, meaning, older students. FP1 stated, “Our students are older students; they want more work experience, and it would be good to have another instructor to work research and hands-on job training with them.” When asked if there was an area her program needed to improve, FP2 mentioned, “I noticed that the traditional older-than-average
students are the ones finding more success in my program then the younger students.” FP3 declared, “I see that the students coming to the college, right out of high school, are not prepared, but the older students are more determined to finish.”

**Research Question 2.** RQ2 asked: What recruitment strategies, bridge programs, do TCU’s offer to middle school and high school students that will prepare them for higher education courses related to STEM? The purpose of this question was to find out what TCUs are doing to prepare, not only their current students, but future students for college-level STEM courses. The following themes were discovered during the student and faculty interview sessions.

**Low cost.** A bonus to having a college in your local vicinity is the ability to pay low tuition cost at that college. In fact, one of the TCUs in this study declared that it has not only the lowest tuition fees in the state, but also one of the lowest tuitions in the nation. When asked why she chose to attend a TCU, ST2 simply responded, “Because its local and low cost.” ST3 made a similar statement when asked if she enjoyed attending her school by answering, “Yes, because its culturally based, close to home, and affordable.” When asked if she would recommend a TCU to other Native American students, ST3 also replied, “I recommend to all Native students to go to their tribal college, at least go and get their general, just to support the tribal community and because tribal colleges have lower tuition, so they won’t have debt waiting on them.” ST5 responded to the same question by exclaiming, “Yes, because most tribes have their own college, and Native students feel more comfortable being around their own people, and it is cheaper than a state university.” ST7 also felt that a TCU was a good place for Native Americans to start their higher education because of the low cost of tuition. When asked why she decided to attend a TCU, ST8 expressed her displeasure with high costs at state institutions of higher learning by
declaring, “At this point of time, I don’t think I would be able to go to school off the reservation because the costs are way too high.” ST13 decided to attend a TCU because of the fact that he would save money and also get a one-on-one teacher for student education. ST1 declared, “The biggest reason actually was just because, I think, it made it easier instead of having to go away and the financial part was more cost friendly.” ST2 simply stated, “Because it was local and lower cost,” when asked why she attended the TCU.

**Accessibility.** Just as much as the students appreciated the lower cost of their TCUs, they expounded their fondness for their college’s easy access and closeness to home. When asked why he decided to attend a TCU, ST1 simply stated, “Accessible and close to home.” “It is close to home,” was the response of ST5, when he was asked the same question. ST8 declared, “My kids go to school on the reservation, and I attend the college because it’s on the reservation and close to my home.” ST8 also stated, “It is really nice that we have a Tribal College to better our lives.” The convenience of the TCUs seemed to be a recurring sentiment as to why the participants choose to enroll at their tribal college. ST12 said that she decided to attend the TCU because, “it was local and close to family.” When asked if she would recommend a TCU to other Native American students, ST12 declared, “Yes, because it has a very personal feeling and is close to home. This is my first time in college, and it has been an amazing experience.” When asked why he decided to attend a TCU, ST7 replied, “The main reason was I needed a change of pace in my life. I was working at the casino, in the kitchen, and it was getting to be too much time away from home. I needed a change for the better. Something that would help me stay home more with my son at night and still move forward. So, I was transferred to a more flexible position at the casino and signed up for classes.”
Culture. Culture is very important to Native Americans, particularly traditional culture and customs. The participants in this study expressed their delight in the fact that their TCUs encouraged and implemented their tribal culture within their mission and through daily activities. When asked why he would recommend a TCU to his fellow tribal members, ST4 claimed, “Culturally, I love it, they let you pray and smudge and keep us involved in our traditions.” He also uttered, “They have a lot of events for us, like bringing in speakers, performers, and musicians that do a lot with our culture.” When asked if she felt successful so far in her education, ST3 replied, “Yeah!” and included, “Here, we are being instructed on how to teach to Native American students as well as other cultures. This program is very culturally orientated.” ST3 also stated, when asked why she attended her TCU, “Because they have a partnership with a university that gives us incentives and a scholarship, and in return, we get to teach at a Native school, which I like because we need more Native teachers at Native schools.” ST11 testified her recommendation to others to attend a TCU because, “Not only do you benefit from education, but spiritually, socially, and mentally as well.” When describing Native American instructors, ST7 asserted, “Being a tribal college instructor, they need to incorporate our culture in their curriculum, and some Native instructors have a problem doing that.” ST7 then added, “Some of the instructors really lean on the students here to help them with the cultural side, and to me, if they come in with and open heart and mind to learn our culture, I am fine with them.” ST6 indicated that he was glad to have had the opportunity, in one of his classes, to research and learn Native American history. He declared, “In one course, I was able to research Native American history and things that happened to this tribe that I never knew before.” When asked why she decided to attend a TCU, ST11 stated, “I wanted a different experience, the ability to observe my culture.”
**Recruitment and retention.** In the discussion with faculty, recruitment and retention frequently came up. When asked how he thought recruitment and retention played a part in his program’s graduation rates, FP2 stated, “Our retention is not a problem because we have academic coaches who keep our students on task with what they need to finish the program.” FP2 then continued by stating, “We have a good graduation rate, problem is that a lot of our students are not passing their boards. So, although we have good graduation rates, most of our students are not employed because they have not passed their board examination.” When asked the same question, FP1 revealed, “Our program just started. This year, we recruited and have three students who are just starting their generals.” FP1 also mentioned, “We have been able to retain all three students and have them on schedule to complete their degrees. The science program people here like to go out and recruit at local high schools and the career fairs they have around here.” When discussing bridge programs used for recruiting, FPI claimed, “We do have two bridge programs for secondary students. Project NATURE helps recruit for STEM and Project GOAL helps students get prepared for college.” When asked why he entered a STEM program of study, ST1 responded, “I actually like science, and it is cool; so, I figured I would just aim in that direction.” ST1 also made it clear in the interview that the recruiting efforts of the instructors and program director made his decision to attend the TCU and enroll in a science instructor program much easier. When asked the same question, ST2 declared, “I have always liked science, and when I found out they have a 4-year degree program for science, I knew I would attend.” ST3 stated, “I like math, and math and science go hand in hand, and this college offers just the science area for a 4-year degree.” ST7 shared, “I wanted to get in the pharmacy program here, but the program had ended. I never had the desire to work with blood or bodily fluids, but I do like working with people, and you don’t get any more intimate with people then
working at a hospital and helping people during their time of need. So, the advisors of the MLT program talked me into signing up for the program.” When asked about the recruitment efforts for his program, FP2 stated, “The HEART program does our recruiting for us. The grant brings in a lot of students who want to pursue a career in the medical field as an MLT.” When asked about their graduation rate FP2 replied, “We have a good graduation rate, but a problem is that a lot of our students are not passing their boards. I also agree with FP1 about the summer programs here that are helping to bring in more students interested in STEM.”

