5-2022

# Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma

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Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in Curriculum and Instruction

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May 2022
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**Abstract**

Native American students have consistently scored less than their white peers on high school academic achievement tests, have the lowest high school graduation rates, and have the lowest college enrollment rates. Research has evidenced challenges and struggles Native American children are faced with that negatively effects their success in the classroom. Native American students often encounter a disconnect between their home and school life resulting in difficulties of navigating two opposing worlds. When Native American students are associated with negative stereotype's indicative of Native American culture as opposed to the dominant culture, this creates a conflict between their cultural identity and what is expected in the classroom; however, culture that is honored and celebrated will cultivate confidence and success. The purpose of this qualitative study was to identify culturally responsive teaching in Native American populated science classrooms in Oklahoma. Thirteen science teachers and one Native American Studies teacher from five schools in Oklahoma participated in this research study, specifically, three public schools (majority Native American student population) and two Bureau of Indian Education schools (100% majority Native American student population). Teachers were emailed a survey that provided knowledge of culturally responsive teaching, implementation of culturally responsive lessons, and degree of cultural knowledge. Each teacher was interviewed in-person so that I could observe the teacher in their natural setting and observe the cultural identity of the environment. Collected data was analyzed and organized through line-by-line coding and axial coding. Data was compiled into case studies describing and detailing culturally responsive teaching, cultural awareness, factors that influence science teaching, and strategies that engage Native American students. This research study affirms the necessity of incorporating culture into the curriculum for student academic success and teacher

efficacy and is crucial to our Native American students and communities to educate the next generation of tribal leaders, health care professionals, business leaders, and to become productive citizens.

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## Chapter 1: Introduction

Student success in a high school science classroom is the intention of all science educators as evidenced by numerous programs implemented by legislation to develop and improve curriculum. Such programs include National Science Education Standards (National Research Council, 1996), No Child Left Behind (U.S. Department of Education, 2002), Next Generation Science Standards (Next Generation Science Standards, 2019), and Every Student Succeeds Act (U.S. Department of Education, 2015). Efforts such as No Child Left Behind focused on closing the wide achievement gap of underrepresented or disadvantaged students in the United States (U.S. Department of Education, 2001); however, American instructional strategies are direct depictions of white middle-class students and not conducive to all ethnicities' environmental situations, classroom behaviors, and cultural beliefs (Nelson-Barber & Johnson, 2019; Cajete, 1999). Comparable to earlier forced assimilation by the government, white educational norms strip Native American children of their cultural identity, can lead to a sense of alienation, and can greatly impact student learning (Nelson-Barber & Johnson, 2019; McMahon et al., 2018). When racial and cultural identification and recognition is absent from the classroom, career and life goals become apparently different among ethnic groups (Ingersoll & May, 2016; Morgan, 2009). Inequitable circumstances, such as textbooks that omit Native American history, classrooms that lack minority teachers, and support systems that lack efficacy, have been identified as inhibiting Native American student success (Bickel & Jensen, 2012; Morgan, 2009). When Native American students encounter a disconnect between their home life and school life, they are more apt to drop out of school; however, learning to participate in both cultures—at home and school—can greatly enhance their educational experience (Bickel & Jenson, 2012; Garrett et al., 2003). In fact, the National School Boards Association (*The*

*Condition of Native American* Students, 2020) reports that from 2010 to 2018, Native American students' college enrollment rate decreased by 33% with only a tenth of students completing high school. Statistical data shows that white middle-class norms are not indicative of best practices for Native American students (Nelson-Barber & Johnson, 2019). Best practices employ educational strategies that are suited for and distinctive of Native Americans that would include knowledge of Native American history, knowledge of Native American personalities and characteristics, and familiarity of cultural traditions, lifestyles, and social issues; therefore, they should be included in decisions that integrate cultural traditions in curriculum (Nelson-Barber & Johnson, 2019). The National Assessment of Educational Progress (NAEP, 1969) was developed to report public and private school student achievement nationally in subjects including reading, math, science, social studies, English, history, economics, arts, technology, and engineering (National Center for Educational Statistics). National assessment data shows that student progress in achieving proficiency on the National Assessment of Educational Progress (NAEP) has had a positive effect on most ethnic groups except for Native American students (The Education Trust, The State of Education for Native Students, 2013; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Boon & Lewthwaite, 2016). In fact, the achievement gaps separating them from their white counterparts is widening rather than narrowing in most states (The Education Trust, The State of Education for Native Students, 2013). In 2011, the Science State Snapshot Report for Oklahoma reported 8$^{th}$ grade Native American students scoring 60% basic and 22% proficient compared to white students scoring 73% basic and 33% proficient (National Center for Education Statistics, 2011). The 2015 Science State Snapshot Report for Oklahoma reported 8$^{th}$ grade Native American students scoring 65% basic and only 26% proficient while white students scoring 75% basic and 35% proficient (National Center for

Education Statistics, 2015). Incorporating culturally based teaching and strategies into the classroom has shown improved student academic success on standardized tests, far higher than predicted (Ladson-Billings, 1995; Price et al., 2010; Powers et al., 2003), but lack of Native American teachers and culturally based lessons including Native American discourse taught in public school systems is all too evident (Clarren, 2017; Price et al., 2010). In a study by Ingersoll and May (2016), minority teachers have increased from all ethnicities except for Native Americans, for whom they reported a decline of 30%. The National School Boards Association (*The Condition of Native American* Students, 2020) reports that 1% of all public-school teachers identify as Native American and that the average salary is lower than all other ethnicities. The lack in Native American teachers presents a problem for Native American students who would benefit greatly by having that minority adult role model (Ingersoll & May, 2016; Lopez et al., 2013). The National Indian Education Study (2019) survey reported that 60% of Native American students in grades 4-8 were taught by teachers that had never attended professional development opportunities specific to Native American culture or instructional strategies. Along with the lack of minority teachers, few textbooks are written from the tribal perspective on historical events and even fewer are taught in the schools (Clarren, 2017; Morgan, 2009). Clarren states that most lessons about Native Americans involve history before 1900 and only a few teach cultural concerns. Incorporating events that depict massacres and cultural genocide are a controversial subject; however, this is an important piece of Native American student history and is a critical component of connecting current situations, emotions, social interactions, and educational achievements (Parker, 2019). Native American students very rarely learn concepts that integrate their cultural heritage applicable to their home life which leads to disengagement, withdrawal, and ultimately disconnect from their school environment (Clarren,

2017; McMahon et al., 2018; Powers et al., 2003; Powers, 2005; Morgan, 2009); however, incorporating culture into the classroom can be a powerful tool for Native American students to find their way out of a dismal and frustrating achievement gap (Hammond, 2015, p.15; Ricci & Riggs, 2019; Powers et al., 2003) and provide healing to distraught and traumatized past, current, and future Native American generations (Martinez, 2014; McCardle & Berninger, 2015). Native American curriculum designed and created by tribal leaders and elders could incorporate historical and cultural aspects of all disciplines (history, government, science, and Native American languages) that could integrate the culture of Native Americans and their white peers (Clarren, 2017). Culturally responsive teaching is an excellent approach to incorporating cultural content into the curriculum "using the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively (Gay, 2002, p. 106).

## Statement of the Problem

Studies have shown that Native American students struggle with inadequate education and college preparation skills that are linked back to such issues as environmental situations, lack of academic programs, financial support, and cultural awareness (Guillory & Wolverton, 2008; Davenport, 2015; McMahon et al., 2018). In 1944, The National Congress of American Indians was created to protect and secure rights, benefits, and laws of all tribal nations, tribal governments, and tribal communities. NCAI serves to lead and act upon issues that impact tribal sovereignty (National Congress of American Indians). According to the NCAI (National Congress of American Indians, Policy Issues: Education, Health & Human Services, para. 3):

> There are over 600,000 Native American and Alaska Native students in the K-12 classroom, representing 1% of public school nationally. Eight percent of American Indian students attend schools funded and governed by the Bureau of Indian Education (BIE) while ninety-two percent attend public schools. Alaska (27 percent) and Oklahoma (19 percent) comprise the largest population of the total student populations.

The National Congress of American Indians (National Congress of American Indians, *Education, Health, & Human Services, Education*) report that Native American students are the only ethnic group that has not shown improvement in reading, math, or science in 4th, 8th, and 12th grades. Native American students have the lowest high school graduation rates, college enrollment, and college graduation rates. The National Assessment of Educational Progress (NAEP, 2019) reports an overwhelmingly dismal statistic for our Native American youth that not only confirms the lack in educational equivalence, but also substantiates a need to revise current instructional strategies and support for Native American youth. A comparison of Native American youths' and white students' performances in science for the National Assessment of Educational Progress (NAEP) reports the disproportion of achievement scores. The Condition of Education, 2020, reports that the national average scores for Native American students in science from 2009 to 2019 decreased, while black students remained unchanged and scores for white, Hispanic, and Asian students increased (Table 1). Proficiency scores in science (NAEP, 2019) for white students were more than double that of Native American students and even greater than that for Hispanic and black students. In fact, 51% of Native American 12th graders scored below the basic level in science on standardized tests (National Center for Education Statistics, 2019).

***Table 1: The Nation's Report Card NAEP Report Card for Oklahoma: Science***
National Achievement-Level Results by Student Group

White

| Year | Below NAEP Basic (%) | NAEP Basic (%) | NAEP Proficient (%) |
|---|---|---|---|
| 2019 | 28 | 42 | 28 |
| 2015 | 28 | 43 | 27 |
| 2009 | 28 | 45 | 25 |

***Table 1 (Cont.)***

Black

| Year | Below NAEP Basic (%) | NAEP Basic (%) | NAEP Proficient (%) |
|---|---|---|---|
| 2019 | 69 | 25 | 6 |
| 2015 | 70 | 25 | 5 |
| 2009 | 71 | 25 | 4 |

American Indian/Alaska Native

| Year | Below NAEP Basic (%) | NAEP Basic (%) | NAEP Proficient (%) |
|---|---|---|---|
| 2019 | 51 | 36 | 12 |
| 2015 | 58 | 31 | 11 |
| 2009 | 47 | 40 | 13 |

Source: National Assessment of Educational Progress science assessment, The Nation's Report card, 2019.

Native Americans' scores in reading are just as discouraging and mimic those on science tests. Proficiency scores in reading for white students were more than double that of Native American students and Hispanic students and even greater than that for black students. Just as disheartening, 46% of Native American 8th graders scored below the basic level in reading on standardized tests (National Center for Educational Statistics, 2019). The idea that Native American students are failing in reading can impact and further complicate comprehension in subjects of higher complexity such as advanced placement courses and upper-level science and math courses (chemistry, physics, biology, and algebra to name a few). Unfortunately, Native American students will not attend schools where Advance Placement courses are offered and only 19% of Native American students will enroll in college upon graduation (Postsecondary National Policy Institute, 2020) with 14.5% completing a bachelor's degree (The American Indian Graduate Center, 2021). Native American students often struggle with merging school and homelife; consequently, preparation for college is greatly affected (Davenport, 2015). In 2018, The Condition of College & Career Readiness (2018) reported that only 6% of Native

American students in Oklahoma took the ACT with an average composite score of 18.2, below the national average of 20.8 whereas 46% of white students took the Act and had an average composite score of 20.5. Native American students are among the top percentage of students who are lacking in proper college preparation with most requiring remedial courses upon entering college (Davenport, 2015).

The U.S. Census Bureau 2020 Supplemental Poverty Measure reported Native American children make up 31% of all children nationwide who live in poverty (The Annie E. Casey Foundation, *How Many Kids in the United States Are Living in Poverty?* para. 4). Despite intentions from educators and administrators, poverty's influence on academic achievement remains too heavy a burden for many students living in poverty (Newberg, 2006). The 1987 Say Yes to Education tuition guarantee program promised 112 inner city 6$^{th}$ grade low-income students in Philadelphia a tuition-free college if they graduated from high school (Newberg, 2006). Of these 112, 70 students completed high school earning either a high school diploma or a GED and only 44 students completed educational degrees beyond high school (20 earned a bachelor's degree, 14 completed technical training, and 10 earned an associate degree) with the remaining 68 citing hardships associated with poverty too difficult to overcome (Newberg, 2006). Although this study focused on inner-city low-income students in one geographical area, the effects on education (or lack thereof) associated with poverty are all too common and the impacts are overwhelming (Jackson & Addison, 2018). Students living in poverty typically score lower on academic achievement (standardized) tests and exhibit atypical structural brain development which has surmounting implications for their academic successes (Hair et al., 2015). The potential for academic success at a young age is limited due to the environmental circumstances experienced in poverty and is directly tied to lack of specific brain activity

necessary for critical processing of academic learning and educational function (Hair et al., 2015).

Education remains a crucial role in the lifestyle and career of Native American people both in the world market and as involved members and leaders in their tribal communities (National Congress of American Indians, *Education, Health, & Human Services*; Ricci & Riggs, 2019; McCarty & Lee, 2014). The National Congress of American Indians (2019) reports the fundamental role of education is to prepare Native American children to become productive leaders of tribal governments and states that "there is no more vital resource to the continued existence of integrity of Indian tribes than Native children" (para. 1). It is estimated that over 600,000 Native American students are enrolled in the United States public school systems and roughly 4.1 million Americans identify as Native American (American Psychiatric Association, *Mental Health Disparities: American Indians and Alaska Natives,* 2010). The Bureau of Indian Education reports that at least 90% of Native American children are enrolled in public schools with more than half enrolled in a school where "less than 25% of the students are Native students" (Rafa, 2016, pg. 2; McCarty & Lee, 2014, p. 104). According to the National Congress of American Indians, Native American's achievement scores remain consistently behind their white peers (NCAI, 2019; Price et al., 2010). According to the Nation's Report Card State Snapshot Report for Oklahoma (National Center for Education Statistics), Native American students scored considerably less than their white peers in science, math, and reading in both basic and proficiency categories (Table 1). In 2018, the adjusted cohort graduation rate (ACGR) of Native Americans reported only 74% graduation rate from high school (The Condition of Education, 2020), the lowest of all ethnicities. Nationwide, Native American students report a dropout rate larger than any other ethnic group (Status and Trends in the

Education of Racial and Ethnic Groups, 2018; Lopez et al., 2013). Overall, our educational system must make necessary revisions to close the large academic achievement gap between our Native American students and all other ethnicities (The State of Education for Native Students, 2013).

According to a 2014 report by the White House, challenges in obtaining and keeping teachers along with the absence of Native American language and culture in schools has been met with the U.S. Department of the Interior administering goals set forth to re-design the Bureau of Indian Education (Education Commission, 2016). Money has been allocated for the sole purpose of promoting educational learning and opportunities for Native American students by government entities; however, that money is declining and there is no control of how that money is being used by the school systems (Clarren, 2017). School districts procure Title VI grants, federal money specifically designated for Native students, for programs designed to teach cultural awareness, languages, history, music, and to enhance core curriculum but unfortunately the money is not being used as intended (Clarren, 2017).

Another challenge Native American students face in the classroom is cultural knowledge. Oregon 509J is a school system designed for students with high disciplinary issues; however, most are Native American students who are the result of their low economic and poverty-stricken environment. Teachers' misunderstanding of cultural issues resulted in students being sent to this alternative school (Clarren, 2017). Students from schools like Oregon 509J are identified as troubled kids resulting in a lack of student engagement, lack of teacher and student relationships, and ultimately inadequate education (Clarren, 2017). A senior student at Warm Springs reservation explains the frustration stemming from the lack of cultural awareness and challenges faced by Native American students (Clarren, 2017, p. 2):

> The computer-taught lessons weren't very engaging. You were kind of on your own—they'd have people watching you, but sometimes, if we asked for help, they couldn't help. The administrators don't see us as people deserving the same sort of education and opportunities.

This misconception of classroom and family life struggles leads to alienation from Native American students resulting in disciplinary actions (Clarren, 2017; Powers et al., 2003; Powers, 2005; Morgan, 2009). Clarren reports that "less than 1 percent of educators nationwide are of Native American descent" (2017, p. 10). Teacher diversity has increased in all ethnicities except for the Native American population which report a decline in Native American teachers and teacher retention rates (Ingersoll & May, 2016). This shortage results in negative outcomes for student achievement and success (National Indian Education Association Teacher Initiative, 2018), leads to discouraging classroom environments (National School Boards Association, *The Condition of Native American* Students, 2020), and results in large drop out and completion rates (Bickel & Jensen, 2012). School reforms and intended educational programs are failing in lessening the achievement gap for Native American students and unfortunately, seems to continue rather than progress toward increasing proficiency in core topics necessary for higher education (The State of Education for Native Students, 2013). The data collected in this study serves as validation that much work is needed to elevate Native American students to the educational level of all other ethnicities, narrow the achievement gap of Native American students, and increase the level of cultural significance in the classroom curriculum.

## Purpose of the Study

As a science educator working directly with teacher candidates as well as a former public high school science teacher, I am aware that emphasis is placed on the importance of providing equitable access to all students. The American educational system has shown to limit Native American students' career opportunities and academic success (Rafa, 2016). Few Native

teachers, lack of lessons about Native Americans, and few textbooks conveying the Native American perspectives on historical and cultural events could be detrimental to tribes and tribal communities (Rafa, 2016; Price et al., 2010). Education is crucial for Native American children to become productive citizens in society, contributing members of their tribal government, and become actively involved in their tribal community (National Congress of American Indians, Policy Issues, Education, Health & Human Services, 2019; McCarty & Lee, 2014). The National Congress of American Indians is committed to providing education opportunities for Native American children affirming the value of preparing them for future leadership roles in tribal governments. "There is no more vital resource to the continued existence and integrity of Indian tribes than Native children" (NCAI, Policy Issues, Education, Health & Human Services, 2019, para. 1). Sufficient teacher candidate training in multicultural and diversity courses will inevitably carry into their professional career in the classroom bridging home life to the classroom environment for Native American students (Ladson-Billings 1995; Lopez et al., 2013). Bridging a student's home life and school life is a crucial component for student success so that they feel fully connected to both worlds (Smith, 2016; Boon & Lewthwaite, 2016). For a Native American student to adjust to both worlds, they must adapt to the classroom environment in such a way that it does not take away from their core values and cultures inherited from their home life (Smith, 2016; McMahon et al., 2018; Ricci & Riggs, 2019). Smith (2016) refers to this as bicultural identity or integrative identity. When this bridge is reconciled, students can adjust to mainstream education without fully disconnecting from their tribal identity (Smith, 2016). This study showed that adequate knowledge among in-service teachers relating to cultural beliefs and socio-societal issues in the classroom can promote a more successful experience for the Native American student and classroom teacher. Through this study, I interviewed science teachers and

one Native American studies teacher in majority Native American student populated schools, identified science topics that teachers perceived as being relevant to the Native American culture, how the topics are taught, how the topics could be taught, and identified what teachers perceive as culturally based lesson themes across their different areas and tribal jurisdictions in Oklahoma.

## Conceptual Framework

Lev Vygotsky's (1978) sociocultural theory provided an element of the conceptual framework for this study. The main idea of this theory involves the interactions between the knowledge of the classroom environment and the knowledge that the child brings to the classroom. The interweaving of education and culture will shape their mental abilities and promote student learning (Scott & Palincsar, 2013). According to Vygotsky, parents, relatives, peers, and society collectively contribute to high levels of functioning and development (McLeod, 2014). Native American culture places high respect on their elders and much of what characterizes them is heavily influenced by their parents and grandparents (Whitewater et al., 2016); therefore, a Native American society will have a strong influence on Native American children that at times proposes an opposition or disengagement to the American educational system (Juneau, 2001).

Vygotsky's concentration was the educational and social problems that plagued his era placing all social and ethnic groups within the same educational paradigm (Kozulin et al., 2003). During his time, the Native American culture was being forced into assimilation into the American educational system (1880-1930's). Vygotsky believed culture to have the greatest impact on cognitive development rather than biological instincts inferring that a child's environment will influence classroom behavior (McLeod, 2014). Vygotsky claims that young

children will imitate or assume traits or characteristics from their immediate surroundings, such as parents, grandparents, or siblings. This theory also applies to knowledge or education and is instrumental in cognitive development. In a culture rich household, children will carry this tradition with them to the classroom (Turuk, 2008). Vygotsky claims that humans possess "symbolic tools" which constructs and directs a child towards developing his or her own mental ability. These tools include cultural artifacts specific to their cultural tradition and beliefs and connect their social interactions with their behaviors and actions (Shabani, 2016). Vygotsky's mediation claim can assume any form of psychological tool that follows internalization of education knowledge, for instance language, culture, and schema. Vygotsky's theory affirms that it is imperative that Native American children integrate culture into their education to enhance and maximize learning and to utilize their specialized skills. Integrating culturally relevant topics into the curriculum can only further and enhance development of curriculum and learning (van Compernolle & Williams, 2013). Vygotsky proposes that social interaction and learning development must be co-dependent for adequate development to occur. Vygotsky's transmission model further clarifies that children will naturally assume cultural identity and practices modeled from their caregivers, parents, and elder to name a few (Scott & Palincsar, 2013). Sociocultural theory focuses on the most effective way the child can learn in accordance with their cultural aspects or learned cultural traditions with the goal being to ultimately prepare children for their environment whether it's a work environment or returning to their home community (Scott & Palincsar, 2013). In most cases, Native American students will aspire to enter tribal communities as members of society or as leaders in tribal government roles or as tribal employees. Vygotsky's transmission model places importance on integrating the child's culture into their cognitive development during the educational phase (Scott & Palincsar, 2013).

Research through Scott and Palincsar (2013) found that interconnecting the child's prior knowledge (learned in the home prior to the classroom) and knowledge learned in the classroom can lead to optimal academic success, increased standardized testing scores, and overall confidence in the classroom for minority students thereby decreasing or narrowing achievement gaps between minorities and their white counterparts (Scott & Palincsar, 2013). Although the world around them has changed dramatically, these skills are still heavily embedded into their characteristics and traits. By modifying learning strategies in the classroom to accommodate Native American students' specific psychological tools, an American educational classroom can become conducive to the Native American population (van Compernolle & Williams, 2013). Although cultural differences amongst ethnicities are prevalent in school classrooms, effectively trained teachers can provide the necessary tools specific to cultural values and needs. Identifying appropriate tools to equip Native American students may present itself differently according to the geographical area and can be a determining factor in an adequate education (Emdin, 2017).

## Research Questions

Research questions studied:

1. What science topics do teachers of Native American students report teaching in culturally responsive ways?
2. What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?
3. What common themes do teachers identify related to teaching in a Native American student populated science classroom?