**Nurturing American Tribal Undergraduate Research and Education (NATURE)**

**Sunday Academy.** An observation of a STEM bridge program at one of the participating TCUs garnered valuable input of the types of recruitment programs that TCUs are offering to insure enrollment by Native American high school graduates. Project NATURE is a STEM bridge program created to give Native American middle school and secondary school students the chance to explore STEM professions by conducting hands-on STEM activities with emphasis of a cultural connection to the activity. The activity observed was called Understanding the Eye with Pinhole Camera and allowed students to learn the principles of geometric optics and image formation. The students built pinhole cameras and experimented with image brightness and resolution, which imitated parts of the eye, including pupil, iris, cornea, and crystalline lens. The students were given a brief introduction of the activity and then were shown a PowerPoint presentation by a tribal elder on the cultural connection the activity had with traditional science. The tribal elder informed the students of the names of the eye parts in their ancestral language and told them a traditional story on sight, which involved a traditional mythological character known to the tribal people. The students were engaged throughout the 4-hour-long session and seemed attentive to all activities, which included learning about geometric optics, building a
pinhole camera, and then working in groups to improve the brightness and focus in their cameras. During the activities the students were able to observe reflection and measured angles made by a light ray, as it hit and reflected off their table surface. The students also measured the spreading of light waves and observed diffraction. The students were asked to build a basic pinhole camera and were given instructions and materials to do so. They were then able to observe images indoors and outdoors using the cameras they built. Students then used prisms, lenses, and mirrors to improve the brightness and focus of their cameras.

**Research Question 3.** RQ3 asked: What outreach efforts do TCUs use to improve STEM education at TCUs so that graduating students are prepared for STEM-related professions? The purpose of this question was to gain an understanding of the endeavors and strategies TCUs are implementing in order for Native American students to succeed not only in their programs but also at mainstream universities for undergraduate and graduate degrees in STEM. The following themes were discovered during the student and faculty sessions.

**Helpfulness and accommodation.** The participants appreciated all the helpfulness at the TCU they attended, from getting them enrolled to guiding them through their academic program. When asked about her TCU, ST12 replied, “My college helps in every way it can to ensure that we succeed. They have helped me to envision my future.” ST11 described her institution’s helpfulness in guiding her through her program of study. She exclaimed, “They have helped me academically. They have several knowledgeable people I can ask any question. It is a venue of growth and self-determination.” When asked about the instructors at her TCU, ST8 related, “They help us out as much as they can. They will take you aside if you don’t understand and give you extra time to complete the lesson.” ST8 also expressed her pleasure about how her TCU helps with funding and tutoring. She stated, “The TCU scholarships are very helpful, and this
college also helps us with tutoring. Success coaches are making sure that we are going to class and pass our courses.” When asked what he liked about his TCU, ST7 responded, “The instructors really help, even if you have a learning disability. This is a good place to learn and be self-dependent.” ST7 also stated, “There are lots of programs here on campus to help students succeed. It’s just up to the student to find the help; there are a lot of options here for help.” ST6 expressed his thankfulness to his advisor by stating, “My advisor is very helpful. When I came to this college, I started a week late, and she helped me get my class schedule and helped me get caught up with the work I had missed.” ST6 also said, “Personally, you can go and talk to your advisor at any time. The instructor who talked me into this program is a nice lady; she went through the program structure with me and told me everything I needed to do, and since this is a science-based degree, it was right up my alley. I like that you can talk to instructors as friends, and they are willing to give you advice when needed.” ST5, when asked about his institution, said, “There is always someone to help with academics if you run into trouble.” ST2 explained, “They may overprepare us, but that is a good thing,” when asked if the instructors prepare them to succeed. ST3 also expressed her delight with the instructors by stating, “I am really pleased with my program. The instructors are wonderful.” When asked if the program he is enrolled in is preparing him for success, ST4 declared, “Most definitely. They have good instructors and a new director who is running the program. The director last year retired, but he did not help us with passing our boards. The people in charge of the program are really helping us to pass, and we should have lots of students passing their boards this year.” When asked the same question, ST5 said, “Yes, I would have to say they have. They let us know exactly what we need to do to be successful: Attendance has to be 95%, and they keep us on the ball with getting our work in on time.”
**Accountability.** Accountability and staying on task were mentioned by most of the participants when asked about how their TCU has helped and prepared them to be successful in their educational progress. When asked if he felt successful in his educational career, ST9 responded by acknowledging the persistence of his institution to keep him on task. He stated, “For the most part yes. I haven’t failed a class, and that is because my instructors and advisors keep me on task with assignments and what classes I need to take.” ST10 claimed that her institution helped her not only with funding for school but also with her plans and preparing for her educational path. She acknowledged, “I am grateful to them for helping with funding and all the extra attention they give, like preparing me to be successful and setting my plan of courses to graduate in a timely manner, and they are always making sure we get work done and are ready for tests.” One student, explained in his interview the hardship of attending a traditional university versus attending a TCU in this way:

When I was younger, I had setbacks. I started my education here many years before I went to the university, and I did most of my general courses here. I got burned out at the university. There was support there, but I overloaded myself and took to many credits a semester, and I spent too much time in front of the computer screen. I was a computer science major and spent roughly 48 hours a week doing homework, and I couldn’t handle that. Once I came back to the TCU, I had no setbacks, except for scheduling conflicts, like needing a class but having to wait a full year to take the course. Fortunately, I have been able to complete my courses without any obstacles here.

When asked if his program gets them prepared to succeed, ST13 responded, “Yes, I have frequent meetings with my advisor about my degree program and with the instructors, too. They keep me focused on my schooling.” When asked to describe the help his institution provides,
ST1 said, “Personally, they are always making sure you are on task.” When asked what his instructors have done to provide adequate instruction, ST5 stated, “They are very thorough and understanding and help us keep up with our deadlines for our work.” When asked if he enjoyed attending a TCU, ST7, who went to a state institution before continuing his education at a TCU, indicated, “It was very hard getting any support from my instructors at the university, but going here, the instructors are always available and very passionate at what they do.”

**Research.** Research opportunities and internships were discussed by the students. A majority of the students claimed that they were given abundant opportunities to do research in their field of concentration, and these opportunities have helped to prepare them for job placement in their desired profession. In her interview, ST2 said, “I did a climate change research last summer. We looked at how the ecosystem has changed since the tornadoes that happened a few years ago and how things are growing.” ST3 remarked, “They have a summer science research program. I get e-mails for research opportunities if we want to apply for them outside of school.” When asked if there has been any opportunity to do research at his TCU, ST5 said, “There have been opportunities. My science instructor has research projects for us to do.” When asked the same question, ST6 replied, “They do have opportunities for research. The science department is good for having research for students, and they are good at e-mailing students to let us know when those opportunities are available.” In her interview, ST8 discussed year-round opportunities for research. She claimed, “There are quite a few, they offer STEM research in the summer and different projects and workshops you can do throughout the year.” ST11, who wants to work in the environmental science industry, was happy to be allowed to do research on the oil industry and how it has affected the environment on her reservation. In his interview, ST1 claimed, “I was able to work for a STEM camp for high schoolers. I believe they
called it a bridge program, and we went through a lot of STEM activities throughout the summer.” ST1 also acknowledged that his institution was always sending research opportunities through e-mail and flyers. ST7 also expressed his contentment with on-the-job training that he was able to receive through his program. He stated, “They have on-the-job training, off campus and on campus. I worked two off-campus internships with the IHS on the reservation, so I was getting real-life training, drawing blood and taking fluid samples.” When asked about his program, FP2 said, “We have a fully functional lab in our area, so our students get hands-on experience with the actual equipment they will use at their job.” FP2 also explained that the students in his program get their clinical experience and testing paid for. FP2 then stated, “We have an affiliation agreement with all the local hospitals in the area to do clinicals.”

**Time management.** Time management, particularly attendance, was frequently mentioned by the participants when asked about what made them successful or, alternatively, why they or their peers have failed. When asked if he recognized any challenges he or his peers have with being successful in this program of study, ST6 said, “In the science education program you need a good attendance rate to stay in the program, and that is a good thing. Some of the students are unable to maintain that rate and are kicked out of the program.” ST5 responded, “Mainly attendance troubles so far,” when asked if he had any setbacks in his educational career. ST5 also stated that his program support prepares students by letting them know of their attendance rate and that they need a 95% attendance rate in order to continue in the program. When asked what would be any challenges that might hinder academic success, ST1 replied, “I would say the biggest challenge anybody would have is time management, but that just falls back on the individual.” When asked if he thought his instructors provided adequate instruction for educational success, ST1 added, “In my experience in the Secondary Science cohort, the
instructors stay on top of you and make sure you stay on track.” When asked the same question, ST7 stated, “They have encouraged me and motivated me to do well and have kept me on schedule to graduate.” ST7 also mentioned a negative aspect of the program he was enrolled in by stating, “It is a 2-year program, and they really push you to finish within that time frame. It seems like you are rushed, but it is a subject area where you need to go into depth, there is a lot of self-learning.” ST2 also mentioned having little time to prepare for exit exams and professional testing, When asked if there are any challenges she has encountered in her education, she stated, “Adequate time to study. We are so overloaded with work, we do not have time to really prepare for our Praxis tests that are coming up.” When asked the same question, ST9 replied, “Outside distractions. Schedules don’t always work out, and it takes longer to graduate.” ST4 also believed that attendance was a factor in students’ lack of success in their pursuit of a degree. ST4 acknowledged, “Attendance is a big issue. A lot of students don’t want to put in the work that it takes to be in the medical field.” When asked if he had any setbacks in his educational career, ST9 replied, “Yes, when I first started college, I did not take it seriously and would miss a lot of my classes. I had to learn the hard way that attendance is important at this level.” When asked if there is any other support her institution provides that helps students to be more accountable for attending classes, ST3 replied, “They do weekly drawings for those who have good attendance.” It is critical for TCU STEM programs to incorporate strategies and methods to allow their students the highest chances of passing any Boards or exams for certification and ability to enter the STEM profession their degree has prepared them for.

Chapter 4 Summary

In this chapter, I presented the findings through student and faculty interviews and a STEM bridge activity observation. I described the sample of participants and the institutions they
attended. Student interview participants were selected based on recommendations by the faculty. The faculty participants were purposively chosen with permission from the institutions’ president and academic dean. Permission to observe the STEM academy was granted by the vice president, the academic dean, and the academy director of one of the participating TCUs. The student interview participants included seven males and six females; all were enrolled Native American students in a STEM program at a tribal college. The faculty participants included two male and one female STEM instructors at a tribal college. A summary of the research methodology and analysis was presented along with the results of the study. The findings were presented by identifying themes uncovered in the interview data. The themes identified by analyzing the student interviews were family and a friendly atmosphere, financial support, low cost, accessibility, helpfulness, culture, accountability, academic support, research, and time management. The themes identified in the faculty data were nontraditional students, recruitment, and retention. In Chapter 5, I draw conclusions based on the findings and offer recommendations for practical application and further research on the topic.
**Chapter 5: Discussion and Conclusion**

**Introduction**

The purpose of this qualitative case study was to explore the perceptions of TCU STEM students and faculty members and describe the impact TCUs exert to raise the number of Native American students in STEM-related programs and professions. The research focused on the experiences and opinions of 13 Native American STEM students enrolled at a Tribal College and University (TCU), situated on a tribal reservation. The participants were individually interviewed and shared their thoughts about their time at the TCU, including recruitment and support. The research also focused on the perceptions of a focus group of three faculty members at a TCU, who not only taught STEM courses but also were directors or overseers of STEM programs of study at their respective schools. The focus group discussion concentrated on recruitment, retention, college-prep practices, and institutional support for students. Lastly, the research focused on the observations of a STEM bridge program between a TCU and Native American secondary education and middle school students on a North Dakota federally recognized Indian reservation. The data collected and analyzed raised awareness of the needs of Native American students pursuing a STEM degree and the support provided by TCUs. TCUs are to ensure that these students graduate and are prepared to be STEM professionals. In this chapter, I provide a summary of the results; a discussion of the findings as well as of limitations of the study, and, last but not least, of the discovery of a remarkable need of successful TCU graduates to carry their success beyond graduation and into the non-Native environment of STEM professionals; implications of the results for practice, policy, and theory; and recommendations for further research.
Summary of the Results

The primary research question of the study was: What influences, with respect to recruitment, student services, and STEM-related programs, do TCUs exert to increase Native American student numbers in STEM-related degrees? The primary research question, along with the three supporting subquestions were answered by analyzing the student interview data, the faculty focus group data, and the STEM bridge program nonparticipant observation data. The three supporting sub-questions were:

Subquestion 1. What are the perceptions of TCU students regarding support systems and resources at their TCU?

Subquestion 2. What recruitment strategies and bridge programs do TCUs offer to middle school and high school students that will prepare them for higher education courses related to STEM?

Subquestion 3. What outreach efforts do TCU educators use to improve STEM education at TCUs so that graduating students are prepared for STEM-related professions?

Student participants revealed through their interviews how important TCUs are to Native American students pursuing a degree in STEM-related subjects and the impact TCUs have on the tribal community as a whole. Students taking part in this study expressed their appreciation of the support they received from their respective TCU, including financial support, academic support, social support, and cultural support. Through data analysis of the student interview transcripts, nine themes were identified: family and friendly atmosphere, financial support, low cost, accessibility and helpfulness, culture, accountability, academic support, research, and time management.
Faculty members who participated in the focus group discussion disclosed certain aspects of their program designed to promote success among their students, including tutoring and academic support, as well as financial stipends and other scholarship opportunities. Faculty members also discussed barriers encountered by students that interfered with the success of their program of study such as lack of child care and transportation, lack of Internet services, as well as lack of family and financial support. Faculty members also discussed the fact that students who were thriving in their programs tended to be older than the average college age or what is usually considered a traditional student. The faculty participants were also concerned about the number of incoming students, newly graduated from high school, who were not prepared for college courses, especially courses that encompassed math and science.

**Discussion of the Results**

**Research Question 1.** The first subquestion asked: What are the perceptions of TCU students regarding support systems and resources at their TCU? The purpose of this question was to gain an understanding of the experiences of Native American students, enrolled in a STEM program at a TCU, and what types of support and resources they could count on to increase their chances of success. The following themes were discovered during the student and faculty interview sessions: family and friendly atmosphere, financial support, academic support, and nontraditional students (i.e., students who were generally older than the usual college age).

*Family and friendly atmosphere.* Most of the students talked highly of the way that administration, staff, and faculty at their TCU treated them, namely, like family. This kind of acceptance helped them in making the decision to stay at the institution and to finish their program of study. Students indicated that being thought of and treated like family by the staff gave them a sense of comfort and created a secure and friendly environment, which increased
attendance and boosted participation. Dameron (2014) acknowledged a connection to family and culture as being crucial to the academic success of many Native American students, along with college preparation and a supportive faculty. Students also acknowledged that, being treated fairly, allowed them to establish a sense of being a part of an institutional team, which encouraged them to interact with faculty and staff without any feelings of insecurity or nervousness. Foltz et al. (2014) recognized that a family-friendly or community-based college strongly influenced students by instilling within them the expectation and the security that they would attend and could finish their college education.