## Significance of the Study

The National Congress of American Indians (NCAI) has worked tirelessly to improve educational opportunities for Native American students (Native American Congress of American Indians, *Helping Native Youth Thrive Through Research and Data,* 2019). For example, the "First Kids 1st Data Resource Book" was created as a resource to help Native American students thrive in educational settings, provide a resource for a healthy lifestyle, provide environmental support, and foster community involvement (Native American Congress of American Indians, *Helping Native Youth Thrive Through Research and Data,* 2019). The NCAI has enlisted leaders to improve and restructure schools through Every Student Succeeds Act (ESSA) to support low-income schools with grants to support art education as well as prevention and intervention programs for at risk or neglected students (NCAI, Policy Research Center, *Tribal Leaders Toolkit*, 2018, p. 32). Through the restructuring of the Elementary and Secondary Education Act (ESEA), NCAI recruiting, hiring, and training effective teachers and leaders remains in the forefront of improvements for schools (Straus & Miller, 2016, p. 23). The need of restructuring the ESEA is evidence that Native American children deserve a quality education and should be the driving focus of the federal government's obligation to tribes (NCAI, Policy Issues, Education, Health & Human Services, 2019). Education is a vital component for Native American children in society, in their communities, and as preparation to become well-equipped future leaders in tribal governments (NCAI, 2019; McCarty & Lee, 2014). For Native Americans to thrive, regain cultural integrity, and to become formidable business leaders, education is a necessary resource (NCAI, 2019). The State of Education for Native Students (2013) data shows that not only are Native American students falling increasingly behind in reading and math than all other ethnicities, but also that the education system in place has been

ineffective in narrowing the achievement gap. Although Oklahoma and Oregon have reported proficiency and advanced levels at a much higher rate than other states, these numbers are still consistently low and warrant the necessity of educational reform for Native American students (The State of Education for Native Students, 2013). With the right instruction and support, culturally relevant topics can be successfully integrated into the curriculum of math, reading, science, language, art, history, physical education, among others, and can achieve at levels comparative to their white counterparts (Reyhner et al., 2011; Milner, 2009).

Identifying high school science teachers' knowledge of culturally responsive teaching, Native American beliefs and traditions, and application and integration of culturally responsive teaching for Native American students in the classroom in predominantly Native American populated schools in Oklahoma served as the focus of this study. Through the survey, interviews, and observations, I compiled comprehensive cultural-based lessons, workshop material, cultural activities, and cultural field experiences geared towards culturally responsive teaching in a multicultural high school science class. These resources, aimed specifically for Native American students, can enhance the science teacher classroom, create cross curriculum culturally responsive teaching lessons, and transform professional development communities in a science classroom. Furthermore, the resources will provide an engaging and enjoyable learning experience not only for Native American students but also for the classroom teacher.

## Research Method

A qualitative method of study consisting of surveys, interviews, and observations of classroom and school environment guided this research. The purpose of this research study was to identify culturally responsive teaching in Native American populated science classrooms in Oklahoma. Administrators from ten Oklahoma schools were contacted and asked to participate

in the study (Appendix D). These schools were identified according to their Native American student population. Six schools were identified as high density Native American student population (majority of 50% or more Native American student population) and four schools were identified as Bureau of Indian Education Schools (100% Native American student population, funded and operated by the tribe or tribal government via a contract or grant). Of these ten schools, five schools agreed to participate in the study. These schools consisted of three high density Native American student population schools and two Bureau of Indian Education Schools. Administrators sent names and email addresses of all sciences teachers in their school. Eight teachers (Seven science teachers and one Native American studies teacher) from the high density Native American schools and 6 teachers (all science teachers) from BIE schools agreed to participate. Teachers were emailed a survey via Google forms (Appendix A) that provided information about their knowledge of culturally responsive teaching, incorporation of culture into the science curriculum, personal ethnicity, percentage of Native American students as well as application of culturally responsible teaching in the science lesson. This survey provided basic information that allowed me to formulate more extensive and comprehensive questions during the interview process. Selected teachers agreed to follow up the survey with an in-depth interview that also included classroom and school environment observations. Participants were interviewed for information relating to their science lessons, cultural lessons (Native American Studies class), relevance to Native American students, and attitudes and opinions regarding their science classroom (Appendix B). Participants were also given the opportunity during the interview process to add comments or information related to the survey. Participants were asked to interview in person rather than virtually for the sole purpose of classroom and school

environment authenticity of a culturally rich observation. Participants were given full access to information regarding the research to allow for valid and reliable research.

A combination of grounded theory research and case study methods was determined as the best approach for this research study. According to Corbin and Strauss (1997), grounded theory involves developing theory that is based on data collected and analyzed throughout the study. This research study made use of a combination of methods including conducting surveys to gather knowledge levels of culturally responsive teaching, Native American tradition, beliefs, and cultures; observations to investigate cultural presence in the school and classroom environment; and interviews. The interview stage allowed the participants to expand on their survey answers as well as discuss in detail the research questions that directed this study. The observations and interviews were recorded for further analysis which allowed me to look for emerging themes surrounding culturally responsive teaching in science classrooms and construct appropriate analyses. The grounded theory method and case study approach helped to better understand the teachers' experience in their preservice training and in-service professional development and how that knowledge has impacted their classroom experience. Grounded theory utilizing Charmaz's process stages (Charmaz, 2006, p.11) and Yin's design and method of case study research (Yin, 1985, Yin, 2012) served as a guide for collecting and analyzing data.

## Reflexivity Statement

When I moved to Northwest Arkansas as an adult, I did not know anything about the area much less the ethnicity in the school systems. I quickly learned that this area consisted of a very diverse community of Hispanic and Marshallese populations. Growing up in Oklahoma, I had little knowledge of either culture. When I began teaching in the high school, it was evident that I needed more education and resources. I was fortunate enough to participate in an extensive

program that taught me effective teaching tools and strategies for a diverse classroom placing emphasis on ethnicities most common to the geographical area at which time I began the process of understanding and learning these new cultures. Teaching a subject like chemistry and physics is intimidating to students anyway, but to students who identify with different cultural traditions with an added language barrier really inspired me to create lessons that would foster connections between what I am teaching and what they brought to the classroom. In turn, it gave me a new perspective on what cultures and traditions mean to students, to parents, and to teachers. I started thinking about my own culture and the impact it had on my life and career, the challenges I faced, and the challenges my Native American friends and family faced. As I began this study, I realized that there were very few Native Americans in educational careers, I didn't really remember very many in college, and not very many in professional careers (medicine, dental, and more). Not sure where this curiosity would lead, I started researching and quickly became interested in the educational progress and process of Native American youth.

I am Native American and am registered through the Seminole Nation of Oklahoma tribe but have a Certificate Degree of Indian blood for Choctaw and Creek. My father is full blood Native American Choctaw, Creek, and Seminole and my mother is $1/16^{th}$ Chickasaw. Born and raised in Oklahoma with Native American bloodline, most people assume that I must have lived on the reservation, or that I identified strongly with my Native American roots; however, that was the furthest from my upbringing. My hometown and school had a small Native American population (and still does), so I didn't know very much about my heritage and most of my friends were white. Most of my Native American classmates lived on "Indian block"; my family did not. I had a parent that was educated while most of them did not. Although I had a very different homelife than most of my Native American classmates, we shared similar educational

challenges. While in high school, I did not take AP classes and was not enrolled in higher level science and math classes as I believe this is the case for my Native American classmates. I had conversations about college, but with no financial assistance, it was not a reality.

I don't know much about my grandparent's education except that I had one grandfather who attended a boarding school and none of my grandparent's attended college. My father was fortunate to meet a school guidance counselor that encouraged him to go to college and was responsible for him obtaining a college degree. Had it not been for this counselor, his low economic upbringing would have played a much bigger part in his education. My father was the first in his family to go to college and the only one that graduated. My mother's education did not exceed beyond 9$^{th}$ grade (she later acquired her GED), so with little educational guidance from my parents during high school and post high school, it would be many years before I would attend college. Most of my Native American classmates did not go to college and, if they did, they soon dropped out. I reflected on my high school and post high school years and often wonder how much easier life would have been with parental guidance, financial capability, and college admissions guidance. Because of my personal experiences, the importance of education remained at the forefront of my parenting role with all three of my children obtaining a college degree. I didn't understand the magnitude of a noncollege track as a young child; but as an adult, as a teacher of a strong diverse community, and as a parent of Native American children, the reality was overwhelming.

When I began this research, I wasn't sure what I would find since I haven't lived in Oklahoma in almost twenty years and I didn't know much about the state of Native American education, but numerous reports indicated that Oklahoma's educational scores among Native American students were well above the national average. This was the starting point of my

research. I began immersing myself into my culture, into my ancestor's history, and into my heritage. With this newfound interest came an alarming awareness and recognition of the challenges that the Native American people face in education, past historical traumas, interactions with their peers and teachers, college, and career aspirations. Challenges that I had to overcome, and challenges that I knew and recognized as an issue that needed awareness. As a child, I thought this was normal because this was all I had ever known; however, as an adult, I realize that the stereotypes and constraints can be alleviated with a little help and guidance. This study reinforced why I chose kindergarten through 12$^{th}$ grade to research, and my personal experiences strengthened my role as researcher.

## Assumptions

Through observations and interviews conducted in this study, I uncovered emerging themes of perceived culturally responsive teaching across multiple areas of science curriculum, Native American studies curriculum, and across diverse tribal affiliated classrooms in Oklahoma. The research findings in this study were evaluated through surveys, interviews, and observations of teachers in two different tribal affiliations of Native American student populated schools in Oklahoma. The following assumptions were made:

1. The participants in the study will provide honest feedback.
2. The participants in this study will exhibit authentic depictions of a culturally rich environment during classroom and school observations.
3. The participants in this study will provide the researcher with authentic culturally responsive teaching science lessons during the interview process.

## Limitations

Limitations of this research study included the following:

1. Limited to schools in Oklahoma and is not representative of other geographic areas (states) and tribal affiliations. Initially, five different tribes were contacted to participate in the study; however, due to teacher hardships surrounding Covid-19 issues, school regulations surrounding Covid-19 issues, and teacher availability, the study was limited to two tribal affiliations.
2. Limited to schools with a high density Native American student population (50% or more Native American student population) and Bureau of Indian Education schools (Funded and operated by the tribe or tribal government via a contract or grant) and is not representative of all schools in Oklahoma. Due to issues surrounding Covid-19, this study was limited to two of the five Bureau of Indian Education schools in Oklahoma.
3. Limited to five schools and fourteen teachers. An in-depth analysis including surveys, observations, and interviews necessitated the limited number of participants. Due to teacher hardships surrounding Covid-19, school regulations surrounding Covid-19 issues, and teacher availability, this study limited the number of participants.
4. Limited to the participating teachers and is not representative of other science teachers or of their schools.
5. Time and travel constraints limited the number of participants and geographical area.

## Delimitation

A research study collecting and analyzing school data in states other than Oklahoma with large numbers of Native American students is ideal for complete and comprehensive data. All public schools in Oklahoma that report a 50% or more Native American student population is

ideal data to represent the entire state's Native America student data. All five Bureau of Indian Education schools in Oklahoma is ideal to represent tribal schools that are funded by the tribal governments and indicative of a 100% Native American student population. A larger sample size would provide a more comprehensive list of resources; however, an adequate amount of data was collected with the sample size researched.

## Summary

Adequate and equitable education is a right for all students despite race or economic status; however, national statistics (NAEP, 2019) have shown a decreasing trend in achievement scores for Native American students. Although schools receive extra funding from the government through grants such as Title IV and Johnson O'Malley programs, much of this money remains unaccounted for or is not utilized as intended (Clarren, 2017). Oklahoma is one of few states to report proficiency scores and graduation rates above the national average of states reporting Native American statistics. Because of these statistics, this research study focused on uncovering educational strategies, knowledge of culturally responsive teaching, and successes of teachers in Oklahoma. Fourteen teachers from five different schools across different tribal areas in Oklahoma were surveyed and interviewed for this research study. Three schools were public school systems that reported at least 50% Native American student population and two schools were Bureau of Indian Education schools that report a 100% Native American student population. The data collected presented a plethora of culturally based lessons that could serve as a resource guide for science teachers, provide opportunities for field experiences, promote cross-curriculum studies, and improve educational equity for all Native American students.

## Chapter 2: Review of Literature

### Research Methodology

The literature review was conducted to find literature that would provide historical resources connecting past generational events, education, and traumas to present-day circumstances. This information would be imperative for recognition of and substantiating the academic achievement gaps present in education necessitating this research. Key words used to refine the search include assimilation, boarding schools, Trail of Tears, Native American, and Indigenous studies. The literature review continued with educational statistics and challenges indicative of Native American students. Because my study focus was specific to Oklahoma, my search began with educational statistics in Oklahoma. Key words used to refine the search include Native American achievement scores, Native American achievement gaps in education, and science education statistics in Oklahoma. My study was exclusive to culturally responsive teaching; therefore, keywords searched for included culturally responsive teaching, culturally responsive teaching with an emphasis on science education, culturally responsive teaching science lessons, culturally responsive teaching/science/Native American education, Native American learning strategies, behaviors, and characteristics, culturally responsive schooling, and culturally relevant pedagogy. While researching, several terms and key studies were found such as cultural border crossing and the crossover effect. Deemed effective for this study, I began to search for literature that contained this information. The literature was retrieved from searching through the following databases Google scholar and the University of Arkansas library.

After research articles, textbooks, etc. were found, I began to read, analyze, and code each article for topics that would relate to my research questions. After this step, I organized the literature, accordingly, constructed an outline, and began writing the literature review. Articles

were selected based on the research questions in the study. Although most recent studies were preferred, older studies proved essential to corroborate the findings between the studies.

## Introduction

The 1800's brought about strenuous policies enacted by the United States government with the sole purpose of acculturation and assimilation of Native American peoples (McMahon et al., 2018). These practices used education as a means of civilization by forcibly removing Native American children from their families and homes and into a boarding school intended to Americanize them or to re-educate them (Nelson-Barber & Johnson, 2019, McMahon et al., 2018). The boarding school era resulted in numerous cases of abuse, rejection, and alienation and although assimilation policies are no longer in place, these practices are still a common topic of concern and conversation today (McMahon et al., 2018). Despite these practices of injustice, Native American people today maintain their cultural values, traditions, communities, lifestyles, and governing society; however, Native American students still face educational challenges with little to no help in bridging the achievement gaps between the diverse student populations (Nelson-Barber & Johnson, 2019; McCarty & Lee, 2014). Such issues as socioeconomic status, cultural activities and practices, mental health issues, depression, environmental concerns, cultural and traditional identities, and teacher/student relationships remain a common obstacle (Nelson-Barber & Johnson, 2019). With over 600,000 Native American students enrolled in public schools or Bureau of Indian Education (BIE) schools, the necessity to incorporate culturally relevant topics into mainstream education and curriculum has become increasingly evident (National Association of Secondary School Principals, 2019; Boon & Lewthwaite, 2016; Morgan, 2009; and others). The State of Education for Native Students reported by The Education Trust (August 2013) reports dismal and discouraging academic achievement results

for Native American students. Research states that not only are Native American students performing under the minimum levels of proficiency and basic levels (Powers, 2005), but their scores are also much less than all the other student populations (The Education Trust, August 2013; *Vistas Multicultural Issues in Counselin*g, Parrish et al., 2012; Boon & Lewthwaite, 2016). This lack in educational performance level results in "psychological, social, and developmental issues" that consistently plagues Native American students (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012, p. 1). These statistics create the need for learning to be more culturally aware and relevant to adapt to the specific learning styles of all ethnic groups as well as Native American students for a more engaging and effective education (National Association of Secondary School Principals, 2019; Gilbert et al., 2011; Boon & Lewthwaite, 2016).

The literature review begins with the history of Native American peoples' assimilation into the white-norms society because this is where we first encounter educational struggles. Through governmental treaties established from 1778-1871, guidelines were enacted that would control the education of Native American children (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Beginning in the 1870's, boarding schools were created by the Bureau of Indian Affairs as an attempt to civilize or Americanize Native American Indians (Heard Museum, *Away From Home, American Indian Boarding School Stories*; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). This assimilation began with the widespread forced removal of Native children into these boarding schools where they aimed to take away their Indian-ness by refusing languages spoken other than English, requiring the boys to cut their traditional hair braids, and requiring them to wear American clothing (Heard Museum, *Away From Home, American Indian Boarding School Stories*). Assimilation programs were designed to eliminate all traces of Native American traditional and cultural identity (Powers et al., 2003).

Past Trauma associated with assimilation practices and disconnect in the classroom continues to inhibit academic success; therefore, becoming the driving force behind this study. The research questions posed helped me understand the reasoning behind Oklahoma's achievement score success, but also provided insight into challenges and concerns from teachers.

The literature reported on statistics that have direct bearing on the consequences of lack of educational support for Native American students. The challenges and struggles faced by the Native American tribes not only include the forced assimilation into boarding schools, but the forced relocations (Trail of Tears) from their homes, political injustices, and economic burdens that still have a profound effect on Native American communities and governments (American Psychiatric Association, Office of Minority and National Affairs, 2010). The educational statistics in this literature review provided the basis for this study and helped formulate the research questions to determine what science teachers in Oklahoma are doing to consistently score higher on academic achievement tests.

This literature review focused on the learning and communication styles of the Native American peoples. Many people are not aware of the cultural values and unique characteristics of Native Americans (Morgan, 2009). There are many communities where Native Americans remain true to their cultural heritage and lifestyle, other areas where Native Americans have accepted and welcomed mainstream American, while others remain somewhere in between (Price et al., 2010). It is for this reason that educational entities must identify and become aware of learning and communication styles of all Native American children (Price et al., 2010). Because Native American children will come from different areas of cultural lifestyles, miscommunication of cultural identification and behavioral issues can lead to difficulties and disconnect from their teachers and peers (Price et al., 2010; McMahon et al., 2018). Knowledge

of the characteristics and traits specific to the Native American culture was a common theme identified by the teachers interviewed. Teachers collectively agreed that this is important to recognize for effective teaching and learning.

The literature showed the importance of incorporating culturally responsive teaching techniques in all levels of schooling. Incorporating culture and language into the curriculum connects education with their homelife, culture, traditions, and history which leads to academic achievement and importance of school responsibilities (Clarren, 2017; McCarty & Lee, 2014; Lopez et al., 2013; Beucher et al., 2020). Science topics/concepts integrated into the science curriculum as well as strategies that enhance the curriculum can have a profound effect on student engagement in the classroom that can lead to increased academic scores.

Lastly, the literature reports on gaps in literature resources. Although the literature identifies concerns, statistical data, and the important of culturally responsive teaching, there are numerous aspects of culturally responsive teaching that is missing, or research is very limited. Qualitative research is a powerful tool to enact or promote change; however, there needs to be a distinct connection between culturally responsive teaching and student achievement outcomes (Lopez et al., 2013). Gaps in literature can have an impact on future publications, workshops, professional development, and cultural awareness.

## History of Native Americans

In an effort to Americanize or civilize Native Americans, Native American children were forcibly taken from their homes and families to enter a federally controlled and governed Indian boarding school oftentimes not seeing their families or relatives for an extended length of time (Archuleta et al., 2000; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). From the late 1800's to the early 1900's, boarding schools were authorized to assimilate Native American

children with the idea that assimilation would take place faster integrated with non-native students (Lopez et al., 2013). The boarding school education was designed to eradicate the Indianness in them as well as their traditional way of life (McCarty & Lee, 2014) by orienting the schools away from tribal communities so that the Native American children would be assimilated into European American cultural practices (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). The government entities assumed that once Native American children were away from their strong traditional communities and attending schools with non-native students, boarding schools would help them blend in and the "Indian problem would be solved" (Deyhle & Swisher, 1997, p.120). The environment of the boarding schools was considered by many harsh and cruel punishment if guidelines and rules were not strictly adhered to. The children were not able to wear their traditional native clothing, boys were forced to cut their traditional hair braids, and could not speak in their own native language (Archuleta et al., 2000). Native American children were victims of harsh discrimination with less-than-ideal facilities and education (Powers et al., 2003; Lopez et al., 2013). Removal from their homes for extensive periods of time was intended to alienate them from their traditional Native culture and expose them to American religion and academics (McMahon et al., 2018). This led to forced religion, language, and beliefs (de la Luz Leake, 2020), eliminating their cultural identity, and subjecting them to psychological abuse (Lopez et al., 2013). In the late 19$^{th}$ century, the first Indian boarding school, Carlisle Indian School in Carlisle, Pennsylvania was established. This boarding school would become the first of many that would strip Native American children of their cultural and tribal lifestyle (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019*)*. Children were required to wear American uniforms, were given white names, could not speak in their tribal language, forced to cut off their traditional long braids, and

only allowed to eat American food and, much like present day education, the boarding schools focus was teaching history with a white bias with Christopher Columbus deemed a hero celebrated as the discoverer of the new Americas (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019). American public-school systems often portray and re-enact Thanksgiving holidays and programs as a happy gathering between the pilgrims and Indians which could not be further from the truth (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019). When Native American children did not comply with the rules and regulations, they endured physical beatings, deprived of food, deprived of basic privileges, or sent to solitary confinement (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019*).* Native American parents, refusing to take their children to the boarding schools, were met with governmental interference as police were sent to their homes to forcibly remove their children. As a result, Native American parents formed an alliance and began withdrawing their children from school, encouraging the children to run away, and undermining American taught philosophy during school breaks (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019). However, in 1893, a court ruling would prevent any further opportunities of withholding their children from enrolling in and attending boarding schools until 1978. The Indian Child Welfare Act (ICWA) of 1978 is a federal law that governs the removal and out-of-home placement of American Indian children (U.S. Department of the Interior Indian Affairs). This law was enacted to protect Native American children from the forcible removal from the homes and families, promote stability, and to secure their Indian culture and values (U.S. Department of the Interior Indian Affairs). This federal law legally allowed Native American parents the right to choose to place their children in off-reservation boarding schools (Northern Plains Reservation Aid, *History and Culture of Boarding Schools*, 2019).

The trauma and forced cultural abandonment experienced by Native Americans throughout history remains a constant reminder of the extreme injustices brought on by common citizens and the U.S. government (Nelson-Barber & Johnson, 2019). These circumstances still have a profound effect on Native American people as they continue to struggle to maintain their cultural identity, cultural uniqueness, historical significance, and equality in educational and career advancements (Nelson-Barber & Johnson, 2019). Prior to assimilation practices, over 600 Native American languages were present; consequently, approximately 200 remain and 50 languages are at risk for extinction (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Implications of forced acculturation and assimilation, loss of Native languages and cultural practices, and loss of traditional cultural values can be directly related to low academic achievements, long term mental and physical health, and is a key contributor to many other challenges Native American students are facing today (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Research has shown that western schooling is directly responsible for the separation of Native American identities from their traditional language, lands, and traditional beliefs (McCarty & Lee, 2014). Ricci and Riggs (2019) argue that colonization and assimilation practices are responsible for educational and social destruction of Native American communities. Native American children forced into boarding schools experienced physical, emotional, mental, and spiritual abuse; consequently, suppressing their tribal knowledge and way of life (Huaman, 2020). This experience culminated self-destructive behaviors of addiction and abuse that would last for generations to come (Huaman, 2020). The U.S. government further reinforced the Native American stereotype by naming weapons of destruction after tribal affiliations suggesting Native American warriors as savage and killers (de la Luz Leake, 2020). These traumas represent a small portion of what Native American people have endured over centuries of unfair treatment;

however, Native American societies have developed restoration strategies intended for strength and healing purposes (Huaman, 2020). Socio-scientific issues substantiating Native American disrespect are still present in Oak Flat, Arizona (mining an Apache sacred site), Dakota Access Pipeline, and the tragedies of the missing and murdered indigenous women and girls, MMIW (Nelson-Barber & Johnson, 2019). Despite the challenges and struggles faced by Native American people, Native American communities and tribal governments have been able to revitalize cultures, traditions, and languages, become formidable leaders in governments, and raise awareness of historical data through cultural centers and museums (Nelson-Barber & Johnson, 2019; Cajete, 1999). Although change comes with the cost of reliving painful histories of boarding school experiences, it is the desire of Native Americans to create a better educational system and enact change for future generations (Huaman, 2020). In 2004, the Smithsonian's National Museum of the American Indian in Washington, D.C. opened and most recently (September 19, 2021), the First Americans Museum in Oklahoma City celebrated its grand opening. There has become a new motivation and drive for children as well as their parents to revitalize and relearn (in most cases, to learn) their cultural heritage (Cajete, 1999).