**Financial support.** Students were adamant about choosing their local TCU because of the added financial security received by being able to retain more of their Federal Pell Grant or scholarship funding. Foltz et al. (2014) wrote that their study participants recognized the importance of financial aid as both an on-ramp and a guardrail in the educational pipeline, providing access to higher education and buffering them from dropping out to earn a living. The financial support reported by the participants included scholarships, grants, and emergency funds used for transportation, food, or any debts the students needed to pay off in order to stay in school. This financial support allowed the students to be somewhat worry free about bills and debts and allowed them to focus on their class work and institutional extracurricular activities. Dameron (2014) believed that, when there is not enough money to cover the basics, needs will overtake a student’s desire to be academically successful in college or in a STEM profession. Although some students would have liked to see more help in the area of transportation and child care, most of the students interviewed were happy with the institutional programs designed to help with financial support. Those students expressed their gratitude for the help they received, which allowed them to bypass the typical obstacles that tended to interfere with the success of
Native American students in the past such as transportation, child care, lack of technological ability, and shortage of food.

**Academic support.** Academic support was mentioned most often by the students during the interview process. Students expressed their pleasure about the help they had received thus far in their educational careers at their TCUs. They were especially satisfied with the help they received from the faculty and acknowledged that having a small instructor-to-student ratio was a most beneficial factor in their educational success. Although some students were displeased with some faculty members at their institution, in particular math instructors, they were happy to have tutors, who were paid by the institution, to assist them in passing their required math courses. Students and faculty were pleased with the services provided by their institution. Such services included the library, computer lab, tutoring lab, and science labs, which all benefitted the students in comprehending the course material, leading to academic success. These services also made life easier for the instructors who had to teach the curriculum content. Foltz et al. (2014) declared that academic support was an element of academic integration and was crucial in keeping minority STEM students in the pipeline.

**Nontraditional students.** Faculty members participating in the focus group discussion talked adamantly about their more successful students being older than the average college student. TCUs across the country have a student population consisting of older than average, or traditional, students and the two TCUs that participated in this study were no exception. Montgomery (2018) commented on the fact that the TCU student population seems to differ in other important ways from the dominant minority student population as well. TCU students tend to be non-traditional, usually enrolling in college in their mid-20s to mid-30s. According to the faculty members who participated in the study, these non-traditional students have a little more
life experience and are able to bounce back from failure faster than the students who are coming straight out of high school. It was also noted by the faculty members that most of the students coming straight out of the local high schools were not ready for college and needed extra guidance in all areas concerning college life, including admissions, financial aid, exam preparation, reading and writing, and social undertakings.

**Research Question 2.** Subquestion 2 asked: What recruitment strategies and bridge programs do TCU’s offer to middle school and high school students that will prepare them for higher education courses related to STEM? The purpose of this question was to find out what TCU’s are doing to prepare not only their current students but also future students for college-level STEM courses. The following themes were discovered during the student and faculty interview sessions: low cost, accessibility, culture, recruitment, and retention.

**Low cost.** Students were very happy with the low tuition fees of their respective institutions. Dameron (2014) declared that Native Americans tended to be represented at the lowest socioeconomic level, and students who were battling poverty were most likely forced to seek early employment over education. Because of the low cost at TCU’s, students were able to pocket more of their financial aid, helping them concentrate more on their education and relieving the stress of financial burdens. One of the TCU’s participating in the study reported using their low tuition costs as an effective recruitment tool; they claimed having one of the lowest tuition costs in the nation. Some of the students at this particular TCU confirmed that the reason they attended the institution was strictly for the low costs and the fact that it was close to home, family, and friends.

**Accessibility.** Generally, Native American students who grew up on a reservation have a hard time adjusting to mainstream university life, as they are either lonely and long for family or
are experiencing culture shock. Having a college on their reservation relieves some of those factors and allows them to get a head start on their higher education. Dameron (2014) stated that Native American students were heavily connected to a home community and reliant on that support system and that their continued success in college largely depended on their active participation in campus communities and seeking out individual resources. Most of the students who participated in this study expressed their gratification with the fact that their institution was situated on their own reservation because it very much eased the transition from high school to higher education. Having the TCU in close proximity to where they grew up was more than just convenient; it was a luxury and much appreciated. It contributed enormously to their needed adjustment and helped them to mature into higher education students. Students who were interviewed and started their higher education off the reservation talked about being uncomfortable at the mainstream institution where they felt alienated from the mainstream population and did not enjoy the mainstream college experience. They also testified to the fact that they felt just like a number in the large classes and were unable to forge relations with their instructors and advisors (Reeves et al., 2017).

Culture. Students voiced their contentment with the fact they were able to learn, participate, and rejuvenate their tribal language and customs while attending a TCU. Cultural reparation has been a significant reason for the students who participated in this study to enroll in their local TCU. Williams and Shipley (2018) stated that improving Native American participation in STEM included allowing them to retain their cultural identity. The students were delighted with the guests the TCUs brought in to help revitalize their traditional languages and ceremonies—something they would not be able to get at a mainstream university. Students felt comfortable and had a sense of cultural identity while attending their TCUs and felt at ease with
the Native instructors and staff members. They were even willing to teach those institutional employees about their tribal traditions. This willingness to incorporate the culture in the classroom gave all those involved an appreciation for the local traditions and encouraged engagement by both instructors and students. Dameron (2014) acknowledged that studies in this area showed that attention to a minority culture was especially important when dealing with issues of recruitment, retention, and graduation and that faculty and students who felt supported in an environment where their unique culture and learning style were respected tended to have greater academic success in higher education.

**Recruitment and retention.** It is fair to say that the TCUs participating in this study had no problem with recruitment and retention at their respective institutions. Dameron (2014) explained that some barriers resulting in Native American students’ not enrolling or not being retained at higher educational institutes were based on a lack of proper planning for recruitment and inadequate retention programs, financial resources, and an insufficient number of eligible students. According to the faculty who participated in the focal group, their summer and weekend STEM bridge programs were instrumental in creating a healthy atmosphere and in supporting a thriving desire in the bridge program participants to enroll in the STEM programs offered at their institutions. It was also evident that the student services programs and academic tutoring services contributed materially to the retention of students in the STEM programs; thus, retention did not seem to be an issue at the participating TCUs. Many barriers contributing to higher educational institutions’ not being able to retain Native American students such as shortage of finances, insufficient family and institutional support, lack of precollegiate preparation, and cultural dissimilarities seemed to be well under control at the tribal colleges that participated in this study.
Research Question 3. Subquestion 3 asked: What outreach efforts do TCUs use to improve STEM education at TCUs so that graduating students are prepared for STEM related professions? The purpose of this question was to gain an understanding of the endeavors and strategies TCUs are implementing in order for Native American students to succeed not only in their programs but also at mainstream universities for undergraduate and graduate degrees in STEM. The following themes were discovered during the student and faculty interview sessions: helpfulness, accountability, research, and time management.