## Native American Educational Statistics

Education remains a crucial aspect in the lifestyle and career of Native American people both in the world market and as involved members and leaders in their tribal communities (National Congress of American Indians, *Education,* 2019; McCarty & Lee, 2014). The National Congress of American Indians (2019, p. 1) reports the fundamental role of education is to prepare Native American children to become productive leaders of tribal governments and states that "there is no more vital resource to the continued existence of integrity of Indian tribes than Native children". Furthermore, an adequate education for Native American people leads to

cultural preservation, economic stability, and constructive social abilities (McMahon et al., 2018) and is imperative to thrive today (Lopez et al., 2013). Higher education attainment in the Native American community can have a profound impact on their ability to sustain and preserve sacred tribal lands, reservation and tribal communities, and ongoing environmental concerns (Ricci & Riggs, 2019).

A 1928 Meriam Report addressed the lack of intelligence or achievement tests performed in Native American schools. Because of this criticism, the following 40 years had been devoted to Indian education and achievement testing (Deyhle & Swisher, 1997). Individual researchers collected data that would detail low academic achievement for Native American children in the 1930's followed by contracted researchers and major universities conducting studies in the 1940's (Deyhle & Swisher, 1997). These studies revealed that contrary to how they were tested, Native American children consistently scored poorly; however, students who were considered more assimilated performed well (Deyhle & Swisher, 1997). This reinforced the idea of public-school attendance (assimilation) of Native children aimed at standardizing the dominant culture (McMahon et al., 2018).

Standardized testing has become the norm for which academic success is based upon preventing teachers from teaching curriculum outside of state mandated topics (McMahon et al., 2018). Because of this, diversifying the curriculum that would benefit culturally diverse students is discouraged (McMahon et al., 2018). Although the Bureau of Indian Education's (BIE) objective is to strengthen and promote cultural identities in BIE schools, approximately 90% of Native American students are enrolled in public schools (non-BIE schools) where the responsibility of incorporating culture into the curriculum relies (McMahon et al., 2018). Furthermore, state policies focus on specific criteria not representative of the influence that

cultural recognition holds (McMahon et al., 2018). Closing or lessening the achievement gap of Native American students by offering culturally sensitive and evidence-based practices should be implemented as a means of restitution for past traumas (McCardle & Berninger, 2015). Although nothing can take away the past traumas endured by Native Americans, promoting strong cultural identity can lead to increased academic success (McCardle & Berninger, 2015). Educators have the tools needed to lessen the achievement gap experienced by Native American students through culture-based education (McCardle & Berninger, 2015). Unless teaching and learning styles of Native Americans are aligned, Native American students will continue to perform poorly and exhibit destructive behaviors (Morgan, 2010) resulting in high referral rates for special education services (Power et al., 2003; McCarty & Lee, 2014).

Educators in Australia have observed much of the same dismal educational achievement gaps for Native American students and non-native peers reporting an almost three-year achievement gap (Boon & Lewthwaite, 2016). Deemed as unacceptable, Australian educators describe the necessity to counter these inequities by examining teacher practices and promoting cultural knowledge and skills within the educational community for effective pedagogy imperative for all ethnic groups (Boon & Lewthwaite, 2016).

Educators in Arizona researched strategies to bridge the achievement gap observed in their school system (McCarty & Lee, 2014). Through initiatives such as high student expectations, rich curriculum, and culturally responsive teaching, Native American students in the study outperformed Native Americans not included in the study and has "ranked among the highest-performing schools in the district" (McCarty & Lee, 2014, p. 116).

Motivation has been recognized to have a profound impact on academic success (Powers et al., 2003). Low teacher expectations, lack of parental involvement, and discontinuity have

been found to contribute to the absence of motivation for Native American students thus propelling the decrease in academic achievement (Powers et al., 2003). Low quality of instruction for Native American students has resulted in unchallenging curriculum and not relative to their educational abilities; consequently, Native American students are too often referred for special education services and remedial education (Powers et al., 2003). However, the Native American community believes that motivation and academic success can be achieved by cultivating a cultural sense of identity, preserving cognitive development, and fostering social and cultural maturity (Lopez et al., 2013).

Native American students are still being represented according to stereotypes learned through history books, cartoons, movies, and misguided instruction/knowledge from teachers (Powers et al., 2003) and parents. De la Luz Leake (2020) describes an example of a kindergarten class studying Native American culture where the students were seen wearing face paint, vests, and headbands with feathers. Curriculum taught without proper knowledge of the culture can lead to misconceptions and misguided instruction that unfortunately reinforce negative stereotypes Native American people have fought hard to overcome. Negative stereotypes witnessed by Native American students have led to detrimental school experiences and academic achievements (Powers et al., 2003). Unfortunately, many Americans do not know a lot about the Native American culture or history and has arguably been one of the most misunderstood ethnic groups (Morgan, 2009). Most textbook authors are non-native Americans and are written with non-cultural viewpoints; consequently, Native American's perspective is often absent in textbooks (Morgan, 2009). Building a curriculum around cultures of other ethnic groups can be challenging; however, educators should desire a community based around best practices (de la Luz Leake, 2020).

Native American students many times experience a lack of parental involvement and participation at school which is crucial in bridging the home-school discontinuity, building student confidence, and providing assistance and support in coursework (Powers, 2005). However, Native American parents oftentimes feel a sense of disconnect themselves from the school environment and do not have the educational skills to offer such assistance (Powers, 2005). Providing culturally relevant programs, promoting Native American parent involvement, and offering academic assistance could be the encouragement and motivation necessary for students to maintain consistency throughout their schooling (Powers, 2005).

To incorporate and implement cultural curriculum, teachers must have adequate education on diversity and multicultural education and availability to resources. (Lopez et al., 2013). Although over 90% of Native American students attend a public school system, most of them are not taught by Native American teachers or teachers that have adequate knowledge on culture (McCarty & Lee, 2014).

It is estimated that over 600,000 Native American students attend United States public school systems (American Psychiatric Association, *Mental Health Disparities: American Indians and Alaska Natives*, 2010). This accounts for almost 1.2 % of the population (Ricci & Riggs, 2019) or 4.1 million Americans that identify as Native American with over 500 federally recognized tribes and over 600 reservations (McCarty & Lee, 2014). The Bureau of Indian Education reports that at least 90% of Native American children are enrolled in public schools with more than half attending a school where "less than 25 percent of the students are Native students" (Rafa, 2016, pg. 2; McCarty & Lee, 2014, p. 104). Only 8% of Native American children nationally are enrolled in a Bureau of Indian Education school (BIE).

According to the National Congress of American Indians, Native American's achievement scores remain consistently behind their white peers (NCAI, 2019; Price et al., 2010). In fact, they are the only ethnicity that has only minimally improved in science but hasn't improved in math or reading (NCAI, 2019). According to The Nation's Report Card Science State Snapshot Report for Oklahoma and provided in Table 2 (National Center for Education Statistics), in 2011, 60% of Native American 8th grade students scored basic and only 22% of them scored proficient with an average score of 146 compared to 73% of white 8th grade students scoring basic and 33% white 8th grade students scoring proficient with an average score of 156. In 2015, 65% of Native American 8th grade students scored basic and only 26% of them scored proficient with an average score of 151 compared to 75% of white 8th grade students scoring basic and 35% white 8th grade students scoring proficient with an average score of 158.

***Table 2: The Nation's Report Card State Snapshot Report for Oklahoma***
Science State Snapshot Report, Oklahoma, Grade 8, Public Schools

| Results for Student Groups in 2011 | | | Results for Student Groups in 2015 | |
|---|---|---|---|---|
| | Percentage at or above | | Percentage at or above | |
| Reporting Groups | Basic | Proficient | Basic | Proficient |
| Race/Ethnicity | | | | |
| White | 73 | 33 | 75 | 35 |
| Black | 34 | 9 | 35 | 9 |
| Hispanic | 43 | 14 | 50 | 16 |
| American Indian/Alaska Native | 60 | 22 | 65 | 26 |

| Results for Student Groups in 2019 | | |
|---|---|---|
| | Percentage at or above | |
| Reporting Groups | Basic | Proficient |
| Race/Ethnicity | | |
| White | 78 | 32 |
| Black | 56 | 13 |
| Hispanic | 59 | 16 |
| American Indian/Alaska Native | 67 | 29 |

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, national Assessment of Education Progress, 1998-2015.

Reports for reading and math were even more discouraging. The Nation's Report Card Mathematics State Snapshot Report for Oklahoma in 2015 (National Center for Education Statistics) reports 61% of Native American 8th grade students scored basic and only 18% scored proficient with an average score of 269 compared to 75% of white 8th grade students scoring basic and 29% scoring proficient with an average score of 281. In 2019, 59% of Native American 8th grade students scored basic and 20% scored proficient with an average score of 270 compared to 73% of white 8th grade students scoring basic and 31% scoring proficient with an average score of 282. The Nation's Report Card Reading State Snapshot Report for Oklahoma in 2015 (National Center for Education Statistics) reports 75% of Native American 8th grade students scored basic and 27% scored proficient compared to 81% of white 8th grade students scored basic and 35% scored proficient. In 2019, 67% of Native American students scored basic and only 18% scored proficient compared to 78% of white 8th grade students scoring basic and 32% scoring proficient.

Native American students are less likely to enroll in upper-level science electives (e.g., physics, chemistry, computer science), advanced placement courses, and concurrent college coursework (The State of Education for Native Students, 2013). In 2018, the adjusted cohort graduation rate (ACGR) of Native Americans reported only 74% graduation rate from high school (The Condition of Education, 2020), the lowest of all ethnicities.

Dropout rates for Native American students have consistently been reported at an alarmingly high rate (Lopez et al., 2013). Research has found that Native American student's parallel academic achievement with other ethnic groups until fourth grade (Zyromski et al., 2011; Powers, 2005) with intentions of academic success (Powers et al., 2003). After this grade level, their achievement motivation decreases and their academic scores average around three

years behind other ethnic groups (Zyromski et al., 2011; Powers, 2005; Powers et al., 2003). It is at this age level that Native Americans recognize they are different and begin to realize their Indianness (Zyromski et al., 2011). Powers (2005) states that although we can't know for sure the reason for this, school discontinuity, family challenges, and learning styles and characteristics most likely accounts for the low achievement scores. This event emerged in the mid 1900's and has been recognized as the crossover effect (Deyhle & Swisher, 1997). Unfortunately, many Native American students do not recover from this decline that continues for the duration of their schooling (Deyhle & Swisher, 1997). Although academic success in later grades lead to higher education attainment, Native American students exhibited poor grades, lack of attendance, and lack of school engagement (Powers, 2005). Low teacher expectations, teacher-student relationships, and school discontinuity were seen to decline as Native American students continued in their schooling (Powers, 2005; Powers et al., 2003; Ricci & Riggs, 2019) resulting in having the highest dropout rates of any ethnicity (Powers et al., 2003; Ricci & Riggs, 2019).

Nationwide, Native American students report the lowest high school graduation rates and the lowest number of students enrolling in college and graduating from college (McMahon et al., 2018; McCarty & Lee, 2014). Native American students also report the highest dropout rates for 16- to 24-year-olds of 11% compared to 4.5% white, 7.0% black, 9.1% Hispanic, 2.0% Asian, and 6.9% Pacific Islander (Status and Trends in the Education of Racial and Ethnic Groups, 2018). Native American students often struggle with merging school and homelife that unfortunately is affecting their preparation for college (Davenport, 2015). The nationwide percentage of Native Americans enrolled in college in 2016 was 19% compared to 42% of white students, 36% black students, 39% Hispanic students, 58% Asian students, and 21% Pacific

Islanders (Status and Trends in the Education of Racial and Ethnic Groups, 2018). In 2018, The Condition of College & Career Readiness (2018) reported that only 6% of Native American students in Oklahoma took the ACT with an average composite score of 18.2, well below the national average of 20.8 and compared to 46% of white students taking the Act with an average composite score of 20.5. Native American students are among the top percentage of students who are lacking in proper college preparation with most requiring remedial courses upon entering college (Davenport, 2015). Of the Native American students entering college, only 9,700 (1% of all students nationally) completed a bachelor's degree through a four-year institution in 2015-2016 compared to 1.2 million white students (65% of all students nationally) (Status and Trends in the Education of Racial and Ethnic Groups, 2018; McCarty & Lee, 2014). Although efforts by numerous organizations have attempted to promote higher education for Native American students, they consistently remain underrepresented (McMahon et al., 2018). Native American students are inadequately represented in higher education (Powers et al., 2003; Ricci & Riggs, 2019). With high poverty rates in Native American communities, many Native American children do not have the financial means to attend college, are the first in their family to attend college, and many do not have the ability to overcome the discontinuity between home and school (Ricci & Riggs, 2019).

Overall, our educational system must make necessary revisions to close the academic achievement gap between our Native American students and all other ethnicities (The State of Education for Native Students, 2013; McCarty & Lee, 2014).

### Learning and Communication Styles of Native American Students

It is imperative that our educational system understand the learning, communication styles, and cultures of Native American students to effectively build relationships and adequately

educate them (Cajete, 1999; Morgan, 2009; McCardle & Berninger, 2015). Research studies have presented numerous learning characteristics exclusive to Native American students dating back to the 1960's advocating for more research to gain knowledge of Native Americans to improve their educational experience (Cajete, 1999; Morgan, 2009; Powers et al., 2003; Powers, 2005; and others). Research shows learning strategies differ considerably between Native American students and non-native teachers oftentimes resulting in misunderstandings detrimental for success in the classroom (McCarty & Lee, 2014; Powers, 2005; Morgan, 2010). Many teachers teach students around one core value requiring all students to conform to one learning style (Morgan, 2010) which can be troubling for Native American students who are forced to comply (assimilate) to the majority culture (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). According to Cajete (1999, pg. 2), the accepted approach to educating Native American children was to teach them according to white norms with little to no mention of their cultural heritage on the grounds that they "suffer from cultural deprivation." Native American children have been forced to learn the ways of the white man to help them assimilate into mainstream America (Cajete, 1999); however, with the increased revitalization of tribal culture and heritage, this trend is increasingly changing.

When teachers and Native American students are misaligned in their interactions, students have an increased risk of isolation resulting in a lack of motivation in their academics as well as placing strain on teacher/student relationships (Powers et al., 2003; Powers, 2005). These behaviors are interpreted as the student being disengaged, unmotivated, or lack of learning (McCarty & Lee, 2014). Teachers' effectiveness in the classroom is greatly impacted when learning styles differ (Morgan, 2009) and can lead to low academic achievement (Morgan, 2010). Cultural differences such as individual competition over collaboration/cooperation, vocal

versus quiet, and observation and listening versus outspokenness conflict with mainstream education with negative effects on Native American students leading to feelings of alienation (McMahon et al., 2018; Powers et al., 2003). Teachers who desire to improve education for Native American students must pay careful attention to their unique learning styles, common differences, and their perception of the world (Morgan, 2009; Garrett et al., 2003). Knowledge and understanding of cultural learning styles can avoid misunderstandings and prevent future misconceptions (Morgan, 2010) and can lead to exponential benefits for Native American students (Morgan, 2010). An educational system that includes, embraces, and values the differing culture of Native American students will transpire into an effective learning environment for the teacher and student (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Native American students' prior knowledge and worldview stems from strong traditional cultural values and experiences and should be respected (Morgan, 2009; Garrett et al., 2003).

To move towards a more culturally respectful and educational approach, behaviors, culture, and learning styles of Native American children must be considered when devising effective lesson plans (Cajete, 1999; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Garrett et al., 2003). Since there are over 500 different Native American tribes, the following descriptions are not direct reflections of all tribal cultures and behaviors and are not meant to overgeneralize; however, most are common enough to be recognized and respected by teachers and will contribute to a positive learning experience for the teacher and student (Cajete, 1999; Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Garrett et al., 2003). It is significant to mention that upon implementing differing learning strategies in the classrooms, educators must identify their specific population, the degree of acculturation, their environment, and their tribal cultures (*Vistas Multicultural Issues in Counseling*, Parrish et al.,

2012). These include noninterference, nonverbal orientation, patience, open work ethic, mutualism, observation, time orientation, practicality, caution, and spirituality (Cajete, 1999, pg. 7-10; Morgan, 2009; McMahon et al., 2018; Ricci & Riggs, 2019; Powers et al., 2003; Beucher et al., 2020).

**Noninterference**

It is very common for Native American people to stay to themselves. They will be concerned only with their personal affairs and do not entertain gossip (Cajete, 1999; Garrett et al., 2003). They believe that everyone is different and unique, and those characteristics will be respected. Native American belief is that all people should live in harmony. They also believe that all people are basically good and will respect the decisions they make. Because this is expected among all Native American's, it is oftentimes difficult to recognize problems or issues within other families. When advice or assistance is needed, they will ask (Garrett et al., 2003). This trait could potentially lead to problems and difficulties that will go unnoticed in the classroom.

**Nonverbal Orientation/Communication**

Historically, being quiet or silent was a value that was necessary to hide from enemies, for hunting, and/or for survival. In Native American families, it is not an uncommon trait for them to be silent and is often seen as a sign of respect. Although this trait served Native Americans in the past, it is often seen as disrespect in the classroom. Silence or nonverbal orientation is a common characteristic/value of Native American people; however, in the classroom, it has inhibited forming relationships between teachers and students. Non-native students conveyed a feeling of being uncomfortable around Native American students who are silent or nonverbal (Powers et al., 2003; *Vistas Multicultural Issues in Counseling*, Parrish et al.,

2012; Garrett et al., 2003). Nonverbal communication styles of Native American students have resulted in also being misidentified as lacking knowledge in the classroom (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Children in mainstream educational systems commonly ask questions, are outgoing or outspoken, and assertive; however, in traditional Native American culture, these behaviors are seen as disrespectful and inappropriate (Garrett et al., 2003).

When Native American children begin to feel uncomfortable or put on the spot, they will immediately shut down and will not speak until trust is regained. Native American people in general prefer listening to speaking and avoid speaking without purpose at all costs. Conversations, discussions, and small talk must have purpose outside of close family and friend relationships. Overall, Native Americans do not talk very much and prefer silence especially outside of their own ethnicity and/or close family.

Native American people value humility and harmony that is also characterized by their nonverbal communication style (Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). This characteristic can lead Native American students to purposely underachieve or not perform tasks to refrain from appearing superior to their peers and (Morgan, 2009; Morgan, 2010); consequently, this has resulted in being considered learning disabled and/or unmotivated (Morgan, 2010). Likewise, individual praise or outward attention for accomplishments is considered disrespectful and frowned upon in the Native American culture (Garrett et al., 2003). Superiority contradicts their cultural norm of cooperation, community, and generosity (Morgan, 2009). In fact, Native American students who are "singled out or put on the spot will drop his or head and eyes as a sign of respect for the teacher or elder" (Garrett et al.,

2003, p. 231). Teachers who are not aware of this characteristic might perceive this as rude, disrespectful, dishonest, or hiding something (Garrett et al., 2003).

In Native American culture, lack of eye contact is viewed as non-compliance, obedience, and respect and representative of nonverbal communication; however, some teachers interpret this as a sign of disrespect (Ricci & Riggs, 2019; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Eye contact is also seen as a form of aggressive behavior which contradicts their patient and generosity values (Powers et al., 2003). According to Garrett et al., (2003):

> The eyes are considered to be the pathway to the spirit; therefore, to consistently look someone in the eye is to show a level of arrogance or aggressiveness. It is good to glance at someone every once in a while, but listening, in the traditional way, is something that happens with the ears and the heart. (p. 232)

**Patience**

Patience was also valued historically. Patience in earlier times was necessary for survival, hunting, and everyday life. Native Americans are known to take long pauses before they will answer a question, respond in a group setting, or speak to other individuals. Native American culture deflects from impulsivity or immediate responses (Ricci & Riggs, 2019). For fear of being incorrect or underperforming, Native American students will consider all evidence and possibilities before they will answer questions in the classroom which oftentimes result in misperceptions of interest and motivation (Morgan, 2009). Native American students traditionally learn through "observations, listening, and patience" and are not expected to ask questions or "verbally analyze situations" (Garrett et al., 2003, p. 231). This is oftentimes interpreted as the student's inattentiveness, having a learning disability, passive, withdrawn, or lazy (Garrett et al., 2003). They want to feel confident in their responses for fear of failure or being wrong. They believe in the proverbial phrase, "good things come to those who wait". Patience is also deemed a sign of respect for others. Quick question and answering practices in

the classroom tend to overwhelm a Native American student and will cause them to shut down. They must be given adequate time to think through their answers or replies. Lesson strategies should avoid quick question and answering sessions and whole class discussions. It is for this reason that most Native American students prefer lecture style courses/classes and hands-on activities and demonstrations. Lesson strategies that include inquiry learning, hands-on activities, and experiments are effective for understanding of knowledge content.

**Open work ethic**

Native Americans believe that work needs to have a specific purpose before it is seen as necessary. Because they are generally nonmaterialistic, there must be a need that can only be acquired through work. In the classroom, busy work tends to be disengaging and uninteresting. There must be value and purpose to the schoolwork.

**Mutualism**

Because tribes lived together and depended on one another in the community environment, their relationships were an important aspect of their tribal lifestyle. Men from different tribes hunted together as well as all protected their villages. The women in the villages worked together cleaning, cooking, and tending to the children. In present day, Native American communities still practice mutualism. Native American students demonstrate a communal lifestyle; therefore, collaboration and cooperation skills are paramount in classrooms as opposed to most competition-based classrooms (Ricci & Riggs, 2019; Morgan, 2010; Garrett et al., 2003; McCardle & Berninger, 2015). The communal lifestyle in their home environment most likely contributes to their communal learning style in the classroom. Native American students are generally field-dependent, meaning they prefer to work in groups rather than alone; however, they may exhibit characteristics of field-independent at times (Morgan, 2009). Incorporating

cooperative learning activities can be accomplished through partnering with other students and group work (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Garrett et al., 2003). Incorporation of inner-group competition might be a reasonable alternative to individual competition when creating and implementing specific activities (*Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). This characteristic values guidance from teachers (relative to guidance from elders in their communities) and is recognized as an important aspect of teacher student relationship (Morgan, 2009). Diversifying the lesson strategies to incorporate collaborative activities and cooperative learning strategies will increase interest, motivation, and engagement among Native American children.