Helpfulness. Student participants conveyed that the helpfulness of faculty and staff at their TCU was a major boon, from getting them enrolled in the first place and, then, to give them the proper guidance throughout their academic program. Dameron’s (2014) research established that academic success of Native American students was dependent on many factors, including college preparation, family support, social and academic support systems within the college, and a supportive faculty. Students were extremely pleased with the help and guidance given by the financial aid officers, especially the scholarship technicians. They stated that knowing that they would not be stressed out from financial burdens helped them concentrate on their courses and stay in line with their academic plan. Students were also content with the help they received from the tutoring services and the extra help they received from instructors, acknowledging that this was very beneficial to them and helped them to succeed in their program of study. One student explained that he felt that the faculty and advisors overprepared him in his field of study, which, in his opinion, was a good thing.

Accountability. Many of the students participating in the interviews mentioned how their TCU staff and faculty helped them stay on task; accountability was a factor in the success of their educational efforts. A few of the students who had started their educational careers at a
mainstream university mentioned that they were given no guidance at their first institutions, but with the help of their advisors at their TCU, they were able to map out a plan for their courses and stay on point to graduate in a timely manner. One reason, most of the student participants gave about their TCUs’ being so conscientious about time on task, was the small advisor-to-student ratio. One student mentioned that, regarding the mainstream university he had attended, he had felt just like a number at that school, and when he went to visit his advisor or instructors, they were either not in their office or otherwise not unavailable to meet, and they did not return phone calls or e-mails. That student also mentioned that, at the TCU he was currently attending, his advisor calls, e-mails, and sets up meetings on a weekly basis to make sure he is doing well, not only in his classes but life in general.

**Research.** Students at both participating TCUs voiced their satisfaction with the ample research opportunities provided to them by their college. The students explained that the research projects in which they were allowed to assist helped them with job preparation and gave them the confidence that they would do well in a profession in the STEM field of their desire. Some students also mentioned that opportunities for internships provided by their program were very helpful and imperative to their training. Some internships the TCUs provided were working in medical lab settings, working with environmental science companies, student teaching in high school science classes, and working with summer STEM bridge programs.

**Time management.** Students and faculty members both discussed the importance of time management, especially attendance. Attendance, according to most of the students, was a key factor in their achieving educational success and finishing their required curriculum to graduate with their STEM degrees or certifications. Dameron (2014) insisted that academic preparedness helped Native American students to be successful in higher education STEM courses and found
that STEM students required a supportive environment to be academically successful in the STEM area. According to the student and faculty participants, the TCUs participating in this study provided a nurturing and supportive environment, most suitable for academic success of their STEM students. Dameron’s study also showed that academic tutoring and mentoring and financial support were a major positive influence on Native American students, resulting in higher rates of success. A number of the students interviewed expressed gratitude for their instructors and advisors who made sure that they regularly got to their classes or found ways to give them essential class materials if they had to miss a day or two because of an emergency. Faculty members in the focal group discussion conveyed that they would sometimes give rides to students, especially during the winter months, when they were in dire straits but still showed initiative and yearning to get their education. A few students, at one of the participating TCUs, stated that their institution or their degree program would give attendance prizes such as gift cards or school supplies to students who had good attendance records.

**Discussion of the Results in Relation to the Literature**

The purpose of this qualitative case study was to investigate the influence TCUs exerted on the success of Native American students who were aiming to finish a STEM degree. The research consisted of face-to-face interviews with Native American students enrolled in STEM degree programs at a TCU, a focus group discussion with TCU faculty members, and a nonparticipant observation of a STEM secondary education bridge program at a TCU. Findings validated some of the information found through a review of the existing literature. The following sections provide a discussion of the findings and their relationship to the literature.

**Family and friendly atmosphere.** Students who participated in the interviews acknowledged that they were influenced to enrol and continue with their education at a TCU
because of the friendly familylike atmosphere. Foltz et al. (2014) found that minority students had much better chances of succeeding in STEM education when they had strong family support. The interview data in the Foltz et al. study suggested that a student’s interest in a STEM field was often sparked by a parent or close relative. The authors maintained that students were more likely to succeed at the higher education level if they had a parent or family member who could help them through various college-related processes such as enrollment, class preparation, and financial aid services. Faculty and staff at the TCUs were typically Native Americans and usually members of the tribe that was served by their TCU. This proved to be beneficial to the students who recognized familiar faces, names, and quite possibly family members helping them through the meticulous college procedures.

Family is a very important aspect for Native Americans. What represents the extended family in most cultures, is actually considered the nuclear family in the majority of Native American tribes. Dameron (2014) expressed that it was important to understand that Native American educational systems tend to view education from a holistic perspective; thus, to continue with life-long learning, a student did not have to abandon his or her culture or family in pursuit of academic success.

Starks (2011) wrote that major cultural values appeared consistent, regardless of tribal membership. Whether American Indian or Alaska Native, many such students viewed family as an extension of themselves, providing a sense of identity, confidence, security, and interdependence among all Native people. Starks acknowledged that family obligations and a desire to be closer to home constituted fundamental obstacles that inhibited the pursuit of degrees at distant colleges or universities. Degree completion and consistent family relationships correlated well at the TCUs and allowed for positive and successful educational commitment.
Starks also emphasized that support from family, as well as from faculty and staff; institutional commitment; personal commitment; and connections to homeland and culture were key factors in the persistence of Native American adult learners.

Stevens et al. (2016) indicated that parents and other family members of Native American students did not want their children to leave home, or, if they did leave for educational advancement, they were expected to return to the community or reservation. This sentiment included the expectation and the need for TCU faculty and staff to produce a family-like and friendly atmosphere for their students. Stevens et al. noted the importance of family members encouraging young minorities to participate in science in order for them to be able to participate and enjoy science activities and programs outside of school. The TCUs who participated in this study had a successful bridge program where parents and guardians had a considerable influence on the students’ progress in the programs. Stevens et al. also mentioned the need for more research on how to involve Native families in STEM education and the impact of family involvement on Native American students’ engagement and retention in STEM education and the STEM workforce.

Smith et al. (2014) explained that many tribal cultures stressed the connection between individuals and their family and the community at large, which showed the importance for their local colleges to exhibit and act on that same understanding. Smith et al. expressed that a sense of belonging with family and tribal community members may not be the primary form of belonging necessary for success and persistence for Native Americans in their STEM majors, but student success appeared to be facilitated greatly by a sense of belonging with one’s academic peers. This statement appeared to concern Native American students who were attending mainstream universities away from TCUs, where it would be beneficial if Native American
students could also have a sense of belonging among their academic peers, as well as with faculty and staff.

Katz et al. (2011) expressed that Native American students may be less likely than White students to pursue college because of deep family ties that make leaving home to attend college difficult. This statement conveys the importance of TCUs and the influence they have on Native American students with respect to attending and finishing a degree program, based on the mere fact that they are located on or near the reservation, so that students did not have to leave their reservation or family to attend school. Katz et al. noted that the Native American participants in their study felt that the support from family, school personnel, and friends was the most important aspect in attaining educational and career goals. Katz et al. also acknowledged that community-university partnerships might be able to address such issues as how students living on reservations appear to be prevented from making career decisions due to family-related emotional issues. Having a strong family atmosphere at a TCU will allow Native American students to stay home and still have the institutional support needed to handle such issues.