Because Native American culture values a communal lifestyle, possessions and property are not individualistic but are shared (Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Garrett et al., 2003), much respect is given to those who share (Morgan, 2010), and it is not uncommon for them to either share their possessions or simply give them away (Garrett et al., 2003). Wealth and excessive possessions are seen as untrustworthy and undesirable which contradicts mainstream American values (Morgan, 2009; Morgan, 2010). Native American's cultural belief is that everything is shared to maintain harmony and balance (Garrett et al., 2003). This proves difficult to maintain when engaged in competition-based activities in the classroom; therefore, cooperative learning activities (group activities) are preferred and welcomed (Garrett et al., 2003).

One common trait and highest virtue among Native American people is their sincere generosity for people, possessions, time, and service (McMahon et al., 2018). Generous acts have been shown to increase overall satisfaction, well-being, and happiness among Native American people (McMahon et al., 2018).

**Observation**

The traditional Native American heritage relied on storytelling as a means of transferring information. Conversation and storytelling are prime transmission methods of knowledge in Native American culture (Beucher et al., 2020). Native American traditional culture depended on observation and demonstration as a learning skill and is a reason they are visual learners (Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Native American students thrive in classrooms that provide ample opportunities to learn through visualization, visual aids, and oral communication (Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). It is for that reason that emphasis is placed on observing and listening skills as well as memorization since nothing was written down. These skills became highly developed throughout generations as it was a means of cultural survival. Lectures, demonstrations, case studies, and hands-on activities in a classroom setting are excellent lesson strategies that can be beneficial for Native American students.

**Time orientation**

A common phrase known in the Native American community is "running on Indian time" generally meaning that time is not structured or seen as imperative which often creates conflicts in and outside of the classroom (Garret et al., 2003, p. 229). "Things happen when they are ready to happen" (Cajete, 1999, p. 9) or "things begin when everyone has arrived and things are ready to begin; and things end when they are finished" (Garrett et al., 2003, p. 229). I have attended numerous church events and funerals and can attest to the start time and end time of these events. A word commonly used and emphasized to designate these parameters of time in my experience is "around". Traditionally, Native Americans do not consider long-term goals but rather live for now which conflicts with mainstream set schedules (Garrett et al., 2003).

Although school environments must have rules and guidelines, allowing flexibility (within limits) in the beginning will create a dialogue of time importance that will lead to learning appropriate time schedules.

**Practicality**

Native American people are very practical minded. Educational disciplines, content, topics, and lesson strategies that are concrete and experimental are favored over abstract and theoretical approaches.

**Spirituality**

Native American traditions and cultures revolve around religion. Spirituality is taken into consideration in every aspect of Native American lifestyle; therefore, education must be considerate of all tribal religions.

**Caution**

Native Americans are commonly portrayed as stoic, meaning emotionless, non-smiling, and quiet. This is a means of indicating a sense of caution towards unfamiliar issues, situations, and knowledge. When Native American students fear a negative perception of their thoughts, opinions, or answers, they have the tendency to shut down or refrain from speaking. By exhibiting acceptance, creating a classroom community, and allowing trust to form between teacher/student and student/student will alleviate these fears of caution and result in effective learning in the school environment.

## Summary of Learning and Communication Styles of Native American Students

American education strongly emphasizes a scientific rationalistic viewpoint which is based on reasoning or logic for understanding and knowledge. This viewpoint dismisses experience, religion, and emotions which is paramount in other cultures, such as the Native

American culture (Cajete, 1999). Because of the discrepancy and imbalance of homelife and school environment, Native American students have difficulty becoming successful in the classroom and, consequently, the home environment becomes the target of the dilemma (Cajete, 1999). Because religion, traditions, and social context is where Native American students frame of reference is determined, this becomes a challenge faced in public school settings. Native American children value culture, traditions, family, elders, and historical connotations; however, they are continually faced with challenges due to historical trauma, characteristics, and stereotypical identification (American Psychiatric Association Office of Minority and National Affairs, *Mental Health Disparities: American Indians and Alaska Natives*, 2010). There is a huge disconnect between what Native American children bring to the classroom and what is supported in the classroom (Price et al., 2010). Price, Kallam, and Love (2010) also noticed that "Native American children learn the activity by observing others, practicing in private, and then performing publicly when confident it can be done well" (p. 38). All people regardless of race, want to feel like they belong, and Native American students are no exception (McMahon et al., 2018; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012). Having a sense of belonging provides a safe environment to build relationships, develop and thrive in a learning environment, and contributes to success in attaining higher education (McMahon et al., 2018).

## Importance of Incorporating Culturally Responsive Teaching

### Cultural Border Crossing

The current American educational system reflects standards and curriculum that are based on white middle class economic status which diminishes the dynamism of the multicultural population (Nelson-Barber & Johnson, 2019). In fact, research has shown that educational interventions tend to hinder academic achievement; therefore, affirming that best

practices may not actually be for the best (Nelson-Barber & Johnson, 2019). Native American people have had to adapt to the American educational system for generations. It is paramount that educational leaders prioritize accessible and attainable learning strategies and resources for all ethnicities beyond the white class norms (Nelson-Barber & Johnson, 2019). Students oftentimes feel alienated in science classrooms because of the increasing disconnect from their traditional culture and American education (Aikenhead, 1996; Jegede, 1997). Nelson-Barber and Johnson (2019) takes the position that specific lesson strategies, practices, and curriculum need to be investigated for efficiency and efficacy within communities such as Native Americans. Because of the increasing differences between Native American students' home lives, the public-school science classroom curriculum, and the administrative idea that education must be universal to all results in a strong disadvantage for Native American children (Aikenhead & Jegede, 1999). This disconnect incites a necessity for educators to create and implement culturally responsive teaching materials and methods that would alleviate and reduce feelings of alienation (Aikenhead & Jegede, 1999). "Cultural discontinuity theory is based on the axiom that behavioral, communication, instructional, and curricular expectations of the school contradict or undermine those of Native youth's families and communities" (Powers et al., 2003, p. 24; Garrett et al., 2003). Native American students have consistently expressed difficulties in maintaining cultural identity while attending mainstream classrooms indicative of the dominant culture (McMahon et al., 2018; Lopez et al., 2013; Ricci & Riggs, 2019; Garrett et al., 2003). Evidence has shown that Native American students' culture and values tend to be undervalued and underrepresented in the classroom (McMahon et al., 2018). Lack of continuity has been shown to affect academic achievement leading to alienation and strained teacher student relationships (Powers et al., 2003; Powers, 2005; Morgan, 2009). In fact, Native American students who

navigate two opposing environments (school and home life) experience a disadvantage in their educational success leading to more destructive behaviors (Powers et al., 2003; Huaman, 2020). They often encounter instructional strategies, values, and curriculum that are unfamiliar (Powers, 2005; Morgan, 2009; Morgan, 2010; Garrett et al., 2003). Choosing between the two worlds, they will often do whatever is necessary to maintain a level of success in the classroom without truly accepting the knowledge as truth (Ricci & Riggs, 2019). However, incorporating culture into the curriculum can integrate traditional Native American culture and Western science and advance scientific understanding (McMahon et al., 2018). This allows Native American students to merge the two worlds together recognizing the strengths and benefits of their traditions and Western science (McMahon et al., 2018; Ricci & Riggs, 2019). Culturally based curriculum can also build self-esteem and confidence easing the demands of navigating home and school (Powers et al., 2003; McCardle & Berninger, 2015). Research has also reported that encouragement and teacher attentiveness will help Native American students navigate these cultural boundaries (Powers et al., 2003).

Mainstream education is defined by the dominant culture often dismissing Native American culture, characterizing them as non-normative, ignorant, or lacking knowledge (Huaman, 2020; Ricci & Riggs, 2019). It is within this context that Native American students are supposed to be successful and thrive (Huaman, 2020). When Native American students are associated with the negative stereotype's indicative of Native American culture as opposed to the dominate culture, this creates a conflict between their cultural identity and what is expected in the classroom; however, culture that is honored and celebrated will exhibit confidence and success (Lopez et al., 2013).

According to a 2014 report issued by the White house (Rafa, 2016), the discrepancy occurs between Native American children and their white peers because of a lack of tribal influence, lack of effective teachers and administrators, and lack of Native American language, history, and culture present in the classroom environment. In a study by Nelson-Barber and Johnson (2019), the goal of a middle school-level teacher was to identify activities exclusive to their normal home life and apply a scientific aspect to it. The activities ranged from sheep herding to weather prediction as well as incorporating their native rituals and cultural responsibilities. The teacher enhanced these activities by implementing field experiences to the curriculum by visiting cultural sites within the community. By relating science curriculum to their customs and culture created a deeper level of academic achievement and success. In another classroom reported by Nelson-Barber and Johnson (2019), the teacher engaged her students in activities that made use of small group collaboration and discussions. These activities were followed up by whole class discussion using strategies most effective with diverse communities such as visual aids, inquiry-driven lessons, and visual cues. Students were encouraged and allowed to speak in their native tribal languages. This study was crucial in attempting to identify areas of improvement for educational success in Native American students. This study argues the necessity of maintaining and sustaining cultural heritages and traditions despite current and past governmental entities of forced cultural dissolution earmarked by generations of educational trauma that was evoked.

Researchers involved in a study in New Zealand identified practices that would contribute to bridging home and school life by talking directly to students (Boon & Lewthwaite, 2016). By promoting and incorporating cultural curriculum, teachers can reduce discontinuity and increase academic achievement (Boon & Lewthwaite, 2016).

Native American tribes and sovereign groups are going through a time of revitalization and regeneration led by culturally responsive teaching which is resulting in academic success, confidence, and emotional stability (Nelson-Barber & Johnson, 2019). With the varying degrees of traditions in the home environment, difficulty lies in identifying students who hold strong cultural beliefs (Cajete, 1999). These strong culturally traditional Native American students will experience negative ramifications when the science curriculum doesn't align with their cultural beliefs and aren't seen as applicable to their way of life (Cajete, 1999). Associating tribal customs, interconnecting science curriculum and tribal heritage, and incorporating cultural aspects into the school environment can not only motivate students academically, but can lead to a positive perspective towards science and bridge disparities between their home life and American worldviews (Cajete, 1999). Although Native American students encounter skills and experiences that are not present in their home, they gain knowledge and awareness from a variety of cultures outside of their own (Cajete, 1999). Aikenhead (1999) identified this phenomenon as "cultural border crossings." He explains that this transition results from a "cross-cultural" experience encountered from Native American children's home life and the American science classroom. He explains that Native American children are expected to accept and learn scientific concepts even when they differ from their traditions, beliefs, and lifestyle. These cultural differences create a considerable threat for Native American students as they attempt to avoid learning science classroom curriculum that may endanger or risk interfering with what they know and have learned through their home experiences (Aikenhead, 1999). Aikenhead further explains that the problem for Native American children stems from the fact that when they enter the science classroom, they may encounter an entirely different viewpoint or aspect of science that is foreign to what they are used to. If the classroom environment closely aligns with their

lifestyle, or there are areas of recognition, Native American children will experience enculturation therefore leading to an environment of positive learning; however, when there is misalignment between their lifeworld and the science classroom, Native American children will feel a sense of threat of the science classroom forcing abandonment of their lifestyle and forcing assimilation. Assimilation or abandonment of culture can lead Native American students to create techniques and skills that will allow them to be successful in science classes without learning the content. Lee (1997) argues that when Native American children are forced to choose between what they know (their lifestyle) and what the American science classroom is teaching or forced to forget about their traditional cultures and values, the student will ultimately choose the former and resist learning.

**Culturally Responsive Teaching**

Culturally responsive teaching has been long valued in the educational system and has been promoted by tribal leaders since the 1928 Meriam Report (Lopez et al., 2013). This report specified the dire need for Native American educators to incorporate culturally relevant curriculum to provide Native youth (and adults) an equitable and successful educational experience in the classroom and beyond (Lopez et al., 2013). Native American peoples' identity is established and sustained through their cultural activities. For that reason, culturally responsive teaching is critical for effective teaching (Price et al., 2010; Powers et al., 2003); however, it is crucial to acknowledge respect for the culture and traditional practices incorporated into the curriculum (McCardle & Berninger, 2015). Culturally responsive teaching assures an education for all students without compromising the traditional values or having to change their lifestyle (Gilbert et al., 2011) and provides an education that is relevant to their family life, community, and culture (McCarty & Lee, 2014; Lopez et al., 2013; Beucher et al.,

2020). Culturally responsive teaching is a productive tool to help alleviate inequities in educational attainment (Ricci & Riggs, 2019; Powers et al., 2003). Culturally appropriate curriculum can increase motivation in students as they observe an overlap in school and home creating a sense of belonging (Ricci & Riggs, 2019). According to the National Association of Secondary School Principals, *Culturally Responsive Schools* (July, 2019) and Ricci & Riggs (2019), they argue the necessity for school environments and classrooms to be culturally responsive to not only make learning more effective, enjoyable, and engaging for Native American children, but to create a connection between their home and school environment. It is possible and critical for teachers and students to discover shared cultural beliefs to improve learning and instructional strategies (Milner, 2009). According to Lee (1997), many science teachers' language and customary classroom environments differ so greatly that it creates a large disconnect for Native American students. Native American students should have equitable educational opportunities that foster their cultural heritage and meets the needs of their tribal community (National Congress of American Indians, *Education, Health, & Human Services,* Education), to secure tribal sovereignty, and sustain and preserve their cultural identities (McCarty & Lee, 2014). Because Native American children suffer the worst educational outcomes, culturally responsive teaching is crucial (Schwartz, 2016). Byrd (2016) reiterates this sentiment stating that applying teaching strategies that link to real world situations, issues, and interests directly align with academic success. By incorporating cultural interest and heritage into the curriculum, Native American students have a connection to the school environment and is seen as an asset to their educational aspirations and achievement goals (Gay, 2000). Furthermore, culturally responsive teaching builds on and relies on these strengths for academic achievement (Gay, 2000). Culturally responsive teachers control classroom environments and

are responsible for cultural awareness among their peers (Byrd, 2016). Byrd also states that understanding of student's own culture, racism, and discrimination will foster their own ethnic identity development.

The Oklahoma State Department of Education created an online resource for teachers in 2014, Oklahoma Indian Education Resource, that incorporated the culture of Oklahoma's Native American tribes into various lesson plans to fulfill Oklahoma Academic Standards (Davenport, 2015). Teachers can download lesson plans that would correlate their specific subject with the cultural traditions and diverse learning strategies of their Native American students. Native American students in Oklahoma have consistently scored higher on national assessments than other states and in 2013, scored higher "on the National Assessment of Education Progress (NAEP) than Native American students nationally in all subject and grades tested that year" (Davenport, 2015, para. 3). The National Association of Secondary School Principals (NASSP, 2019) recommends the urgency for education to prepare administration and faculty to learn, understand, and know the cultures of their classroom environment, differentiate lesson strategies, know cultural behaviors and traditions, and embrace classroom diversity.

Culturally responsive teaching can be found in many forms of strategies that include storytelling, talking circles, field experiences, and collaboration and in disciplines such as science, technology, math, history, and more (McCardle & Berninger, 2015). Including elders and tribal members in lesson activities can enhance curriculum and provide the historical component sometimes absent from mainstream education (Ricci & Riggs, 2019). Native American guest speakers, Native American elders, and members of the tribal community can have a profound impact on the authenticity of relaying information and stories relevant to the curriculum (Beucher et al., 2020; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012).

De la Luz Leake (2020) discusses that her level of cultural knowledge was limited until she visited a museum art exhibition where she gained insightful understanding of cultural history firsthand. She learned the importance of the buffalo as a food source and for clothing. She also learned that many Native American tribes were forced to move to lands owned by the government because of the buffalo population. Field experiences help bridge the historical and contemporary knowledge by presenting information about Native American existence and identification (de la Luz Leake, 2020). Many cultural contexts observed in museums can help foster Native American understanding and help connect the context to contemporary curriculum (de la Luz Leake, 2020).

Research has shown that Native American teachers positively impact academic success for Native American students because of the shared cultural knowledge and experience that they are able to integrate into their curriculum (Lopez et al., 2013). Most Native American students are taught by non-native teachers where cultural awareness is often absent in the science curriculum (Price et al., 2010). Price, Kallam, and Love (2010) argue that many teachers are not able to differentiate learning strategies as well as implement culturally responsive teaching into the curriculum that is necessary for diverse student populations. They also believe that miscommunication and challenges faced by teachers and students can be reduced when teachers are knowledgeable about their students' cultures, traditions, and community lifestyles. Research shows that when classroom teachers can connect the curriculum with culture, Native American students will be motivated academically resulting in higher achievement outcomes (Lopez et al., 2013); however, teachers must be willing to commit to incorporating culturally responsive teaching (de la Luz Leake, 2020). Teachers must gain their trust, establish appropriate cultural curriculum, collaborate with the community, and be positive role models (Lopez et al., 2013).

Academic success has also been related to high expectations from teachers, positive relationships between student and teacher, and differentiated instruction (Lopez et al., 2013). Research has recommended against generalizing characteristics of Native American's learning styles; however, studies have shown that collaboration, cooperative strategies, and culturally responsive teaching are all effective teaching tools (Lopez et al., 2013).

Concerns have been discussed regarding the level of cultural knowledge teachers possess and if they were adequately trained in multicultural education (Lopez et al., 2013). There is also a need to clarify and define culturally responsive teaching competence for teachers (McCardle & Berninger, 2015; Lopez et al., 2013).

The Australian government was also instrumental in ensuring appropriate and proper training in cultural knowledge for teachers (Boon & Lewthwaite, 2016). It is imperative that administrators provide multicultural professional development opportunities for teachers to benefit Native American students as well as all ethnic groups (Boon & Lewthwaite, 2016).

Research in the Onondaga Nation in New York (Schwartz, 2016) found teachers incorporating relevant lessons into their curriculum by discussing pollution in biology class. In 2016, workshops led by the Texas State Institute at San Marcos were held at the National Aeronautics and Space Administration (NASA) Ames Research Center in California. Pre-service K-8 teachers from California, Hawaii, Montana, and Nevada attended the workshops that focused on culturally responsive teaching, specifically, Native American students in science classrooms (Marlaire, 2016). The workshops were responsible for teaching pre-service elementary students the importance of cultural consideration, appreciation, and recognition of their future students. Storytelling was introduced as an example of culturally responsive teaching to help explain a concept or relate a concept. A state funded public charter school in

Albuquerque, New Mexico successfully implemented culturally sustaining pedagogy into their curriculum along with teaching to the state standards reporting increases in many academic scores (McCarty & Lee, 2014). Research has shown that Native American students actively engaged in hands-on culturally relevant activities had higher achievement scores than students in traditional classrooms (Ricci & Riggs, 2019). However, in a chemistry classroom, teachers will need additional support to meet the challenges and difficulties associated with language discrepancies, literacy, technology, and science techniques and skills (Rushton et al., 2016).

Ricci and Riggs (2019) report that wild rice was taught in Earth and environmental science curriculum as a connection to their tribal lands and communities. They also describe a summer program in California for Native American students that focused on Earth science that introduced the importance of managing natural resources and connections to their tribal services. Lessons included climate change, natural resources, plant use, and history with lesson strategies that included field experiences. This program instilled a love for science, an avenue for higher education, and promoted confidence and self-worth. Ricci and Riggs (2019) also describe a summer camp held on a reservation. Students participated in lessons associated with "water quality, botany, air quality, and waste management" (p. 493) and was led by tribal members who made connections with tribal needs. Issues such as water settlements, contamination, and stream management were addressed. Tribal members shared their roles in the environmental protection division of their tribal governments, significance of their jobs, and served as an inspiration for students. These programs and more have proven to be successful, and students reported a positive experience (Powers et al., 2003).

The need for clean water has been an ongoing issue for reservations as well as global environmental issues (McMahon et al., 2018). Unfortunately, there is a lack of knowledge

regarding environmental health and safety in the tribal communities (LaVeaux et al., 2018). Studies conducted in the Apsaalooke Nation reservation (2007) showed high levels of *Escherichia coli* in the water systems resulting in unsafe swimming conditions and drinking water (LaVeaux et al., 2018). Studies more recently conducted on well water in homes revealed contamination of uranium, manganese, nitrates, and other microbial contaminants subsequently making the water unsafe to drink (LaVeaux et al., 2018). Because of concerns like this, tribal researchers partnered with a Native researcher to form summer camps for Native American youth that would incorporate culturally based pedagogy into science curriculum directed towards water quality (LaVeaux et al., 2018). The camp focused on collaboration with tribal elders, tribal community, and local professionals to share information and knowledge (LaVeaux et al., 2018). They also implemented science curriculum developed by Project Water Education for Teacher (WET) which provided excellent lessons for students and provided workshops for educators (LaVeaux et al., 2018). Incorporating water quality testing (surface and groundwater) into science curriculum related to cultural environmental issues would educate Native American youth, provide real life connections to their home and school life, promote an interest in environmental issues, and potentially spark an interest as a career in their tribal community (LaVeaux et al., 2018).

The cultural and historical relationship of science knowledge is often absent from traditional science curriculum (Kimmerer, 2000). Kimmerer (2000) discusses an extract from a plant commonly used in Native American medicine and land management as examples of effective cultural lessons that might not have the same impact without the cultural context. His discussions include the science as well as the Native American cultural meanings associated with the traditions practiced and the importance of maintaining and preserving the knowledge. For

example, Kimmerer (2000) discusses composition of species in the ecosystem that only Native American people will know. Because the Native language is becoming less known and much of what is known is orally transmitted through generations, the information is in danger of being lost. Native American traditions recognize the importance of the relationship between the land and human beings; therefore, integrating this piece of culture could potentially raise awareness of the necessity for preserving, restoring, and management of natural resources as well as the Native American historical component to other ethnicity groups (Kimmerer, 2000; Huaman, 2020). Classroom connections to cultural knowledge can also lead to a revival or renewed interest in Native American practices, culture, and languages (Huaman, 2020).

Hodson (1993, p.16) and McCardle and Berninger (2015, p. 203) suggested that as educators, we are tasked with teaching all children science knowledge and skills without discrediting or dishonoring their personal cultural traditions and beliefs. Aikenhead (1999) reiterates this by stating that if Native American children are to effectively learn science, they must do so in relation to their lifestyle and without interference with their previous conceptions. Educational systems must include traditional cultural curriculum, strategies that align with traditional culture and contemporary knowledge, tribal community participation, and community collaboration (Lopez et al., 2013). Culturally responsive teaching utilizes many strategies such as cultural knowledge, experiences, and learning and communication styles to provide Native American students a more productive and effective classroom experience (Boon & Lewthwaite, 2016). A culture rich classroom "should reflect, validate, and promote their culture and language" (Boon & Lewthwaite, 2016, p. 457) and must begin with language and culture that promotes and supports cultural traditions, knowledge, and language (Lopez et al., 2013). To provide effective education for Native American students, culturally responsive teaching must be

incorporated into the curriculum and cultural identity must be preserved (Lopez et al., 2013). Culturally responsive teaching has the potential to reduce discontinuity Native American parents face promoting and providing an increase in parental involvement and alleviating feelings of alienation (Powers et al., 2003).