**Financial support and low cost.** Students who participated in the study conveyed their satisfaction with the financial support they received while attending their TCU and the benefits of not having to worry about money as a factor in their educational success. Foltz et al. (2014) established that financial aid served as the biggest inducement to attend the TCU by removing financial barriers that would otherwise deter minority and low-income students. TCUs have low tuition fees and not as many hidden fees as mainstream university systems, allowing their students to pocket more of their federal PELL grant and scholarship funds. Foltz et al. also stated that many students who made it through the financial-aid process with ease, or who said that they understood the process, actually did have help from someone in their family, at their high school,
or in their undergraduate institution’s financial aid office. Many student participants in this study also acknowledged getting sufficient help from the financial-aid office staff at their TCUs, not only in getting set up with their FAFSA but also with available scholarships for Native American students. Dameron (2014) acknowledged that economic and financial-aid issues played an important role in Native American students’ academic success in postsecondary education, and financial-aid packaging could have an influence on the retention and graduation rates of those students. Dameron further argued that Native American students faced serious socioeconomic issues, with the majority of Native American students being dependent on social programs, financial aid, and additional employment to survive.

**Academic support and academic preparation.** Students participating in the study declared their gratitude for the academic support given by faculty and staff at their TCU. Some students also verbalized how unprepared they were for college courses right out of high school. Dalbotten et al. (2014) let it be known that Native Americans show an achievement gap compared to their non-Native peers on every measure of academic achievement. The authors also disclosed that insufficient math skills were most frequently noted in articles on STEM student preparation and retention, with Native American students finding themselves frequently far behind the general public on all levels. Most of the students participating in this study acknowledged having low math skills and crediting their instructors and tutors with getting them prepared in math to tackle the science courses where math was required. Like Dalbotten et al., Foltz et al. (2014) noted that academic preparation was particularly important in math, and their study participants acknowledged that having a strong high school academic preparation was crucial to their success.
Starks (2011) stated that Native Americans reported that academic preparedness was a factor influencing their decisions to attend or not to attend college or a vocational school. Many of the students participating in this study reported not being ready to attend a mainstream university and that choosing to attend their reservation’s TCU was their way of getting their general courses completed and becoming better prepared to transfer to a 4-year higher education institution. Starks also stated that numerous studies on Native American students who attended mainstream universities suggested that factors such as precollege academic preparation, family support, supportive and involved faculty, and institutional commitment were crucial elements that impacted Native American students’ desire to persist in college. Students participating in this study were satisfied with the academic support they received from their TCU faculty, advisors, and tutors; this proved to be a key element in their retention at the institution and successfully completing their degree program.

**Location near home and accessibility.** Students participating in the study mentioned attending their respective TCU because of its location, accessibility, and no need to leave home to attend school. Dameron (2014) declared that, in her experience in the field of education, Native American students who left home experienced loneliness and feelings of separation, which could be detrimental to academic success. The student participants also mentioned feeling more comfortable participating in campus events or reaching out for institutional help because of the homelike atmosphere at their TCU. Dameron asserted that Native American students needed the connection to their home community while actively participating in campus events and activities to have a sense of belonging and ensuring academic success.

Starks (2011) confirmed that Native American students needed to maintain an active presence in their home communities and at cultural ceremonies in order to persevere in higher
education. Starks also verified that Native Americans were raised to think of themselves as part of an interconnected whole; thus, leaving home to attend college can cause intense feelings of loss and isolation. The students who participated in this study and who had previously attended a mainstream university, talked about feeling unaccepted at their first institution and how much more comfortable they felt now at the TCU because “it is home.” Starks also declared living away from home to attend college, as many students do, may deprives Native Americans of the necessary and dependable support systems on which they rely. Stevens et al. (2016) also mentioned that prior research indicated that parents and other family members of Native American students did not want their children to leave home, or if they did leave home for educational advancement, they were expected to return to the community or reservation when finished with their education. Smith et al. (2014) concurred that students from tribal communities did not lack feelings of belonging at tribal colleges and that most reported a strong sense of belonging with their families and home communities. Katz et al. (2011) also mentioned that Native American students may be less likely than White students to pursue college because of deep family ties that make leaving home extremely difficult. Strongly supported by prior research, it is an indubitable fact that Native American students will have better academic success at a TCU because TCUs are located on or near their home reservation, thus providing the sense of security and comfort necessary for academic achievement.

**Culture.** The student participants declared that their culture, language, and traditions were very important to them and a major reason why they chose to attend their tribal TCU. Starks (2011) expressed that Native American institutions serving their distinct tribal entities as TCUs were in a unique position to serve the distinctive educational needs of many Native Americans with aspects of culture, language, and religious beliefs. Marroquin (2019) emphasized
that preserving culture and language was paramount in the mission of most TCUs. He analyzed the mission statements of 35 TCUs and found that the word *culture* appeared 27 times, while *language* appeared 15 times. Marroquin (2019) also stated that tribal culture and language are essential components and outcomes of a TCU education. Dameron (2014) argued that, in order to increase representation of Native Americans in STEM professions and faculty positions, retention and graduation rates of Native American students in STEM degrees must improve by taking into account the unique culture and identity of Native American students. Faculty and students participating in this study appreciated the fact that their TCUs allowed for tribal culture and language to be incorporated into the curriculum.

Smith et al. (2014) wrote that Native American students’ success was often connected to their belief that they have both the personal capability to succeed in their studies and the ability to remain true to their traditional culture. Smith et al. also expressed that these findings of Native Americans and their ties to culture have important implications for interventions to alter STEM culture and teaching in a direction that fosters and supports Native American students in feeling a sense of belonging with STEM. Smith et al. imparted that the students in their study revealed that they were successful in college in part because they stayed engaged in their programs of study, often by finding meaningful connections between their tribal culture and the demands of college. This recognition was also strongly evident in the present study. Smith et al. also conveyed that Native American students who exhibited bicultural efficacy demonstrated more positive educational beliefs and positive experiences. Higher education support programs that helped Native students bolster their bicultural efficacy appeared to be an important component in retaining Native American students at the institution and in STEM disciplines, specifically.

Paitrick (2016) explained that opportunities were being readied to prepare students for college
learning and to groom them for entrance into STEM professional jobs on the reservation. TCU STEM programs are structured in ways that support Native learning styles and consider the unique cultural needs of Native American students.

**Recruitment and retention.** Faculty members participating in the study determined that recruitment of students and retention of those students in their STEM programs were crucial in the success of the programs. Both faculty and student participants were pleased with the recruitment process, and the faculty members did not perceive any problems pertaining to students in their programs. Dameron (2014) also explained that minority retention programs were usually institution- or grant-funded programs, designed to assist specific students with the support needed for academic success and with the greater purpose of increasing retention and graduation rates among minority populations. Student participants revealed that they were able to continue their education and retention at their institution because of the student services program and grant programs that helped with transportation, child care, educational materials, and food expenses. These programs were critical for them personally and made a successful education possible.

**Limitations**

While the impact of TCUs on the success of their students in the STEM programs was explored in this case study, the study was limited to two out of the 37 TCUs in the continental United States and Canada. However, the two TCUs participating in the case study were directly comparable to most, if not all of the existing TCUs. For example, the TCUs participating in the study had a high enrollment of Native American students and were private not-for-profit higher education institutions with STEM, associate degree, and certificate programs. Other limitations pertaining to sampling and data collection are explained in the following sections.
**Sampling limitations.** A limitation in this study was the small sample size of only 13 students and three faculty members. Although the initial goal was to recruit 15 students, only 13 were able to participate due to the academic calendar and the time scheduled for interviews. The sample was, however, diverse with respect to gender, race, and program of study, with an emphasis on being Native American and enrolled in a STEM-related program at a TCU.

**Data collection time.** Two weeks were allocated to the interview process, with 1 week at each of the two participating TCUs. Because the interviews took place later in the Fall semester, it was difficult to recruit the intended number of students. Because the interviews were spread out over a 1-week period per TCU, it is not known if the data were skewed because the student participants were able to exchange information regarding the interview questions and possibly affect the spontaneity of the answers. The interview data were collected through one-on-one interviews, during which the researcher expected to collect descriptions of personal experiences. Also, students were interviewed only once due to the short time period available at each site, when multiple interactions or follow-up interviews between interviewer and interviewees might have revealed further important information.

**Implication of the Results for Practice, Policy, and Theory**

Most noticeably, the participants in this study were satisfied with the quality of education they received at their respective TCUs. They were pleased with the accessibility, low cost, and extra help made available by the institution, instructors, and staff. They were also very appreciative of the fact that their tribal languages and traditions were practiced at the institutions and incorporated into the course curriculum.

**Implications for practice.** Student participants explained that the friendly, family-like atmosphere at their respective institutions was a key factor in their decision to enroll and persist
at their tribal TCUs. Dameron (2014) found in her research that the commitment of family, the family-like atmosphere, and feelings of community provided confidence and comfort and were a major influence in Native American students’ success in their STEM education. TCUs were established to incorporate the traditional aspects of Native American philosophy, and most tribal nations value family and community togetherness. In their study on how Native American students considered college and career, Katz et al. (2011) found that support from family was the most important aspect for Native American students in pursuing and attaining educational and career goals.

The student participants in the study recognized their TCUs’ contribution of financial and academic support as a critical component in their overall success in STEM higher education. Dameron (2014) acknowledged that student support programs and financial aid helped Native American students to feel connected at their institutions, thus improving graduation rates. Foltz et al. (2014) rationalized that financial aid served as the biggest inducement to enroll and remain in attendance by removing financial barriers to college education, which would otherwise deter minority and low-income students. Also, most Native American higher education students fit the criteria for a low-income background. According to Foltz et al., the Native American students in their study conveyed that mentoring, research opportunities, academic support, and scholarships were essential in their success in STEM education. The students participating in the present study were also delighted with the academic and financial support they were given at their TCUs and praised their student support staff, instructors, advisors, and tutors for their steady encouragement, help, and assistance during their time at the institution.

Student participants claimed that low cost and accessibility of their TCU factored substantially into their educational success. One of the participating TCUs claimed to have the
lowest tuition in its state and one of the lowest tuition rates in the United States. Marroquin (2019) reported that TCUs are located in seven of the 10 most economically disadvantaged counties in the United States, with an average annual tuition rate of $2,937 and the most diverse student body of Native American tribes. Marroquin also expressed that Native students attending TCUs perceived to receive more support from their institution, faculty, staff, and peers compared to students who attended non-Native institutions. The students participating in the present study also voiced their appreciation and satisfaction with the close proximity of the TCUs to their homes. They explained that being able to attend an institution of higher learning right on their reservation was beneficial to their well-being and to maintaining their cultural identity. Past research have shown that Native American students who were able to retain their cultural individuality had a higher probability of success in STEM higher education (Williams & Shipley, 2018), and the fact that TCUs are founded on this principle (AIHEC, 2014) empowers their students to preserve their cultural identity through their higher education journey.

The student participants in the present study insisted that learning and experiencing their traditional tribal culture and language was an imperative dynamic in their decision to attend the TCU. The Dalbotten et al. (2014) study suggested incorporating various perspectives such as social, cultural, political, and economic factors to help Native American students place what they are learning into a wider context when involving STEM education. Dameron (2014) explained that studies concerning Native American STEM students showed that attention to their culture was of critical importance when dealing with issues of recruitment, retention, and graduation. Some of the student participants elaborated on their feeling of belonging and having a cultural connection to their tribal traditions at their TCU; they were delighted to be involved in traditional ceremonies such as smudging and prayer, which they would not be able to do at a mainstream
university. Student and faculty participants both acknowledged the importance of integrating the culture and traditions of the local tribe in program curricula and course content. Dameron discovered through her research that faculty and students felt supported in an environment where their unique culture and learning style were respected, and this combination of respect and support led to academic success in higher education.

**Implications for policy.** The results of this study are based on the information provided by a limited sample of Native American students and faculty of two TCUs, located in some of the most economically disadvantaged counties in the United States (*Collaborating to Grow the Pathway*, 2016). Results of this case study indicated that the participants were content with the relations between student body and institutional staff, including faculty, tutors, and advisors. The participants emphasized key factors resulting in Native American students’ success in STEM education being financial and academic support, family and community support, and tribal cultural components integrated into the curriculums. Montgomery (2018) conveyed that TCUs were driven and shaped by their separate tribes that reinforced their culture, built tribal sovereignty and identity, and developed workforce capacity through accredited bachelor’s degree programs or associate degree programs that could be transferred to other institutions. Montgomery also stated that the U.S. government perspective on TCUs was based on federal mandates that requires all federal agencies to support tribal colleges through strategic planning and collaboration.

Faculty participants in the focus group discussion expressed their concerns about incoming students’ insufficient preparation for higher education. Faculty members discussed seeing students enrolling in the institution straight out of local high schools with no ability to do any of the paperwork themselves. These students needed help filling out enrollment applications,
federal aid applications, scholarship applications, and enrolling in courses. The faculty members also mentioned that most of these students were not prepared to handle college course work, and a great percentage of them tested for developmental math and english courses, or courses that would not count toward any degree program. The responses of faculty members and students indicated an urgent need for TCUs to develop workshops for local high school seniors planning to enroll in higher education courses. Those workshops could be used to instruct incoming students regarding the application process for enrolling at the institution, financial aid enrollment, preparation for math and english placement testing, and study skills development.

Implications for theory. Student participants recognized that their success in their respective STEM programs was due, to a large extent, to the assistance they had received from staff and faculty at their TCU. They also acknowledged that being comfortable at their TCU because of the cultural connection provided to them throughout the institution contributed to their success. Schooler’s (2014) Native American college student transition theory (NACSTT) provides tribal colleges and other institutions of higher education with a better understanding of the challenges Native American students face during their initial year of college. The NACSTT is based on six stages of development: remembering history, learning to navigate, moving toward independence, building trust and relationships, reestablishing identity and reaching out, and developing a vision for the future. The students participants showed in their interviews that, by attending a TCU, they were able to transition through the six stages faster because of the familylike relationships they had established with staff and faculty. Providing the ability to navigate through the system helped them to become more independent in their higher education journey. TCUs are institutions developed to maintain cultural awareness, preservation, and resiliency, thus allowing the student body to be aware of and combat the historical dramas of the
tribe, reestablish or maintain cultural identity, and develop a plan for future educational or job endeavors.

Horse’s (2005) perspective on American Indian identity development examined the character enhancements needed for American Indian students to grow, including Native language, genealogical heritage, tribal traditions, identifying as American Indian, and being enrolled in a federally recognized tribe. The TCUs participating in this study have incorporated the local tribal culture, language, history, and traditions into their mission and vision statements and have integrated tribal culture into their curricula and institutional learning outcomes. It is suggested by this researcher, based on the reported experiences of the participants in the study, that TCUs incorporate the cultural uniqueness of their tribe into all of their STEM programs and STEM curricula to give their students a common awareness within the course. Incorporating the tribe’s culture and language into the course content will benefit not only the students’ ability to relate and comprehend the material, but also the program by increasing retention and graduation rates.