## Gaps in Literature

The research identified the ongoing concern regarding achievement gaps and low performance scores for Native American students, however; the literature did not provide actual lessons that pre-service science teacher candidates or in-service science teachers could access. The literature suggests numerous recommendations merging effectively teaching Native American students in accordance with their cultural characteristics but not with specific science topics and concepts required in state mandated objectives and standards. The literature suggests recommendations to increase cultural awareness but doesn't mention resources on how this could be attainable and maintained. The literature addressed the lack of culturally responsive teaching knowledge of teachers, but the research was absent of conditions surrounding this knowledge (Lopez et al., 2013). Information such as workshops attended, multicultural education received, professional development attended, and the degree to which this information was learned and retained would be beneficial for further understanding what resources teachers could benefit from for future training. The literature suggests that culturally responsive teaching is imperative for academic achievement of Native American students; however, research is limited regarding if the teachers possess the skills and resources necessary to implement in the classroom (Lopez et al., 2013). The literature emphasizes numerous conditions that impact academic achievement for Native American students, but little has been investigated correlating achievement with economic status or single parenting (Powers et al., 2003). Quantitative research on the

effectiveness of culturally responsive teaching for Native American students is also very limited. Qualitative research can provide needed research to advocate for equitable education for Native American students; however, "it lacks an explicit link between culturally responsive schooling and student outcomes" (Lopez et al., 2013, p. 518).

## Summary

Forced assimilation of earlier Native American generations is still impacting Native American children today (Nelson-Barber & Johnson, 2019). Colonization and the establishment of boarding schools have resulted in low academic achievement, high graduation and college dropout rates, and few Native American students furthering their education (Ricci & Riggs, 2019). Although great strides have been made in tribal governments, tribal school control, and tribal leadership, Native American students are still experiencing inequities in student educational achievements (The State of Education for Native Students, 2013; Ricci & Riggs, 2019). Native American students have been and continue to be underserved in the educational system (Powers et al., 2003; Ricci & Riggs, 2019). With over 600,000 Native American students enrolled in public schools and Bureau of Indian Education schools nationwide, Native American students consistently score below the national average as well as all other ethnicities in critical content areas of math, science, and reading (The State of Education for Native Students, 2013; Powers, 2005; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Boon & Lewthwaite, 2016). Because education is fundamental in preparing Native American children to become productive members of American society as well as their tribal communities, significant improvements are necessary to close the wide achievement gaps experienced (National Congress of American Indians, *Education*, 2019; McCardle & Berninger, 2015). At least 90% of the Native American student population is enrolled in public schools with the majority attending a

school where less than 25 percent are Native American (Rafa, 2016; McMahon et al., 2018). Further, most Native American children are being taught by non-native teachers who oftentimes find it difficult and challenging to effectively relate to their Native American students' traditions, beliefs, and cultural lifestyle (Price et al., 2010). Only 1% of Native American students who enroll in college will complete a bachelor's degree at a four-year institution compared to 65% of white students (Status and Trends in the Education of Racial and Ethnic Groups, 2018; McCarty & Lee, 2014). The current educational system reflects standards that are based on white middle class norms which can be detrimental to the strength and livelihood of a diverse student population (Nelson-Barber & Johnson, 2019; McMahon et al., 2018). The educational statistics described in this literature established a dire need for learning to become more culturally aware and relevant for ethnicities other than the common white middle class norms (National Association of Secondary School Principals, 2019; McCardle & Berninger, 2015). Academic achievement and success can be accomplished by incorporating culturally responsive teaching into science curriculum (Clarren, 2017; Powers et al., 2003; Price et al., 2010) as evidenced by numerous studies and research (Cajete, 1999; Nelson-Barber & Johnson, 2019; Schwartz, 2016). Native American students also face challenges blending their homelife with their school environment (Davenport, 2015) and often experience a significant disconnect between what is brought to the classroom and what is supported in the classroom (Price et al., 2010). To alleviate discrepancies in these situations, educational paradigms must move towards a more culturally respectful environment by teaching cultural awareness as well as implementing educational strategies beneficial to all ethnicities (Cajete, 1999; Lopez et al., 2013). Embedded into this approach includes learning and communication styles indicative of a Native American student and includes such recognition as noninterference, nonverbal orientation, patience, open work

ethic, mutualism, observation, time orientation, practicality, caution, and spirituality (Cajete, 1999; Garrett et al., 2003; Ricci & Riggs, 2019; Morgan, 2010; McCardle & Berninger, 2015; and others). Culturally responsive teaching is vital in affording Native American children the ability to receive an education that has the potential to not only merge their two worlds but to learn scientific knowledge outside of their own preconceived wisdom (Price et al., 2010; Gilbert et al., 2011). Relating science curriculum to their culture creates a deeper level of academic achievement and success (Nelson-Barber & Johnson, 2019). The phenomenon, cultural border crossing, is a result of transitioning from one world to another as in the case of many diverse student populations (Aikenhead, 1999). Cultural border crossing is attainable and has proven successful both from the teacher aspect as well as the student accomplishments (Aikenhead, 1999). Aikenhead's (1999) position states that cultural border crossing can be achieved albeit a complex event evidenced by scientists and students who have successfully accomplished this feat. Henderson (1996, p.23) agrees:

> A multiple-world outlook does not necessarily discourage students from learning science. A First Nations educator argued: "It's okay to be educated in two worlds in two ways…People think differently, that's okay—differences don't have to get in the way of bringing things together."

## Chapter 3: Methodology

### Introduction

The purpose of this qualitative study was to identify culturally responsive teaching in Native American populated science classrooms in Oklahoma. Five schools in Oklahoma participated in this study, specifically, three from a high density Native American student population school (majority of 50% or more Native American student population), and two from a Bureau of Indian Education school (BIE, 100% Native American student population, funded and operated by the tribe or tribal government via a contract or grant). Oklahoma was chosen for the focus of this research because of the proximity to Arkansas, proficiency and advanced level scores reported, and a large number of Native American student populated schools. Because of the time obligation associated with extensive classroom observations, teacher interviews, and teacher surveys as well as Covid-19 restrictions, the research was limited to five Oklahoma schools. Ten administrators/schools and tribal council persons were emailed and asked to participate in the study that included six schools that identified as high density Native American student population and four schools that identified as Bureau of Indian Education Schools (Appendix D). Of these ten schools, three schools from a high density Native American student population school and two schools from a Bureau of Indian Education school agreed to participate. Administrators sent me names and email addresses of all science teachers in their school. From this list, seven teachers from the high density Native American schools and six teachers from Bureau of Indian Education schools agreed to participate. While observing and interviewing at one of the public schools, I was introduced to the Native American Studies teacher. Realizing the importance of her classroom and cross curriculum connections to science topics, I decided to include her in this study. The original 13 science teachers were emailed a

google form/survey to complete prior to their interview and the Native American Studies teacher was sent the google form/survey to complete prior to her interview (Appendix A). This information provided basic information that allowed me to concentrate on more in-depth questions during the interview process and field observation. The interview process occurred in person in the teacher's natural setting—in their classroom (Appendix B). This decision was made so that I could observe the cultural identity of the school and the student's classroom. A qualitative method was chosen for this research, specifically a combination of case studies and grounded theory, because data obtained from teacher surveys, observations, and teacher interviews was analyzed to explore and identify effective culturally responsive teaching in Native American student populated schools. Data collected are useful to enhance teacher education and to provide exceptional professional development to in-service teachers to improve or enhance the education of the Native American student.

## Research Questions

The central research questions guiding this study focused on the level of culturally responsive training and teaching knowledge and implementation of the science educator, cultural attitudes and beliefs of Native Americans, and implementation of culturally responsive teaching in the classroom. A survey was emailed to fourteen teachers in Oklahoma that provided me with background information of selected participants for the study. The research questions are as follows:

1. What science topics do teachers of Native American students report teaching in culturally responsive ways?
2. What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?

3. What common themes do teachers identify related to teaching in a Native American student populated science classroom?

Surveys, classroom observations, school observations, and interviews were conducted throughout the study to determine what science topics teachers have identified as relevant to construct an appropriate lesson plan indicative of culturally responsive teaching. Teachers were asked in the survey and interview what their degree of culturally responsive teaching knowledge consist of and what topics they perceived to lend themselves to culturally responsive teaching in the classroom. I made careful field observations of the classroom and school environment recognizing culture and tribal affiliation representation.

## Nature of the Study

A qualitative method approach was used in this study to analyze the data collected from observing participants in their natural setting and interviewing them regarding culturally responsive teaching. Surveying teachers in the selected schools allowed an appropriate overview of cultural beliefs, attitudes, percentage of Native American students as well as application of culturally responsive teaching in science lessons. The intention of the survey was for me to gain as much information about the teacher before the interview so that I could adequately prepare specific questions unique to each teacher during the interview stage. I observed the classroom environment as well as the school environment with the interview to follow. Interviewing the teachers in the classroom allowed me the ability to collect necessary data to discern the level of cultural engagement, participation, and applications of culturally responsive teaching. Interviewing the participants in their natural setting allowed face-to-face interaction so that the participants were able to give a personal account relating to the survey and the observations. An

observation of the school and classroom environment allowed me to experience the nature of the tribal culture and heritage represented.

The qualitative method used was a combination of case studies and grounded theory. "Grounded theory involves developing a theory that is grounded in data collected and analyzed" (Corbin & Strauss, 1997, p. 273) throughout the study. A general, abstract theory of culturally responsive teaching in high school science classrooms was derived directly from teachers in the field. Numerous sources of data collection were employed such as observations, surveys, and interviews for validity. This research utilized Kathy Charmaz's process stages in grounded theory as a guide for collecting and analyzing data (Charmaz, 2006, p. 11) and coded according to Table 3.

***Table 3: Coding, Common Themes Across All Schools***

| Category | Sub-Category |
|---|---|
| Science Topics | Environmental Science |
| | Physics/Engineering Materials and Design |
| | Forensic Science |
| | Biology |
| | Ecology |
| | Ecosystems |
| | Botany |
| | Genetics |
| | Computer Science |
| | Chemistry |
| Strategies | Projects that engage Native American students |
| | Guest Speakers (Native American, non-Native American) |
| | Collaboration with the community |
| Factors that Influence Science Teaching | Native American ethnicity/Identification |
| | Success/Achievements |
| | Challenges: Classroom |
| | Challenges: Family |
| | Teacher motivation/Encouragement |
| | Personalities/Traits of Native American students |
| Teacher Training | Preparation |
| | Continuing Education |

Line-by-line coding and axial coding was utilized to transcribe and code data.

Through grounded theory, I was able to observe the classroom environment from the participants viewpoint. According to Charmaz, it would be impossible to envision their viewpoint exactly, but with being in their natural setting, we can get as close to the situation as possible. By

interviewing the participant in their classroom, I was able to obtain viewpoints and impressions otherwise not attainable. A benefit of case study is that it provides "an empirical inquiry that investigates a contemporary phenomenon within its real-life context" (Ebneyamini et al., 2018, pg. 1). The advantage of a case study made it possible for me to observe numerous aspects of the intended data collection as a whole system rather than limiting the research (Ebneyamini et al., 2018). This allowed me to observe and examine different aspects of the classroom environment (tribal cultures and identity), analyze the interview, and examine the data. Relying on multiple areas of evidence—surveys, observations, and interviews proved that a case study was an invaluable resource for the researcher (Yin, 1985).

## Subjects

Participants for this study were selected through homogenous sampling. In homogenous sampling, teachers and schools are chosen because they have a large Native American population and consist of the same teaching fields, specifically science. Although not a science class, the Native American Studies class was chosen due to its cross-curriculum advantages. Homogenous sampling was chosen for this research study because of the ethnicity of the population and the educational curriculum (Crossman, 2018). This research is specific to science pedagogy and Native American ethnicity in Oklahoma schools. For a more comprehensive study and analysis, a sample size of thirteen science teachers and one Native American Studies teacher were chosen to participate in the research study.

## Sample Selection and Recruitment

The research was limited to Oklahoma schools to allow me a firsthand experience with the participants, face-to-face interviews, and observations of science curriculum and school and

classroom environment as well as the large numbers of Native American students enrolled (Creswell & Creswell, 2018, p. 188). Administrators were contacted from the initial pool of ten schools in Oklahoma requesting permission to conduct research in their school. An initial summary and intent of the study was outlined in the email which also included details of the timeline and methods for research. From this list of ten schools, fourteen teachers from five schools committed to participate in the study. Upon confirmation of the participants, the International Review Board (IRB) consent form was sent to the administrators for final approval to participate as well as to each teacher requiring signatures (Appendix C). IRB consent forms were printed and are kept in a confidential file located in my office. Each teacher was emailed a brief survey via Google forms to complete that provides specific information that guided me into the interview. This information included number of Native American students and culturally responsive teaching, knowledge, and application in the classroom (Appendix A). Three teachers were selected from elementary level science classes and three teachers were selected from secondary level science classes who teach in a Bureau of Indian Education school. Eight teachers were selected from secondary level science classes and a Native American Studies class who teach a substantial number of Native American students in Oklahoma public schools.

## Sample Size

Ten schools in Oklahoma were identified and asked to be a participate in the research study based on the high density Native American student population (six schools) and Bureau of Indian Education school (four schools). Of these ten schools, three high density Native American student population schools that participated included Walnut High School, Dogwood High School, and Cypress High School. These schools are in the Cherokee National tribal jurisdiction. Teachers that agreed to be a participate in this research study from Walnut High

School were Mrs. Jones, Biology, Ms. Smith, Native American Studies, Mr. Roth, Chemistry, and Mrs. West, former Biology, and current Johnson O'Malley program director. Walnut High School has a minority enrollment of 46% (Public School Review, 2021); however, selected teachers interviewed had class Native American student populations of 60% or more. Teachers who agreed to be a participate in this research study from Dogwood High School were Ms. Porter, Chemistry, Mr. Baker, Computer Science, and Mr. Williams, Computer Science. Dogwood High School has a minority enrollment of 82% (Public School Review, 2021) with the Native American student population consisting of 71%. Mr. Brown, Cypress High School, Chemistry, participated in this research study. Cypress High School has a minority enrollment of 60% (Public School Review, 2021) with the Native American student population consisting of 53%. Two BIE schools who participated in the study included Cedar Academy and Pine Tree High School. Cedar Academy is in the Choctaw Nation tribal jurisdiction and Pine Tree High school is in the Cherokee Nation tribal jurisdiction. Teachers that participated in this research study from Cedar Academy included Ms. Davis, Elementary Science, Ms. Johnson, Elementary Science, and Ms. Miller, Elementary Science. Cedar Academy is a Bureau of Indian Education school; therefore, the Native American student population is 100%. Students must have identifiable credentials, such as a Bureau of Indian Affairs card/enrollment, to be admitted into the school. Teachers who participated in the study from Pine Tree High School include Mr. Wilson, Physical Science, Ms. Anderson, Biology and Chemistry, and Mrs. Edwards, Biology and Botany. Pine Tree High School is a Bureau of Indian Education school; therefore, the Native American student population is 100%. Students must have identifiable credentials, such as a Bureau of Indian Affairs card/enrollment, to be admitted into the school. Initial surveys (Appendix A) were created using Google forms and emailed to science teachers in the selected

Oklahoma schools. From the initial list, a smaller sample size of fourteen teachers from five schools were selected to participate in a more in-depth study and analysis. A smaller sample size was necessary to be able to interview and observe classrooms throughout the study for each participant. Participating schools were selected on the percentage of Native American students in the classroom and culturally responsive teaching and application in the classroom. A larger sample size would prove too difficult for travel, observations, and analyzing data efficiently needed for optimal detailed data collection. Time and travel constraints greatly hindered research opportunities and due to the Covid-19 pandemic, schools were reluctant to allow extra people into their classrooms. Teachers also expressed the extra workload already asked of them as reasoning for not participating in the study. Case study data presented provided a historical component relative to each school, school demographics that evidenced Native American student educational statistics, and Indian education programs that promotes student success.

## Settings

### Description of Participating Teachers' Schools

Because the focus of this study was exclusive to schools with a majority Native American student population, specific schools were researched and identified as meeting the criteria. Three high density Native American student populated schools that participated in this study include Walnut High School and Dogwood High School, Cherokee Nation tribal jurisdiction, and Cypress High School, Choctaw Nation tribal jurisdiction. Two Bureau of Indian Education Schools that participated in this study include Cedar Academy, Choctaw Nation tribal jurisdiction, and Pine Tree High School, Cherokee Nation tribal jurisdiction.

### High Density Public Schools

#### Walnut High School

### *School History*

Walnut High School is a public school located in the Cherokee nation tribal jurisdiction. In 1908, they celebrated their first graduating class in a two-story schoolhouse building located on the current school site. An indoor gymnasium and new high school were built in 1936, but in 1957 both were destroyed by a fire as well as the elementary school in 1975. A new elementary school was quickly rebuilt. A new middle school, football program, band program, track and field house were constructed over a span of 15 years following the construction of the new elementary building (Walnut High School website).

### *School Demographics*

Walnut High School reports a school population of 417 students enrolled from 9th through 12th grades. The Native American student population is 46%. Although below the majority 50% criteria, teachers interviewed reported classroom Native American student populations of 60% or more. According to the Oklahoma School Report Card (Walnut High School online resource), Native American student graduation rate at Walnut High School is 100% with the total per pupil expenditure of $10, 802, 90 (state average is $9, 039.91). Walnut High School students eligible for free lunch remains consistent at 25% compared to the state average of 55% with the reduced lunch eligibility of 10% with the state average of 7%.

### *Indian Education Programs*

Walnut High School offers numerous programs dedicated to Native American success and motivation. One such program, the Johnson O'Malley program, has been instrumental in teaching culture, language, and history. The Johnson O'Malley program, approved through the

Johnson O'Malley Act of 1934 (U.S. Department of the Interior Bureau of Indian Education, para. 1) and states:

> This act authorizes contracts for the education of eligible Indian students enrolled in public schools and previously private schools. This program is operated under an educational plan which contains educational objectives to address the needs of the eligible American Indian and Alaska Native students.

Johnson O'Malley Programs vary amongst all high schools in Oklahoma. Walnut High School offers student services to include funding for supplies, graduation cap and gown, special projects, college fees, organizational dues, and educational incentives and awards. Cultural services include after-school programs, cultural and tribal presentations, instructional material, and student travel. Eligible Native American Indian students must be "enrolled members of a federally recognized tribe or at least one-fourth or more degree of Indian blood descendant of a member of a federally recognized Indian tribal government eligible for services from the Bureau" (U.S. Department of the Interior, Bureau of Indian Education, para. 3). Another program that has contributed to the success of Native American students (although anyone is allowed to enroll in the course) is a recently added Native American Studies class. Taught as an elective, students are offered a mixture of native history and culture, hands-on activities, and educational field trips. The Native American Studies teacher, Ms. Smith, collaborates with the art teacher on many projects.

## Dogwood High School

### *School History*

Dogwood High School is a public school located in the Cherokee nation tribal jurisdiction. Dogwood High School boasts the mascot Indians with a school motto of "It's a

Great Day to be an Indian" (Dogwood High School website). Dogwood High School was completed in 1940 and served as a major economic resource for the community. Facing a dismal economy, wages earned from the construction of the school helped fuel the economy and allowed for consolidation of several districts that would provide improved facilities (Dogwood High School resource online).

***School Demographics***

Dogwood High School's student population is reportedly 634 students with Native American student population of 71%. According to the Oklahoma School Report Card (Oklahoma State Board of Education, 2019), Native American student graduation rate at Dogwood High School is 83% with the total per pupil expenditure of $10,236.16 (state average is $9, 039.91). Dogwood High School's students eligible for free lunch is 100% with the state average of 55% and reduced lunch eligibility is 14% with the state average of 7%.

***Indian Education Programs***

The American Indian Science and Engineering Society (AISES) grant has made it possible for Native American students at Dogwood High School to participate in numerous activities, courses, and college preparation programs that has allowed them to become not only interested but engaged and motivated to further their education. AISES is a "national nonprofit organization focused on substantially increasing the representation of indigenous peoples of North American and the Pacific Islands in science, technology, engineering, and math (STEM) studies and careers" (The American Indian Science and Engineering Society, *Our Mission*, para. 1). AISES provides support to teachers in STEM fields by contributing to career opportunities, professional development, mentoring, and networking. AISES assists Native American students in their educational aspirations by providing numerous programs and scholarship opportunities.

AISES scholarships provides Native American students the opportunity to gain skills and adequate training that will further their STEM needs in their community. Through this program, Dogwood High School has been able to hire Native American teachers, offer computer science electives, Native American Studies courses, and provide Native American students with computers. Dogwood High School depends on grants and funding through programs such as the American Indian Education Scholarship and Impact Aid to provide students from a rural and high poverty area with career and educational opportunities. Impact Aid funds early intervention, early childhood programs, Cherokee language courses, and Native American studies and promotes success for students in and outside of the classroom (Dogwood High School website). Opportunities include leadership skills, computer programs, integrating culture in classes, offering Cherokee I and II, Native American Studies, and language revitalization which is imperative for success during and after high school for Native American students.

## Cypress High School

### *School History*

Cypress High School is a public school located in the Choctaw nation tribal jurisdiction.

### *School Demographics*

Cypress High School reports a student population of 199 students in grades 9-12. The Native American student population is 53%. According to the Oklahoma School Report Card (Oklahoma State Board of Education, 2019), Native American student graduation rate at Cypress High School is 95% with the total per pupil expenditure of $13,675.45 (state average is $9, 039.91). Cypress High School's students' eligibility for free lunch is 25% with the state average of 55% and reduced lunch eligibility of 16% with the state average of 7%.

### *Indian Education Programs*

Cypress High School has an expansive Indian education program. One of the programs includes the Johnson O'Malley program. Through the program at Cypress High School, services provided include school supplies, activity fees and/or dues, graduation cap and gown assistance, cultural and tribal activities and trips, family events and gatherings, and student incentives (Cypress High School website). Another program offered is the Title IV program. Title IV is a "federally funded program through the Department of Education operating within the Office of Indian Education in Washington, D.C" (Cypress High School website). Funds dispensed from the Title IV program are directed to provide for academic, communal, cultural needs, and college and career planning. Native American students enrolled in a recognized tribal affiliation by the federal government are eligible to participate regardless of income level. Services that are provided include tutoring, cultural development through a collaboration with the Choctaw School of Language, elementary level language and cultural lessons, concurrent enrollment assistance, and help with Choctaw Nation Higher Education application (Cypress High School website). The Choctaw Nation also directly collaborates with the school to provide cultural opportunities, assisting students with scholarship and award applications, assistance with the Choctaw Nation higher education program, Choctaw Success Through Academic Recognition (STAR) program that awards Native American students who excel in the classroom, cultural activities, promotes the Choctaw Nation youth advisory board that empowers Native American youth towards leadership positions, college and career counseling, Choctaw Nation Partnership of Summer School Education (POSSE) program that provides academic remediation, Choctaw Nation project Renew Indigenous Strength with Empowerment (RISE) that prepares Native American students for college and careers beyond high school, career development, and Choctaw nation emergency services (Cypress High School website).

## Bureau of Indian Education Schools

### Cedar Academy

#### *School History*

Cedar Academy, a Native American boarding school, was founded in 1891 by the Choctaw Nation "providing individualized care and development through educational, cultural, and spiritual opportunities" (Cedar Academy website). Cedar Academy encourages and motivates each student to be a warrior academically. Cedar Academy staff not only provides an excellent educational experience but promotes cultural and life skills necessary for success beyond the classroom. In 1891, Cedar Academy was established and named after a Choctaw Chief who was born in Mississippi but was forced to relocate to Oklahoma during the Trail of Tears. Having little formal education, he regarded education as imperative for the survival of this tribe. The Choctaw people prioritized and invested in education, business, and English language skills for all Native American children, agriculture and mechanical skills for the boys, and household skills for the girls. Cedar Academy was initially founded as a school for Choctaw boys but became co-ed in 1955 when the Native American girls' school closed. The Indian Self Determination and Education Act of 1972 allowed the Choctaw Nation to "become the first Native American tribe to operate a tribally controlled grant school" (Cedar Academy website). According to Cedar Academy's website:

> Together, we're transforming learning experiences for Native youth by helping them discover life pathways and cultivate a sense of cultural identity. Education at our American Indian boarding school isn't only about book knowledge. It's also about the life lessons that create mature, balanced, responsible, and compassionate adults.

Cedar Academy focuses on empowering Native American students by providing personalized attention and care through education, culture, and religious opportunities (Cedar Academy website).

### *School Demographics*

Cedar Academy is a Bureau of Indian Education School (100% majority Native American student population, funded and operated by the tribe or tribal government via a contract or grant). According to the school's website, out of 147 schools across the nation, Cedar Academy students scored "among the highest in recent testing by the Bureau of Indian Education and the Northwest Evaluation Association, ranking 4$^{th}$ in math and 6$^{th}$ in reading" (Cedar Academy website). Cedar Academy is a no-cost Native American Indian Boarding school in Oklahoma and is located on 540 acres. Approximately 200 students are enrolled in grades 1-12 annually from various tribal nations around the United States and in the surrounding communities. The no-cost attendance includes travel, housing, and meals. Cedar Academy currently has grades 1-6 on campus and grades 7-12 are bussed to a nearby public school. According to public school review statistics (2016-2017), math proficiency is 30-39% (state average is 35%), reading/language proficiency is 20-29% (state average is 38%), and 100% eligibility for free lunch (state average of 55%).

### *Indian Education Programs*

Opportunities provided at Cedar Academy include Project Pehlichi (Meaning "leader" in Choctaw), STEAM camps, Student Success Center, and Reading programs. Project Pehlichi is a program funded by the Department of Education to prepare students for college and career opportunities. This initiative focuses on culture awareness as well as developing competent and confident Native American adults into leadership roles. Project Pehlichi has become an invaluable resource for countless students at Cedar Academy in advancing their academic careers. Academic partnerships with Cedar Academy include the American Indian Science and Engineering Society (AISES), collaboration with the UNITY Native Leadership, partnerships

with the American Indian Institute (Aii) at the University of Oklahoma, and the National Aeronautics and Space Administration (NASA). The STEAM Saturday camps are taught on campus to elementary and secondary students to foster exploration in science, technology, engineering, art, and mathematics. The Cedar Academy robotics team has successfully competed and won at numerous events. The student success center is instrumental in providing educational support through tutoring and necessary technology needs such as laptops and desktop computers. The center also serves as a place for students to further their educational studies as well as better themselves. The reading program emphasizes reading motivation, reading comprehension, and overall proficiency in reading scores. This program focuses on assisting special education students, English language learners, or any student who needs extra help. Additional activities offered include annual trips to amusement parks, movies, picnics, excursions to area lakes and parks, zoos, museums, local sporting and cultural events, shopping trips, work programs, family day, motivational speakers, career fairs, fishing, stickball, agricultural programs, and livestock showing, and drug and alcohol education.

**Pine Tree High School**

***School History***

Pine Tree High School proudly boasts the mascot Indians with the mantra of "Honor the Spear: Success, Perseverance, Excellence, Acceptance, and Respect". Pine Tree High School began as an Indian boarding school in 1871 as an orphan asylum to take care of the numerous orphans at the end of the Civil War (Pine Tree High School website). In 1914, the Cherokee National Council sold the property to the United States Department of Interior and was subsequently renamed to honor a Cherokee Indian who created and developed the Cherokee Syllabary in 1925 (Pine Tree High School website). The Cherokee Nation took over operations

of the school in 1985 and is currently regionally and state accredited with more than 300 Native American students enrolled with over 40 tribes represented from 14 states. Eligibility requires membership of a federally recognized Indian tribe or one-fourth blood descendant. Pine Tree High School's creed states that "As Native American students, we are commissioned to keep traditions alive. We are the future. We choose success". (Pine Tree High School website).

### *School Demographics*

Pine Tree High School is a Bureau of Indian Education School (100% majority Native American student population, funded and operated by the tribe or tribal government via a contract or grant). Statistics obtained from Public School Review (2016-2017) reports the graduation rate of 85-89% compared with the state average of 80%, math proficiency of 15-19% compared with the state average of 35% and reading proficiency of 35-39% compared with the state average of 38%. Pine Tree High School enrolls 390 students from grades 9-12 and ranks the larges percent (100%) of students eligible for free lunch (top 1%).

### *Indian Education Programs*

The American Indian Science and Engineering Society plays a large part in student academic success. The school's chapter of AISES encourages and supports students to pursue careers in technical fields that are largely unrepresented by Native American Indians. AISES funding supports activities as well as opportunities for Native American students interested in technical careers. Pine Tree High School also offers such classes as Native American History, Cherokee I and II, and Cherokee History.

## Protection of Human Subjects

This dissertation was sent to my doctoral committee in the Graduate Education department at the University of Arkansas and the Institutional Review Board at the University of Arkansas.

Participants in this research study were presented with the IRB approval (Appendix C) as well as a basic outline of the research for review before they committed to the study. Interviews were set up in accordance with their schedule and timeline. Due to the time commitments involved in this study, participants were informed of their ability to terminate their participation in the study. Since teachers were interviewed for their role and responsibility in science curriculum, confidentiality of names and schools will be upheld and are identified by pseudonyms (Table 4). Names of all participants and any other identifying information, pictures, videos, transcripts, or recordings of interviews will remain securely locked in the researcher's office and will be destroyed after five years.

**Table 4**
***Case Study Teachers and Demographics***

| School | Teacher, Subject | Tribal Member | Type of School | Population | % Na | Free/Reduced Lunch (%) | Graduation Rates (%) |
|---|---|---|---|---|---|---|---|
| Walnut High School | Mrs. Jones, Biology | No | Public | 417 | 46* | 25/10 | 100 |
| | Ms. Smith, Biology | Yes | | | | | |
| | Mr. Roth, Chemistry | No | | | | | |
| | Mrs. West, Native American Studies | Yes | | | | | |
| Cypress High School | Mr. Brown, Chemistry | Yes | Public | 199 | 53 | 25/16 | 95 |
| Dogwood High School | Ms. Porter, Chemistry | Yes | Public | 634 | 71 | 100/14 | 83 |
| | Mr. Baker, Computer Science | Yes | | | | | |
| | Mr. Williams, Computer Science | Yes | | | | | |
| Cedar Academy | Ms. Davis, Elementary | Yes | BIE | 77 | 100 | 100 | - |
| | Ms. Johnson, Elementary | Yes | | | | | |
| | Ms. Miller, Elementary | No | | | | | |
| Pine Tree High School | Mr. Wilson, Physical Science | Yes | BIE | 390 | 100 | 100 | 85-89 |
| | Ms. Anderson, Biology/Chemistry | Yes | | | | | |
| | Mrs. Edwards, Biology/Botany | Yes | | | | | |

*Note.* The abbreviation NA means Native American. The abbreviation BIA refers to the Bureau of Indian Education.
*Teachers interviewed reported 60% Native American student population in classes.

## Interview Instruments

Interview instruments in this study were key in collecting data for this qualitative study. An initial survey (Appendix A) to gain background information and to appropriately prepare me for the interview was collected from all teachers through Google forms. An in-depth interview (Appendix B) was conducted in the teacher's classroom that identified culturally responsive teaching in the classroom, learning strategies of Native American students, and to address any situations occurring in the classroom. Each teacher was interviewed in person to gather detailed and specific information. I formulated an interview dialogue (Appendix B); however, the initial survey guided the researcher towards specific questions from the base interview questions. The interview process was beneficial because it enabled me to observe the cultural environment of the schools and the classroom. I was able to photograph numerous cultural artifacts, Native American statues, and student work as it pertains to the culturally responsive teaching lessons. I recorded field notes during the interview process in a Google document as well as audio recorded the interview for further analysis.

## Research Procedure

### Overview of Research Process

The study was focused on schools in Oklahoma that comprised a majority student body of Native American Indian students. These schools were specific to Native American student population of 50% or more Native American student population and Bureau of Indian Education schools with a 100% Native American student population. I had a difficult time locating the information I needed from the Oklahoma State Department of Education website; therefore, I had to rely on my own experience in finding schools. Since I lived most of my life in Oklahoma, I was familiar with schools that would most likely have a high number of Native American

students. I began to google school information from sites that listed statistics for each school in Oklahoma. The research began with this initial list. Once I had comprised a list of schools consisting of majority Native American student population, I began contacting the administrators for permission to participate in the study (Appendix D). From this initial list, seven administrators expressed interest in participating and emailed me a list of science teachers to contact. An email summarizing the research and intent of the study and inclination to participate in the research study was sent to twenty-seven science teachers. Thirteen teachers responded and expressed interest in participating. A survey was emailed via Google forms to the 13 science teachers that contained questions relevant to culturally responsive teaching integrated in a science classroom with Native American students, level of culturally responsive teaching knowledge and application, and background information deemed necessary to conduct meaningful interviews (Appendix A). The survey also provided background information from each participant obtaining an overview of teacher ethnicity, culturally responsive teaching training, and subjects/topics taught. Questions were specific to science topics taught that incorporate traditions and cultures among Native American students. An in-depth interview with each teacher was conducted in their classroom upon completion of the surveys (Appendix B). The interview included observations of the classroom environment, traditions and cultures in the classroom and school environment, and lessons and activities either utilized pertaining to culturally responsive teaching or perceived as a topic that would lend itself to culturally responsive teaching. The interview allowed the teacher to discuss additional information related to the student's culture, learning strategies within the classroom curriculum, and any challenges they have faced incorporating culture into the curriculum. The interview location deemed necessary to observe tribal identity, culture, and classroom environment. One teacher, a Native

American Studies teacher, was identified by a science teacher as an excellent participant for this study. Although not initially in the study, the connections between the Native American Studies class and science classes deemed relevant and appropriate as an excellent cross curriculum opportunity. The interviews were video recorded for later analysis. A detailed outline of the interview questions is provided in appendix B.

## Inductive and Deductive Data Analysis

Data collected through surveys, interviews, observations, and lesson plans produced specific themes of culturally responsive teaching and are categorized into patterns, theories, and generalizations that support culturally responsive teaching for Native American students in science classrooms in the study. Data were compared with my personal experiences and compared with literature reviewed in Chapter 2.

## Data Analysis Process

Data collected from the initial surveys were utilized as a demographic tool and organized into a detailed graphic organizer. Surveys provided background information on each participant and assessed knowledge level of both culturally responsive teaching and Native American culture, traditions, and beliefs. Google forms were utilized that provided a summary of results. Data were analyzed using a combination of case studies and grounded theory. Line-by-line coding procedures detailed in Constructing Grounded Theory (Charmaz, 2006) were utilized to study the data collected from surveys, interviews, and observations in the classroom. Line-by-line coding (Table 3) was used during interviews to identify and categorize specific data indicative of culturally responsive teaching in the classroom, themes identified across geographical schools in Oklahoma, challenges endured in providing culture-based lessons, and other pertinent information useful for the study. Initial line-by-line coding generated three

categories that paralleled the research questions. When transcribing and coding the interviews began, it became apparent that categories needed to be further broken down into subcategories. Axial coding (Charmaz, 2006) includes categories as well as subcategories. Axial coding includes a major category but allows for additional information to be included into subcategories after initial coding which allows for a more detailed organization of data. Line-by-line coding was used as an initial coding that developed a baseline thus moving into axial coding. Axial coding was a strategy utilized to present the data combining the main categories and subcategories to form a whole meaning of the data (Charmaz, 2006). Interviews were audio recorded for further analysis and coding which allowed me to analyze data related to the research (Charmaz, 2006, p. 53). The data is a study of what science teachers perceive as culturally responsive teaching in science classrooms, therefore; in-depth interviews were conducted to ascertain what classroom practices are in place that relate to culturally responsive teaching to Native American students in the science classroom and if they are teaching these topics. Culturally Responsive Teaching frameworks (Gay, 2002) were identified and utilized as a baseline to determine knowledge of diverse cultures and the intrinsic motivation of the teachers to participate in culturally responsive teaching. In-depth interviews and field observations directed the data towards utilizing Robert Yin's method of case studies. A case study focuses on smaller participant numbers (cases) affording the researcher the opportunity to observe the participant in a more intimate, in-depth manner set in their natural setting (Yin, 2012). Yin further states that case studies provide proximity to the participant aiming to achieve a deeper understanding of the data collected and to ascertain evidence of culturally responsive teaching in the classroom and its application. Line-by-line coding showed concrete, behavioristic descriptions of actions observed in the science classroom from the initial survey and interview.

Attention and emphasis were placed on prior biases by me and authentic science practices by the participants.

## Research Timeline

The timeline for data collection and analysis was performed over the course of one school semester with data being analyzed throughout the study (Table 5). Initially, ten high density schools were emailed to participate in this research study. Of this initial pool, five schools and fourteen teachers agreed to be a participate in this research study. Initial surveys and IRB's were sent to all fourteen teachers. Surveys were sent via Google forms and IRB's were emailed directly to the teacher. Upon collection of surveys and IRB's, interviews were scheduled. The timeline schedule for observations and interviews were conducted according to each teachers' schedule. Each participant was interviewed in their natural setting in February and March. Several unforeseen events such as snow and Covid-19 restrictions caused rescheduling of interviews but was built into the initial proposed timeline. Interviews were then transcribed and organized in a Google document. Peer debriefing was conducted by the doctoral committee chair for further reliability and validity.

***Table 5: Timeline of Data Collection***

| Time Frame | Data collection/analysis | Participants |
|---|---|---|
| Week 1 | Initial email to Administrators | 10 high density schools in Oklahoma |
| Week 2 | Google survey<br>IRB's emailed | 5 case study participants. 14 teachers.<br>13 science teachers, 1 Native American Studies teacher. |
| Week 3 | IRB's organized in Google docs<br>Surveys organized in Google docs<br>Teacher interviews scheduled | Case study participants. |
| Weeks 4-8 | Interview, observations, & field notes | Case study participants<br>14 teachers interviewed |
| Weeks 9-11 | Interviews transcribed | Case study participants<br>14 teachers |
| Weeks 12-14 | All data analyzed, categorized, & Arranged in Google docs | Case study participants<br>14 teachers |

*Note.* The abbreviation IRB refers to the Institutional Review Board.

## Methodological Validity and Reliability

Validity of the qualitative research findings incorporated several approaches. During the survey, observations, and interview portions of the study, emphasis was placed on authenticity and credible evidence. Participants were encouraged to disclose all information pertaining to lessons, activities, and day-to-day practices as normal as possible. They were informed that the intent of the study was to observe science curriculum and instruction as it pertains to culturally responsive teaching. I conducted an in-depth interview in the teacher's natural setting. The interview was deemed necessary to determine and compare any inconsistencies within the interviews, compare with the initial survey answers, and to observe the cultural environment of the school and the classroom. I spent a full day at each school and two hours with each teacher to allow for in-depth understanding of the science teachers' classroom, attitudes, and practices as well as observing the cultural history portrayed in the school environment. The added experience in the classroom and with the participant provided a more accurate and valid finding.

Reliability of the qualitative research findings was identified by a systematic approach to the study. Because the initial survey was emailed to the teacher, the interview process allowed the teacher to expand upon or clarify answers given in the initial survey. Prior to the interview, I utilized the survey answers to align the components of the interview dialogue for further proof of reliability during the interview. Consistency in observations and coding was evidenced in the raw data collection tables, summaries of each survey and interview, and video and audio recordings. I conducted peer-debriefing with the doctoral committee chair throughout the data analysis process for further reliability and consistency pertaining to lesson authenticity, line-by-line coding, and member checking. Each step of the study was documented and recorded in a

Google document to maintain accuracy and reliability that contain line-by-line coding and descriptions, memos, and transcriptions.

## Summary

Ten schools in Oklahoma based on the Native American student population were contacted and asked to participate in this study to identify culturally responsive teaching in Native American science classrooms. All ten schools consisted of majority Native American student populations. Six of the schools were high density Native American student populated schools and four of the schools are Bureau of Indian Education schools which consist of 100% Native American student population with certifiable evidence of documentation required to attend the schools. Citing Covid-19 issues and availability, the study was limited to fourteen teachers from five schools participating (three high density Native American student populated and two Bureau of Indian Education schools). The study focused on research questions directly pertaining to culturally responsive teaching: what science topics teachers perceive as a culturally responsive teaching lesson in a Native American student populated classroom, what culturally responsive teaching strategies do teachers perceive as effectively teaching science topics related to Native American student populations in a culturally responsive classroom, and what are common themes identified among teachers in different Native American tribal areas in Oklahoma. Teachers were sent a survey that would lay the foundation for the interview stage of the study. Interviews were conducted in-person rather than via zoom so that I could observe the teacher in their natural setting and observe the cultural identity of the environment. A qualitative method was applicative because of the disposition of the data collection. Case studies and grounded theory was implemented to analyze the data. Science teachers were chosen specifically to participate; however, during the interview process, it became apparent that other

courses, such as the Native Studies class, proved to be an imperative piece to culturally responsive teaching thus adding the teacher to the study. This study was limited to the Oklahoma area due to time and travel constraints as well as the above average state testing scores and graduation rates. Data collection and analysis occurred over the course of one semester allowing for rescheduling due to unforeseen events. Based on the data collected through surveys, observations, and interviews, analysis was made to identify what teachers perceive as culturally responsive teaching and to document effective teaching to minority students, specifically Native American students. These data are useful for developing and implementing workshops that could incorporate multicultural/diversity learning and additional training in multicultural/diversity for in-service teachers. Data was used to increase understanding and enhance knowledge of Native American cultural beliefs and attitudes.

# Chapter 4: Data

## Data Analysis

Through qualitative research, collections of surveys and interviews were studied to analyze strategies teachers are implementing to engage Native American students in science classrooms and incorporating cultural and historical aspects into the science curriculum. Surveys were created using Google forms and emailed to the participants. The survey was beneficial in the initial stage of the study to gain information that would better prepare me for the interview stage. The survey also provided evidence that the initial proposed coded categories would need to be further expanded upon. The interview questions were modified according to each teacher's survey responses. Teachers were offered the opportunity to elaborate on their responses from the survey. The interviews were audio recorded for later analysis and coding and was transcribed in entirety in a word document. Upon completion of transcriptions, the surveys and interviews were coded and organized into a graphic organizer. (See Table 3 for a detailed description).

According to Charmaz (2006), the first step in qualitative coding includes determining specific data collection. Coding data allowed me to form categories from the collected data and summarize the data relative to the information gathered from the surveys, interviews, and observations. I analyzed the data and constructed a framework of analysis from the collected data (Charmaz, 2006). Data was coded and analyzed (Table 3) according to Charmaz's, Constructing Grounded Theory (2006) and Yin's, Applications of Case Study Research (2012). Line-by-line coding was used to formulate main categories relating to the research questions. Originally, three main topics were used to code the interview discussion transcriptions; however, during this process, several topics emerged that were considered essential to the case stories presented requiring me to modify the research (Figure 1).

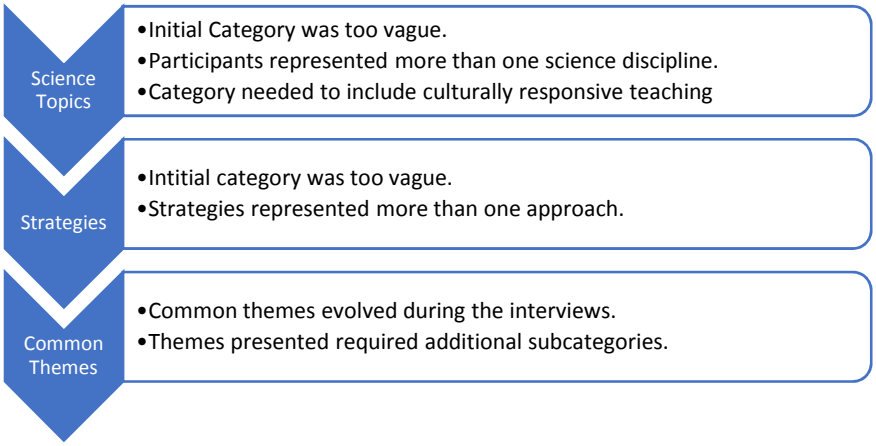



***Figure 1: Development of Main Categories and Subcategories***

Consequently, after the initial line-by-line coding, the data was further broken down into main categories and subcategories or axial coding (Table 3). Specific quotes from the teachers during the interview stage were considered beneficial in answering the research questions posed and were coded aligning with the main categories and subcategories. Quotes were selected that would directly connect the data with the research question and that added a deeper meaning to the teachers' responses (Table 6).

***Table 6: Example of Data Analysis & Coding***

| Artifact—from interview |
| --- |
| Researcher: "You don't incorporate culturally responsive teaching into the curriculum, and you reported a "2" level of culturally responsive teaching knowledge. From our discussions today, are there topics in your science class that you could incorporate?" |
| Mrs. Jones: "I could definitely incorporate this into our genetics unit. For example, I know the diabetic gene is more prevalent in the Native American culture, but I have never related that to my students and their culture. I believe this could be beneficial in many ways. My neighbor is Choctaw and one of my students. Her stepdad recently lost three toes due to diabetes. This is an ongoing battle that I see all the time in this community. When they lose toes, what is happening there? Diabetes side effects and symptoms also include losing eyesight. I have a Native American girl in class who suffers with rheumatoid arthritis that is losing eyesight. As a Native American female, could this be related? Could this be a symptom of diabetes?" |

***Table 6 (Cont'd)***

| Artifact—from interview | Coding |
|---|---|
| Researcher: "Would this engage your students?"<br><br>Mrs. Jones: "Of course, the rest would be thinking of their families. They would all know someone who is diabetic and Indian. This could easily lead into our unit of population analysis. We do this in ecology with animals but could do it with people easily. This would definitely pull them into science. We could also do a research project with jam boards." | genetics unit: example of a future culturally responsive teaching lesson. Answers RQ1: Science topics. Would fall under Biology—Genetics. (Subcategory) |
| This is an ongoing battle that I see all the time in this community. When they lose toes, what is happening there? Diabetes side effects and symptoms also include losing eyesight.: | provides rationale and relevance that genetics is directly impacted by the Native American culture and would substantiate the importance of this lesson. |
| This could easily lead into our unit of population analysis. We do this in ecology with animals but could do it with people easily.: | example of a future culturally responsive teaching lesson. Answers RQ1: Science topics. Would fall under Biology—Genetics. (Subcategory) |
| My neighbor is Choctaw and one of my students. Her stepdad recently lost three toes due to diabetes: | add quote to provide emphasis of connection to the topic and culturally responsive teaching. Supports her argument of incorporating culture into the science curriculum. Supports the genetic lesson. RQ1: Science topics. Biology—Genetics |
| I have a Native American girl in class who suffers with rheumatoid arthritis that is losing eyesight. As a Native American female, could this be related? Could this be a symptom of diabetes?": | add quote to provide emphasis of connection to the topic and culturally responsive teaching. Supports her argument of incorporating culture into the science curriculum. Supports the genetic lesson. RQ1: Science Topics. Biology—Genetics. |

Additionally, observations of the teacher's classroom and school environment further validated the authenticity of a rich cultural atmosphere conducive for preserving and promoting the student's Native American identity. Examples of cultural artifacts photographed by the researcher included evidence of cultural lessons implemented in the classroom (Figure 2) and a rich cultural school environment (Figure 3).