**Recommendations for Further Research**

This study could be expanded upon with further research into the affiliation of Native Americans and STEM education. Further research on this topic could potentially identify additional barriers that keep Native Americans from succeeding in STEM education. Further research could also aid in recognizing key components needed for Native Americans to prosper in STEM fields. There is a need for more professionals in the STEM fields, and Native Americans fill merely a micropercentage of those professional seats today. It would be valuable, not only for the Native American population but also for the STEM industry, to understand what factors allow Native American students to succeed, versus failing, in higher education.
A recommendation for further exploration on the topic might involving all 37 TCUs to gain a larger pool of participants. An obstacle encountered by this researcher was finding student participants who were able to take part in the study during the time frame set for data collection. It is also recommended that both qualitative and quantitative research methods be considered to compare enrollment, retention, and graduation rates of all 37 TCUs and also to compare these rates with those of mainstream universities with high enrollment numbers of Native American students. Quantitative data would include exact numbers of Native American students graduating from a TCU with a STEM degree in comparison to Native Americans students graduating with a STEM degree at a mainstream institution. Quantitative data could also include how many students graduating at a mainstream institution with a STEM degree started their higher education at a TCU. It would be beneficial for a future researcher to develop a survey that could be distributed to all TCU students enrolled in a STEM program to gain increased data, including both positive and negative personal experiences. Because of time constraints, this researcher was not able to conduct follow-up interviews or have follow-up contact with student and faculty participants. It is recommended that a future researcher set up multiple contacts with the participants, including survey, personal interview, member checking, and e-mail follow-up. This would allow the researcher to collect more data and identify more barriers impeding student success, as well as identifying more factors contributing to student success. It is also recommended that TCUs find effective strategies and methods to ensure their students are passing any Boards needed to certify their employment in STEM professions. If the students are successfully completing their course work and not able to use their degree to perform the work the degree intended, then their educational success is all for not.
Conclusion

In this chapter, the results of the study were discussed in detail and a summary of the results was provided and related to the existing literature. Also discussed were limitations that could potentially hinder the research. Implications of the findings for policy, practice, and theory were discussed, and recommendations were offered for further research. The purpose of this case study was to explore the perceptions of TCU STEM students and faculty members and the impact TCUs exert on elevating the success of Native American students in STEM-related programs and professions. Native American involvement in STEM education and STEM professions is needed, not only for the United States but for the 573 recognized tribes and 326 Native American reservations found in the continental United States. The findings in this case study suggested possible methods that can be utilized by TCUs to increase enrollment, retention, and graduation rates from in their STEM programs. The findings also suggest for TCUs to find fruitful strategies to help their students pass Boards and exit exams allowing them to become employed in STEM professions. Those methods include integrating tribal culture into STEM curricula, developing workshops to prepare high school students for college life, developing methods to increase Board certifications, increasing awareness for financial aid and scholarships, and providing a family-friendly atmosphere for students’ feeling of security and comfort. The next big step is for TCUs to make sure that their students are not just stuck with a fine TCU degree to hang on their walls, but also have the skills to claim their rightful place in society as a STEM professional.
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Appendix A: Statement of Original Work

The Concordia University Doctorate of Education Program is a collaborative community of scholar-practitioners, who seek to transform society by pursuing ethically-informed, rigorously-researched, inquiry-based projects that benefit professional, institutional, and local educational contexts. Each member of the community affirms throughout their program of study, adherence to the principles and standards outlined in the Concordia University Academic Integrity Policy.

This policy states the following:

Statement of academic integrity.

As a member of the Concordia University community, I will neither engage in fraudulent or unauthorized behaviors in the presentation and completion of my work, nor will I provide unauthorized assistance to others.

Explanations:

What does “fraudulent” mean?

“Fraudulent” work is any material submitted for evaluation that is falsely or improperly presented as one’s own. This includes, but is not limited to texts, graphics and other multimedia files appropriated from any source, including another individual, that are intentionally presented as all or part of a candidate’s final work without full and complete documentation.

What is “unauthorized” assistance?

“Unauthorized assistance” refers to any support candidates solicit in the completion of their work, that has not been either explicitly specified as appropriate by the instructor, or any assistance that is understood in the class context as inappropriate. This can include, but is not limited to:

- Use of unauthorized notes or another’s work during an online test
- Use of unauthorized notes or personal assistance in an online exam setting
- Inappropriate collaboration in preparation and/or completion of a project
- Unauthorized solicitation of professional resources for the completion of the work.
Statement of Original Work (Continued)

I attest that:

1. I have read, understood, and complied with all aspects of the Concordia University–Portland Academic Integrity Policy during the development and writing of this dissertation.

2. Where information and/or materials from outside sources has been used in the production of this dissertation, all information and/or materials from outside sources has been properly referenced and all permissions required for use of the information and/or materials have been obtained, in accordance with research standards outlined in the *Publication Manual of The American Psychological Association*.

Daniel J. Henry

Digital Signature

Daniel J. Henry

Name (Typed)

9/12/2019

Date
Appendix B: Questions for Students

The researcher will ask the following questions in the Student interviews:

1. Are you in a STEM program of study?
2. Are you Native American?
3. Did you grow up on or off a reservation?
4. Did you graduate from High School or receive a GED?
5. Do you enjoy attending this school?
6. Why did you decide to attend a TCU?
7. Why did you decide on entering a STEM program of study?
8. Describe the type of help your institution provides for you academically and personally?
9. Is there any type of help or assistance you would like your school to provide that they do not at the moment?
10. Have you had any setbacks in your higher education career?
11. What have you done to succeed in your program of study?
12. How has your program of study helped you succeed?
13. Do your instructors provide adequate instruction in the classroom for you to understand the material?
14. Do you feel more comfortable with a Native American instructor or non-Native instructor?
15. Do you know if any of your classmates have challenges that hinder their success in the program of study and if so, what are they?
16. What have your instructors, advisors done to help your progress?
17. Has there been any opportunity from your school to do research?
18. Has there been any opportunity from your school to have an internship?

19. Would you recommend a TCU for others to start your higher educational career, please elaborate?
Appendix C: Questions for Faculty

The researcher will ask the following questions to the faculty focus group:

1. Are you a faculty member or advisor in a STEM program of study?
2. Are you Native American?
3. Did you grow up on or near a reservation?
4. Did you ever attend a TCU or community college?
5. Do you enjoy teaching at this school?
6. Why did you decide to teach at a TCU?
7. Did you have any input in designing your STEM program of study?
8. What is some assistance(s) your institution provides for academic success?
9. How successful would you say your program of study is for recruiting, retaining, and graduating your students?
10. Is there any type of help or assistance you would like your school to provide to help the students that they do not have now?
11. Is there an area of your program you would like to improve upon?
12. Do you consider your program of study a success?
13. Do you believe your program of study is set up to help your students succeed?
14. Do you feel you provide adequate instruction in the classroom for your students to comprehend the material?
15. What components of your program appear to be most beneficial and useful to your students?
16. Can you describe the type of support you get from administration?
17. How is your program funded?
18. Is there any opportunity in your program for your students to do research?

19. Is there opportunity from your program to provide internships?

20. Would you recommend a TCU for Native American students to start their higher education career, please elaborate?
Appendix D: Observation Tool

Investigator: _________________________ Date and Time: ______________________

Program of Observation: ______________________________________________________

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