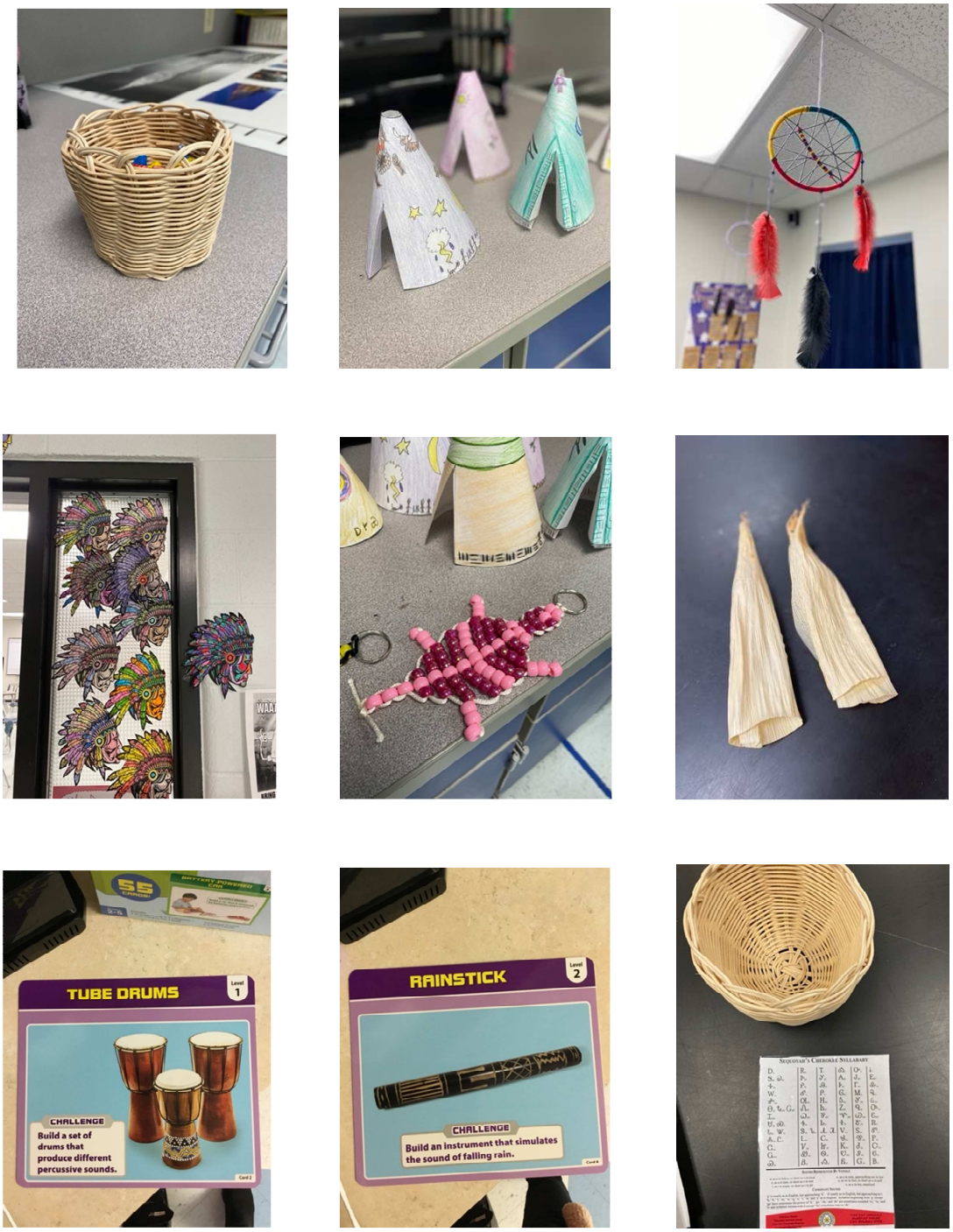
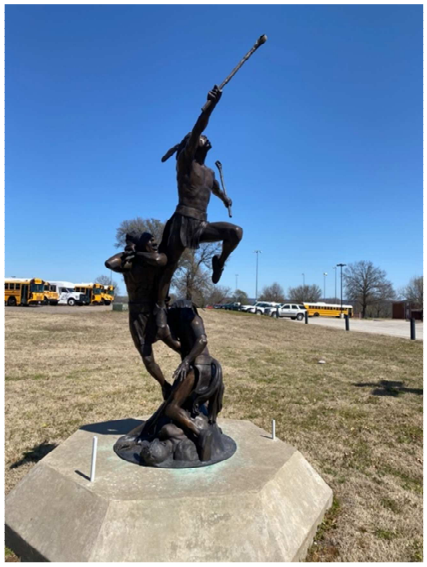



***Figure 2: Cultural Artifacts Observed in the Classroom. Photos by author.***



Pine Tree High School

Pine Tree High School

Walnut High School


Walnut High School

***Figure 3: Cultural Artifacts Observed in the School Environment. Photos by author.***

The following research questions maintained the central focus of the research and was significant in directing the main categories:

1. What science topics do teachers of Native American students report teaching in culturally responsive ways?
2. What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?
3. What common themes do teachers identify related to teaching in a Native American student populated science classroom?

Analysis of the fourteen teacher surveys and interviews along with the three research questions established and determined the four main categories: science topics, strategies, factors influencing science teaching, and teacher training. From these main categories along with the research questions, numerous subcategories evolved from the data.

Subcategories were created from the initial research question (research question one) because "science topics" seemed quite vague and wasn't explicit as to what the science topics or the science discipline included. When the research question regarding the actual teaching of culturally responsive teaching of science topics was formulated, there wasn't a specific idea of what would conceptualize until the survey and interview stages had taken place. Originally, intention was focused on "what" science topics teachers are incorporating into their curriculum; however, through discussions with the teachers and realization of non-culturally responsive teaching lessons and strategies in place, several ideas started developing and planning of future lessons began to materialize. Subcategories that evolved from the survey and interview stage included environmental science, physics/engineering materials and design, forensic science,

biology (to include ecology, ecosystems, botany, and genetics), and computer science (Description in Table 3).

Subcategories were created from research question two because throughout discussions with teachers, numerous projects, educational field trips, guest speakers, collaborations with other teachers, and collaborations with the community emerged. Since these strategies were proven to highlight teacher success in enhancing the classroom material, it was important to include them exclusively.

Numerous common themes surfaced across the different tribal areas in Oklahoma that connected the research questions with the literature review, most notably, personalities and traits of Native American students, classroom challenges, and family challenges. Other themes that were useful included teacher motivation and encouragement from both Native American and non-native teachers and the success/achievements associated with their sincere concern for their students. Because this study was exclusive to Native American student populations, the ethnicity of students and teachers were identified across all case studies. Lastly, data collected from the study was essential to develop resources and opportunities for teachers to increase their knowledge of Native American cultures and traditions and to apply culturally responsive teaching in their classroom. Therefore, preparation and continuing education deemed crucial to all aspects of the categories but most notably was indicative of a common theme from all teachers involved in the study.

**Research Question 1:** What science topics do teachers of Native American students report teaching in culturally responsive ways?

During the survey and interview stage of the study, teachers explained culturally responsive teaching lessons implemented in their classroom as well as topics and lesson ideas

perceived that would align with culturally responsive teaching. Science disciplines that emerged from the base question formulated the subcategories that included environmental science, physics/engineering materials and design, forensic science, biology, and computer science.

**Research Question 2:** What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?

Throughout discussions during the interview stage, teachers detailed projects, educational field trips, guest speakers, collaborations with other teachers, and collaborations with the community. They explained how these strategies enhanced the science curriculum while implementing culturally responsive teaching in their classroom.

**Research Question 3:** What common themes do teachers identify related to teaching in a Native American student populated science classroom?

Common themes that were consistent among all the teachers interviewed provided information beneficial for teachers during the creation or development of lessons and activities associated with culturally responsive teaching lessons. Knowledge of students is necessary for successful teacher/student interaction, rapport, and learning of material. Teachers expressed the importance of recognizing, respecting, and being responsive to personalities and traits specific to Native American students as well as classroom and family challenges. The teachers also described how teacher motivation and encouragement have led to academic and career successes and achievements. Teachers recognized the need for multicultural professional development to improve their knowledge of culturally responsive teaching, increase their knowledge of Native American culture, and to become effective culturally responsive teachers.

## Science Topics

Research question one was created to include all science disciplines in identifying culturally responsive teaching. The data collected represented more disciplines and topics than was originally planned but because culturally responsive teaching encompassed a need in all science classrooms, all disciplines were considered fundamental for this research (As detailed in Figure 1). For this reason, subcategories were created from each science discipline and then further broken down into teachers' perceptions of culturally responsive lessons.

### Environmental Science

Ms. Smith, Walnut High School, is not a science teacher but was considered important in this study because she teaches Native American Studies. Native American Studies is an elective at Walnut High School (any student can enroll in); however, the possibility of collaborating with science teachers could prove an excellent advantage for non-native and Native American students. The activities conducted and taught in this class could serve well in several science classes. One such project, making effigy pots is a class favorite that would be an excellent cross curriculum project in environmental science classes and earth science classes. An Effigy pot is pottery that is made in the form of animals such as dogs, deer, frogs, as well as people and is indicative of the Quapaw people (Figure 4). This pottery is known for its artistic detail, artistry, and unmistakable characteristics (Museum of Native American History, Bentonville, AR., *Mississippian 900 AD-1450 AD).* Ms. Smith invites a Cherokee storyteller into the classroom to share stories with the students as they are making their effigy pots. She described the excitement and elation from the students during this activity:

> The students loved doing this activity. They take my Native Studies class because we not only make cultural projects, but we get to learn about them as well. During this project, we got to hear the actual stories that go right along with what we are working on.


"Crouching Fawn" Effigy Teapot


Dog Effigy Bowl


Duck & Turtle Effigy Bowl


Frog Effigy Bowl


Quapaw "Double Dog" Effigy Pot


Effigy Pots and Waterbottles

***Figure 4: Effigy Pots. Photos taken by the author at The Museum of Native American History, Bentonville, Arkansas.***

Ms. Smith emphasizes the use of Earth's natural resources as a cultural educational experience that leads to a rewarding connection for the Native American student, non-native student, and the school environment. She also makes connections of utilizing natural resources as an important role of responsible stewardship of Earth's resources in Native American lifestyle. Since not all her students are Native American, she discusses the benefits of cultural awareness to her non-native students.

Ms. Miller, Cedar Academy, teaches land and agricultural use, soil, and different types of materials used for early Native American housing. Topics studied include geographical location, traditions involved in tribal housing, environment, and arable soil. Because planting was an important aspect of Native American livelihood, land and soil became a critical component for growing foods; therefore, Ms. Miller incorporated soil and water pH testing into her science curriculum.

Ms. Anderson, Pine Tree High School, explained that her students also conduct experiments on testing pH of soil and water. Although not technically taught as a cultural lesson, the topic is pertinent to their surroundings since many of the communities in the area just obtained fresh running water. This lesson is an excellent example of an opportunity of integrating culture, Native American history, and environmental science exploration in the classroom.

In Mrs. Edwards class, Pine Tree High School, students research and discuss the damage to water systems and the issues surrounding land and water damage. She explained that:

> When I started teaching environmental topics, the Pitcher, Oklahoma controversy pushed the envelope of getting people to pay attention to the water in that area from deserted lead mines and piling of those places. You take care of the environment. Indigenous idea is that you didn't own the land, you were part of it and needed to take care of it.

Mrs. Edwards emphasizes the importance of environmental care and concern placed on the Earth by the Native American people. She explained that the Pitcher, Oklahoma issue is one socio-scientific issue concerning damage to land and agriculture effecting not only Native American lands, but non-native land as well. She explained that is a critical environmental issue that is ongoing and necessitates awareness in science classrooms. "So much is not discussed in traditional textbooks that it is a disservice to our Native American students as well as our non-native students. These issues need to be discussed."

Mr. Wilson, Pine Tree High School, identified a lesson in water systems, aquifers, that he could relate back to their heritage. Presenting issues such as the Dakota Access Pipeline could lead to discussions of problems with the environment currently and throughout history. He expressed an interest in the students performing field studies and researching historical background. By connecting socio-scientific issues with the direct effects on Native American land (as well as non-native lands) could enhance topics regularly taught in his science class and immerse students in a topic relative to their cultural communities.

Topics explored in environmental science that can provide teachers applicable lessons in culturally responsive teaching include flint knapping and water systems. Ms. Smith, Walnut High School, expressed her desire to explore flint knapping. She explained that flint is a hard stone. Flint can be gray, brown, red, or black in color and sometimes has a glassy appearance. Because of its hard characteristics, Native Americans used flint to construct their tools and weapons. A flint knapper is used to refer to a person who makes tools out of flint. She would like her students to learn how to find flint and knap them into arrowheads since this was a crucial component for survival in earlier times. Stones used by Native Americans often included chert, flint, or obsidian and was specific to the need. The historical and science component would be an excellent lesson that would align with culturally responsive teaching. A detailed description of flint knapping and arrowheads constructed from flint are provided in Figure 5:


***Figure 5: Flint knapping and arrowheads. Photos taken by the author at The Museum of Native American History in Bentonville, Arkansas.***

Ms. Johnson, Cedar Academy, explained that she often teaches concepts without connecting rich Native American culture. She explained that:

> Their science word for the day was erosion. I did pull up a video on erosion to show the class, but I get so caught up in the content, what I must teach, the objective, that I forget to pull in culture.

She realized the missed opportunity of relating such geographical areas as the rich Native American culture surrounding the Grand Canyon, livelihood of the Badlands for the Native Americans, and numerous waterfalls and caves exclusively used by Native Americans for safety, security, and shelter. She became aware of the numerous examples of erosion that could be taught in conjunction with Native American heritage.

***Table 7: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Environmental Science***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Ms. Smith | Walnut High School | Effigy Pots | EN.ESS3.2<br>EN.ESS3.3 |
| Ms. Miller | Cedar Academy | Land, Soil, and Agricultural Use<br>Materials<br>Soil and Water pH Testing | EN.ESS3.1<br>EN.ESS3.1<br>EN.ESS3.1 |
| Ms. Anderson | Pine Tree High School | Soil and Water pH Testing | EN.ESS3.1 |
| Mrs. Edwards | Pine Tree High School | Impacts of Human Activities on Natural Systems (Water Systems) | EN.ESS3.4 |
| Mr. Wilson | Pine Tree High School | Impacts of Human Activities on Natural Systems (Water systems) | EN.ESS3.4 |
| Ms. Smith | Walnut High School | Flint Knapping | EN.ESS3.2 |
| Ms. Johnson | Cedar Academy | Erosion/Geographical Patterns | EN.ESS2.1 |

**Physics/Engineering Materials and Design**

Teepees were constructed in Ms. Smith's class at Walnut High School. Students designed and made teepees, created their tribe and symbol, and related the history behind what they chose. Some students chose a star while others chose a moon as a symbol. In this activity, she referenced the movie Dancing with the Wolves. She explained:

> The main character talks about teepees and how the women assemble them very quickly, better than any organized army could ever do. We looked at that piece in the movie and talked about the tear down process. It was assembled so quick that it was a great way to show the students how the Native Americans were able to pack it up and move very quickly when needed. It also showed how efficient they were.

This would be an excellent physics/engineering cross curriculum opportunity. Engineering aspects would include materials acceptable to withstand weather conditions, appropriate for transportation purposes (must be light enough to carry long distances), material availability, and construction of the teepees (Figure 6).

***Figure 6: Teepees constructed in Ms. Smith's (Walnut High School) Native American Studies class. Photos taken by the author.***

Another project Ms. Smith makes in class is constructing baskets. This project would also be an excellent engineering lesson. She discussed the many uses of baskets and how many different variations of baskets were utilized by the Native Americans. Engineering concepts consider what the basket would be used for as all were specific to a certain task. She explained:

> Are they too tight? Too loose? Too little? For example, flour and cornmeal were staples for Native Americans; therefore, the baskets used to hold them could not have holes. Baskets were also used to carry water to camps, so baskets were constructed specific for that purpose.

The students were also expected to think outside of common uses for baskets and present this information which required additional research further integrating cultural history and science (Figure 7).

Ms. Davis, Cedar Academy, also expressed her desire to incorporate basket weaving into her curriculum. Although the students might be too young to construct the baskets themselves, she explained the ease of bringing in different types of baskets that would lead to discussions relating to uses specific to the need and materials in constructing along with the historical component. She was also excited about the idea of letting the students test different baskets to formulate scientific hypotheses.


***Figure 7: Baskets (L to R) 1 and 2 photos taken by the author at The Museum of Native American History, Bentonville, Arkansas. Baskets 3 and 4 photos taken by the author at Walnut High School.***

Although Ms. Johnson, Cedar Academy, has not yet incorporated cultural homes into her science curriculum, she was very excited about the project and anxious about getting the activity planned. She explained that:

> Something I have wanted to do is study Native American homes and have the students construct different types such as teepees, wigwams, long houses, and Hogan houses. These homes could easily be constructed out of classroom materials on a smaller scale.

The construction of Native American homes is an activity that could easily be planned and implemented and would provide the students with engineering design practices that would directly align with learning the historical component. Homes made from natural resources plentiful during this period could incorporate earth science and environmental science curriculum as well.

Students in Ms. Smith's Native American Studies class had the opportunity to see many different types of cradleboards (commonly known as papoose boards) when touring the National Cowboy & Western Heritage Museum in Oklahoma City. She explained that because this museum is home to more than 20,000 Native American Indian artwork and artifacts, students can see a lot of the traditional items, like cradleboards, that they talk about in class. Cradleboards were used to transport children comfortably and safely (Figure 8). Construction of cradleboards lends itself to different areas of physics such as type of wood, angles, shape, weight, and additional materials added to the boards. Ms. Smith explained that:

> Since materials can be quite costly, some of the projects can be accomplished on a smaller scale. Materials such as popsicle sticks, twine, and fabric scraps could be used, but students could also bring in items from home if they wish. If cost is too big of a challenge for materials, guest speakers bringing in the items and/or demonstrating how to make them would suffice as an excellent alternative.

Through discussions in the interview process, Ms. Smith was eager to begin this activity. She also began planning a collaboration with the science department to incorporate the cultural

curriculum with the science curriculum. Although built on a smaller scale, students will be able to create and design a cradleboard specific to their tribal culture connecting science, history, and engineering design.

***Figure 8: Photo 1 (L to R) is a Mohawk Wooden Cradleboard. Photo 2 is a Paiute Cradleboard. Photos taken by the author at The Museum of Native American History in Bentonville, Arkansas.***

Discussions with Mrs. Jones, Walnut High School, (who explained that she has not incorporated culturally responsive teaching in the science curriculum) led to future collaboration plans with Ms. Smith's Native American Studies class. Some topics that Ms. Smith and Mrs. Jones discussed collaborating include stickball (Figure 9), basket weaving (Figure 7), blow guns and Cradleboards (Figure 5).

Although Ms. Smith's class has never made the components of the stickball game, she has discussed the history behind it, what tribe it came from, and what Anglo sport evolved from it. Collaboration could entail both classes constructing the sticks and balls, computing and experimenting with the trajectories, angles, and force, the engineering design of the stick and

balls, and how they throw the ball. Although a science class, Mrs. Jones recognized the impact of introducing and incorporating cultural history into a science lesson to provide deeper meaning for many of the common science concepts taught. Showing videos and movies of Native Americans participating in the game of stickball would prove to be an effective engagement activity to begin the lesson.

***Figure 9: Stickball. Photo taken by the author at the University of Arkansas.***

These same concepts could be utilized in the construction of blow guns and bow and arrows. Mr. Wilson, Pine Tree High School, explained that "he talks about bow and arrows in his physical science class teaching projectile motion, but I never related it to the Native American culture, but I do believe this to be a topic easily relatable." He reflected on past lessons taught on velocity, acceleration, and force with paper airplanes or little cars, and quickly realized that this topic could easily be replaced with bow and arrows (Figure 10). Replacing the

lesson with blow guns and/or bow and arrows could bridge common physics topics to Native American history. Mr. Wilson explained that:

> I have now come to realize that if you implemented culturally responsive teaching it just may help them understand it better. It is very big here; their culture is a big part of their life here. If we were able to relate that in physics, they might understand it better if they were learning it in other classes as well. Archery and stickball are still played here. You could have them make their own blow gun or bow and arrows to test different things. Have them create their own, test different angles, and perform the projectile lab.

***Figure 10: Bow and Arrows. Photos taken by the author at The Museum of Native American History in Bentonville, Arkansas.***

The lessons involving blow guns, stickball, and bow and arrows integrates Oklahoma's science standards with culturally specific traditions that allows the Native American student to connect their science classes with their tribal heritage and celebrations.

***Table 8: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Physics/Engineering Materials and Design***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Ms. Smith | Walnut High School | Constructing Teepees<br>Constructing Baskets<br>Papoose Boards | PS.PS2.3 |
| Ms. Davis | Cedar Academy | Constructing Baskets | PS.PS2.3 |
| Ms. Johnson | Cedar Academy | Constructing Native American Homes | PS.PS2.3 |
| Mrs. Jones | Walnut High School | Stickball<br>Basket Weaving<br>Blow Guns<br>Papoose boards | PS.PS2.1<br>PS.PS2.1<br>PS.PS2.1<br>PS.PS2.1 |
| Mr. Wilson | Pine Tree High School | Bow and Arrows<br>Blow Guns | PS.PS2.1<br>PS.PS2.1 |

**Forensic Science**

Although not a standard elective in most schools, Walnut High School offers forensics as a science elective. This course provides non-native and Native American students another opportunity to delve into a science field not common in typical science classrooms. Mr. Roth, Walnut High School, explained that he invites the county sheriff's department every year to speak to the students about fingerprinting, investigations, blood spatter analysis, DNA analysis, and identifying types of evidence. Culturally relevant issues that are incorporated into the class include ethnic differences in fingerprinting, blood type, and hair samples. Native Americans have distinctive hair, basically straight hair, but what about distinctive fingerprints? Distinctive blood types? An activity the students engage in during this lesson is fingerprinting. He has all the students take their prints, shuffle them, and they must find out which set of cards go with

each student. He mentioned, "A further analysis project that he could incorporate culturally responsive teaching is analyzing hair samples." Throughout this discussion, he realized that Native Americans have exceptional artistic abilities. Pencil sketch artists (composite artists) still play an integral role in forensic science. Mr. Roth delighted in the idea of incorporating this aspect of forensic science in the future to his Native American students. Although an elective, forensic science includes numerous areas associated with DNA analysis and genetic codes.

***Table 9: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Forensic Science***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mr. Roth | Walnut High School | DNA Analysis | B.LS4.1 |

**Biology—Ecology**

Ecology has been implemented in culturally responsive teaching in three different schools. Mr. Roth, Walnut High School and Mr. Brown, Cypress High School, incorporates Native American culture into the population ecology unit. Mr. Roth discusses with his class the history behind the Trail of Tears and its effects on animal behaviors. During the Trail of Tears, Native American Indians were moved from one geographic area to another over a period of time. Discussions surrounding issues include the population of specific animals and their habitats in their original environment, along the Trail of Tears, and their final destination in Oklahoma. Mr. Brown explained that:

> Many of these areas exhibited overpopulation of deer, rabbit, and squirrels because even though white settlers came in, they weren't necessarily hunters, so they had to be taught. The animal population was overpopulated because they weren't being thinned out naturally by their predator, the Native people.

He also explained that:

> The Native American culture did not waste anything from the animals they hunted. Bones were used to make jewelry and tools; hides were used to make tents and clothing, and meat was used for food. What they didn't use, they dug a hole and buried it to return it back to Mother Earth.

Mr. Roth and Mr. Brown spend adequate time talking about animal behaviors and population as it relates to the Trail of Tears. They both explain that many of their students don't know the complete history of the Trail of Tears, so this lesson connects rich cultural history with the effects that it had on the animal population.

Ms. Davis, Cedar Academy, also recognized the benefits of incorporating cultural heritage in her ecology unit. She states that:

> I could easily incorporate ecology into my science curriculum, specifically population ecology. Since animal habitats are included in my standards, the students could easily learn about animals distinctive to the geographical area of Native American tribes such as buffalo, bison, deer, squirrel, and coyotes. With the Trail of Tears movement, overpopulation is a topic that could easily integrate culturally responsive teaching into my science class.

Although she has not taught this yet, she realized the opportunity to engage the students in a topic that could resonate with them and provide a more in-depth understanding of their heritage.

**Ecosystems**

Ms. Miller, Cedar Academy, incorporates Native American research/culture into ecosystems and the biomes unit. In her classroom, the students choose an animal, research the animal, and build the ecosystem specific to that animal. Students are given the choice to choose an environment from their tribal area or research other tribes and/or geographic areas. Students are either provided the materials needed to construct the ecosystem or they can collect the materials from their homes. The projects are placed on display with informational posters for other students and classes to view.

Ms. Johnson, Cedar Academy, explained that she has never integrated culture with ecosystems but realized that it would be an excellent lesson for her students. Discussions of a collaboration on this project with Ms. Miller occurred during the interview. Ms. Johnson was eager to plan and implement the lesson. She fears that most of her students don't have much knowledge of the Trail of Tears as well; therefore, this is a chance to introduce history into her science ecosystem lesson as well as lead into a lesson on population ecology.

***Table 10: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Biology: Ecology***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Ms. Roth | Walnut High School | Population Ecology | B.LS2.6 |
| Mr. Brown | Cypress High School | Population Ecology | B.LS2.6 |
| Ms. Davis | Cedar Academy | Population Ecology | B.LS2.6 |
| Ms. Miller | Cedar Academy | Ecosystems | B.LS2.6 |
| Ms. Johnson | Cedar Academy | Population Ecology | B.LS2.6 |

**Biology—Botany**

Botany has presented itself as an excellent disciplinary area to incorporate cultural lesson activities into the curriculum. Mrs. Edwards, Pine Tree High School, is Native American and explained that she has successfully incorporated her personal cultural experiences into her botany classes. For example, she discusses and teaches the Native American's cultural and historical practice of using blowguns as a hunting weapon in her science classes. Blowguns (also called blowpipe or blow tube) were used by Native American Indian tribes as weapons utilizing poisonous darts and arrows. A blowgun is made from a hollow tube of cane or reed and used as

a weapon for firing arrows or darts. Blowguns get their name from the person blowing into the river cane tube to force the arrow or dart out (Figure 11). She incorporates this piece of culture into her botany class when they discuss plants, specifically river cane. She explained that blow guns are constructed from a long piece of river cane. River cane grows thick and very fast like bamboo. Within each section of the cane, or node, it is solid in between; therefore, requiring a hot metal rod to burn out the nodes. She explained that:

> Originally, Natives used hot rock to push it through and burn out the nodes. If the cane wasn't straight, you could either heat it across the fire and press it against your leg or hang it with a rock weighted at the end.

Although this lesson was used in botany, Mrs. Edwards and I discussed how this activity would be an excellent cross curricular lesson in physics. Physics aspects would include projectile, angles, construction, force, to name a few.

***Figure 11: Blow Guns. Notes From the Frontier. Twelve Native American Weapons*. 2020. *https://www.notesfromthefrontier.com/post/twelve-native-american-weapons***

Mrs. Edwards explained the importance that plants played in food use, medicinal use, fabric use, and fabrication use (Figure 12). She designed a cooking class because they were

studying plants. Her students went and collected different plants that the Native American community would eat. Such items included wild onions, walnuts, chickweed, berries, water crest, poke, shepherd's purse (was used as a seasoning), and sassafras (which she explained has been discouraged because of evidence of kidney problems). These are all common Native American plants general to all geographic tribes; however, "Native American Indians would use any and all plants that were plentiful in their specific area." Mrs. Edwards explained that "this area is what I know, and my students know". When she brings in a plant sample, they talk about the veins, for example, poke. She explained that:

> When it is being prepared to be cooked, you must boil it once, rinse it off, and boil again because of the chemicals that it contains. Don't go out and gather and boil and eat like it is, or you will have digestion problems. The chemical in poke is so potent. The berries are poisonous. I can't tell you how many kids have stained themselves horribly from playing with it. That is a lesson.

Plants also have been known for its medicinal uses such as sassafras. Although it has been shown not to be good for your kidneys, Mrs. Edwards relayed that she "remembers drinking that tea when I was a young girl." Her mother would gather it up, make a little bundle, cut it in pieces, wrap in string, and put in hot water. Incorporating her personal experiences into her classroom lessons has proven her as a credible and reliable resource for her students to gain insight into authentic Native American history and culture. She explained that the students enjoy these activities and reiterates the importance of making strong connections between science and their culture. "These are the lessons they will remember most, more than just a lecture." Examples of plants and herbs used for medicinal and food use are provided in the figure below (Figure 12).





***Figure 12: Plant use in medicines and food use in Native American culture. Photos taken by the author at The Museum of Native American History in Bentonville, Arkansas.***

***Table 11: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Biology: Botany***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mrs. Edwards | Pine Tree High School | Materials: Blow Guns | EN.ESS3.2 |
| | | Plant use: Medicinal | EN.ESS3.2 |
| | | Fabric | |
| | | Food | |
| | | Fabrication | |

**Biology—Genetics**

DNA, genetics, statistics, and diseases are topics in biology that lend themselves nicely to culturally responsive teaching. Mr. Brown, Cypress High School, utilizes biology statistics to discuss Covid-19. He retrieved data from the government website for discussions with his biology class. These discussions included identifying different ethnicities and Covid-19 rates. They looked at infection and death rates among Native American Indians, white, African Americans, Hispanics, women, and poverty range. The students were then required to write a discussion paper referencing any of the areas that related to them. He also delved into heart disease and diabetes, which are both prevalent in minority communities, discussing diets of today as compared to the older cultures/Native Americans. He explained that "the older Native culture diets consisted of fruits and vegetables, no processed foods, no fats, ate less and only what they needed to survive." This leads to much discussion that is all too relatable to the students and their families. Although the staggering statistics regarding health issues is common knowledge among Native American people, Mr. Brown wants his students to dig deeper into causes, solutions, and ultimately change.

Mr. Roth, Walnut High School, also discussed the Native American's history with smallpox in his biology class. He explained that:

> When the Europeans arrived carrying germs, the Native American population had never experienced such diseases as smallpox, measles, or the flu. Smallpox is believed to have arrived in 1520 on a Spanish ship sailing from Cuba carrying an infected African slave. As soon as the ship landed, the infection devastated the Native American colonies killing an estimated 90% of the people. It is also believed that the U.S. Army issued blankets laced with smallpox to decimate the Native American population in the late 1700's.

Mr. Roth explained that most of his students didn't fully understand the nature of the devastation that ensued that greatly impacted the Native American people. This history lesson is an excellent

introduction to his unit on DNA that allows his students to engage in an area of science that directly affected their communities and families.

Diabetes, liver condition, and heart disease are prevalent in Native American Indians; therefore, heritage in biology could have a large impact on awareness, treatments, and advocacy in science environments. Mrs. Jones, Walnut High School, expressed her desire to tap into this realm. She explained that "my neighbor is Choctaw and one of my students. Her stepdad recently lost three toes to diabetes." An ongoing battle for many Native Americans, she realized that many students may not understand exactly what is happening, side effects, and symptoms. All the students would know someone who is diabetic and/or diabetic and Native American. This unit could easily lead to population analysis, a topic she teaches in ecology with animals. She also explained that she "has a Native American girl who suffers with Rheumatoid arthritis that is losing eyesight. As a Native American female, could this be related? Could this be a symptom of diabetes?" Mrs. Jones explained:

> Culturally responsive teaching is showing me another way to relate to the kids. We are about to discuss cells, which will lead to talking about cancer. Some of them have lost relatives to cancer, it may be emotional for them, but maybe they can see what this could mean to them in the future. Is this genetic? Environmental? Although culturally responsive teaching is not specific to Native Americans, it can relate to all students, all ethnicities to educate them, make them more empowered and allow knowledge that will give them direction in the future and give them some way to contribute.

Mr. Brown, Cypress High School, expressed a more in-depth study possible in genetics to include diabetes, alcoholism, and depression. Digging into the DNA genetics of the topics could lead to understanding of culture, genetics, hereditary genes, to name a few.

Ms. Anderson, Pine Tree High School, takes a different approach to teaching diabetes in her genetics unit. She collaborated with the Native American History teacher to develop a

website that looks at traditional Native American foods compared to the diets of today's Native American population. She described the project as:

> The students kept a food diary which was compiled into a data document and analyzed. The students had total control of the project designing, creating, and analyzing all facets. The students created categories of healthy and unhealthy diets. They also looked at different food recipes for traditional foods and connected it to specific tribes. The end goal of the project was to provide a tool available for students to recognize sugar problems in Native Americans as it relates to diabetes, looking at past diets with natural foods to processed foods eaten today and how that has impacted their health.

This project led the students to research recipes and look at the content of the recipes for protein and carbohydrate sources. This is something she is wanting to pursue further and more in-depth in her honors biology course.

Ms. Anderson and Mrs. Edwards, Pine Tree High School, both discuss genetics as they look at DNA testing. Mrs. Edwards discussed with her class the differences in sibling genetic variations such as hair and skin color. Ms. Anderson researches a little further into genetics. Her students discuss the popular DNA tests as she uses her own family as an example.

***Table 12: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Biology: Genetics***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mr. Brown | Cypress High School | Genetics | B.LS4.2 |
| Mr. Roth | Walnut High School | Genetics | B.LS4.2 |
| Mrs. Jones | Walnut High School | Genetics | B.LS4.2 |
| Ms. Anderson | Pine Tree High School | Genetics<br>Genetics: DNA | B.LS2.8<br>B.LS3.1 |
| Mrs. Edwards | Pine Tree High School | Genetics: DNA | B.LS3.1 |

**Computer Science**

With the emergence of computer science courses, it has become a necessity not only for school courses but for graduation requirements as well. With such grants as AISES and Impact Aid, schools have been given the chance to offer this opportunity to all students but has had a profound effect on females in computer science. Mr. Baker's computer science class (Dogwood High School) was made possible through the AISES grant and has led to utilizing scratch coding in his curriculum. His curriculum specifically incorporates cultural relevance into their projects. He explained that they are coding an animation project that will require the students to find a story, preferably culturally relevant to them. He encourages them to ask an elder or family member for a family story rather than just looking it up online. They will then code the project using that story. This is a great way for the students to learn their ancestral history, and for the teachers to learn about their students. Ms. Porter, Dogwood High School, explained that:

> Even though they are all mostly Cherokee, they will all have a different story to tell. This project is a great way for the teacher to connect with these students on another level. The students also learn from their peers too. Since not all students in this school are of Native heritage, this allows for all cultures, besides Native American students, to learn their heritage, learn to code, and learn about their peers' culture.

Mr. Williams, Dogwood High School, described a recent computer science lesson involving virtual reality (VR), more specifically engage Virtual Reality (VR). Engage VR is a social meeting space where you can host conferences or meetings to connect with people in VR. He explained:

> As an advanced computer science project, we are building a VR lesson world where you can learn about Cherokee culture on any topic. My students are building the technology side and another teacher who teaches Cherokee language is providing the cultural aspects, the bulk of the project. Our starter project is the evolution of the Cherokee words for vehicle. Vehicles started out like a wooden wheel, two-wheeled cart like a chariot type vehicle. There is a specific Cherokee word for that. The evolution is now instead of a wooden wheel, it's a wooden wheel with a rubber coating, so now they have a word for that. In the early 1900's, they came out with a vehicle with big headlights.

> Since Cherokee is a descriptive language, they have a word that means "big eyes". Evolving into a two-seater, there is a Cherokee word that means a vehicle with a front row and a back row. If you build the world and you are going to navigate that car, you are at the corner of whatever this street is and that street is; therefore, there is a Cherokee name for that as well. A year ago, they started the VR projects and built a Cherokee village from a trapper's sketch from the 1800's that came from a Cherokee resource. My students built that off the trapper's sketch, so now they can get into it and view a Cherokee village pre-colonization.

A few other projects Mr. Baker and Mr. Williams have incorporated culturally responsive teaching into the curriculum include internet searches for basic computer science classes, LiDAR (Light Detection and Ranging), engage VR with stickball, Arduino projects, and LED matrix. Cherokee nation has funded a grant that will provide Dogwood High School with the LiDAR technology. The students can look at aerial shots of where they live now and what it looked like in a different time, back in their ancestral times. Mr. Williams collaborated with a local media network camp in conjunction with an engage VR project. They invited guests who taught them the cultural game of stickball (Figure 9). Stickball is the Native Americans version of a popular American game called lacrosse. Stickball is most played by the Cherokee Indians as they were the first Native tribe to play consistently. The objective of stickball is to get a "tiny, walnut-sized, leather-covered ball through a goal using sticks shaped like tennis rackets" (Anderson, 2006, para. 1) in any way possible with no time limit, no time-outs, or substitutions. The guest speaker recorded in engage VR explaining what stickball is, what the poles look like, and was able to put a scale on the ground for the scoring. The students built a stickball arena directly from these descriptions with the result being able to play in VR. Although it didn't allow the flexibility to put physics in the lesson, the students were able to simulate it by grabbing an object that looks like a ball and push a thumb toggle to push it away from you. They were able to simulate a throw and follow the arc down. Mr. Williams mentioned that they do have another platform where they can build the physics into it. Within the LED matrix lesson, students were

able to take a Native design and program the LED matrix like a bead belt or program a pattern for a bead project.

Smaller scale computer science lessons in Ms. Miller's class, Cedar Academy, include individual research of their tribe and creating a "pic collage". The students downloaded pictures of their culture, arranged the pictures into the collage, researched, and presented their research.

Computer science has become an emerging theme in schools not only for the computer skills and technology, but to incorporate the concepts with real-world applications. Many of the computer science lessons have also shown to be an excellent opportunity for cross curriculum studies with the science departments.

***Table 13: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Computer Science***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mr. Baker | Dogwood High School | Coding<br>LIDAR<br>Arduino | *See Below |
| Mr. Williams | Dogwood High School | Virtual Reality<br>LED Matrix | |

*Standards met include: L2.AP.M.03, L1.AP.PD.03, L2.AP.PD.03, L1.IC.C.01, L1.IC.C.02, L2.IC.C.03, L1.IC.SI.01

**Chemistry**

Chemistry seemed to be a difficult discipline to incorporate culturally responsive teaching. Through much discussion with science teachers, several topics emerged. Mr. Brown, Cypress High School, explored the idea of looking at the chemical makeup of insulin as well as different paints, specifically face paint, artist paint and pigments relative to Native American culture. Although this lesson would present itself as a research project rather than experimental,

Mr. Brown thought that the students would enjoy a project that would integrate the arts into the science curriculum. This is an area that is seldom incorporated into science classes that he is eager to explore.

Although Mrs. Edwards talks about poke in her botany class, we explored the idea of the chemical makeup of poke as an excellent chemistry experiment. This lesson could be created utilizing the numerous plants that are discussed throughout the year.

Ms. Anderson, Pine Tree High School, identified chemical components of tobacco use as a possible culturally responsive teaching lesson since tobacco is commonly used for ritual purposes as well as a large income source for many Native American families.

Ms. Anderson also brings in a guest speaker each year from the environmental office with the Cherokee nation to talk about radon and the dangers of it. Radon tests are performed on any Cherokee Nation member's home, and they have tested the school on occasion. Ms. Anderson noted that this could lead to investigating lead poisoning in Native American homes. She explained that:

> We have a housing authority that has built those homes for years. I wonder if I could get with them and find out what years they built the homes, what safety standards were in place at that time, what they do now, and if people are still living in the homes built before the new standards came out. We could also look at asbestos in reservation homes.

***Table 14: Research Question 1:*** *What science topics do teachers of Native American students report teaching in culturally responsive ways?*

***Chemistry***

| Teacher | School | Lesson Topic | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mr. Brown | Cypress High School | Chemical Composition | CH.PS2.6 |
| Mrs. Edwards | Pine Tree High School | Chemical Composition | CH.PS2.6 |
| Ms. Anderson | Pine Tree High School | Chemical Composition<br>Chemical Testing | CH.PS2.6<br>CH.PS1.1, CH.PS1.2 |

## Strategies that Engage Native American Students

### Educational Trips

Educational trips cultivate student outcomes in education as well as increase students' lasting success. Educational trips inspire students and allows them to experience the world beyond the classroom. Students are much more likely to remember a group project, a guest speaker, or an educational field trip from their classes. These experiences oftentimes spark a passion or curiosity and guides a career choice (Behrendt & Franklin, 2014). Numerous teachers in the study were afforded the opportunity to take their students on educational trips (Table 15).

Mrs. Jones' science class (Walnut High School) visited and toured the Pensacola Dam that was constructed for the purpose of hydroelectric power generation. Students were able to learn how energy is created through hydroelectric power as well as the difference between renewable and non-renewable energy. Students were also able to observe engineering careers associated with designing dams, how dams are constructed, and the environmental impact through the creation of dams. This field trip meets Oklahoma Academic Standards for Science in Physical Science, Energy (PS3), PS.PS3.3 which states, "Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy".

Ms. Smith's (Walnut High School) students tour the National Cowboy & Western Museum in Oklahoma City each year during the Cherokee holiday. At the museum, students observed original Native American history cultural artifacts such as cradleboards, baskets, and bead work. They also participated in the stickball game. Ms. Smith explained that "very few students knew of stickball beforehand." Her school collaborated with the Cherokee Nation to fund this trip. Ms. Smith teaches the elective class, Native American Studies. She explained that

this field trip enhanced knowledge discussed in class. She discussed the planned visit to the First Americans Museum in Oklahoma City for future references and cultural heritage.

Ms. Davis's (Cedar Academy) science class visited and toured the Choctaw Nation headquarters. This opportunity allowed the students to learn about the Trail of Tears, observe dress in Native outfits, watch presentations on shooting a bow and arrow and blow guns, how Native American food was made, and how Native American bowls were constructed. This field trip was culturally based and designed specifically to enhance their cultural knowledge.

Cedar Academy takes their students annually to pow wows. A pow wow is a social gathering held by Native American tribal communities. More currently, this event includes exhibition dancing, competitive dancing, singing, socialization, and cultural exhibits. Cedar Academy's dedication to field trips fosters the cultivation, preservation, and maintaining the cultural identity of their Native American students.

Ms. Anderson, Pine Tree High School, took a group of students to a reservation in South Dakota to volunteer for a week and learn about a different Native American culture. The students were able to meet elders in the community and look at their beading and artwork. Although Ms. Anderson is a science teacher, her students are majority Native American, so they were able to identify with their culture on a much deeper level. This field trip was funded through a grant for Native American students as a cultural activity.

Although educational trips have shown beneficial in conjunction with classroom learning, funding tends to remain an obstacle for teachers. Evidence has proven the advantages of learning beyond the classroom and the profound effect on career interests (Behrendt & Franklin, 2014).

***Table 15: Research Question 2:*** *What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?*

**Strategies—Educational Field Trips**

| Teacher/School | Cultural Trip | Lesson | Oklahoma Academic Standard for Science |
|---|---|---|---|
| Mrs. Jones/Walnut High School | Pensacola Dam | Energy | PS.PS3.3 |
| Ms. Smith/Walnut High School | National Cowboy Hall of Fame | Native American Culture and History | |
| Ms. Davis/Cedar Academy | Choctaw Nation of Oklahoma | Native American Culture and History | |
| Ms. Anderson/Pine Tree HS | South Dakota Reservation | Native American Culture and History | |
| Cedar Academy | Regional Pow wows | Native American Culture and History | |

**Guest speakers**

Guest speakers bring an additional benefit to the classroom curriculum. Students can hear experiences, engage in career interests, see tribal artifacts, and learn from professionals of experts in their fields. These experiences are unique and can't be learned from a textbook (Leor, 2015). Guest speakers can be utilized for several reasons to include student interactions, career opportunities, activities, to enhance course curriculum, and to experience different cultures and lifestyles (Education and Employers: Speakers for Schools, 2019). Many teachers in this study utilized this resource to enhance the curriculum (Table 16).

Ms. Smith, Native American Studies at Walnut High School, invited a guest speaker to discuss hepatology, an area of medicine that focuses on diseases of the liver. At the time of the guest speaker, she did not realize how relatable this disease is to the Native American community. Although the opportunity was missed at this time, she recognized the importance of bringing the guest speaker back to discuss this narrative with the students. Ms. Smith also

recognized that this topic and guest speaker would be an excellent opportunity to collaborate with Mrs. Jones during her unit on genetics.

Ms. Smith invites Cherokee story tellers to come into her classroom while the students are working on their Native American pottery, effigy pots. She also brings in Cherokee elders to cook Native foods. Traditional Native American foods include grape dumplings (traditional Cherokee food), squash soup, and three sister soup. She invited a Cherokee elder who brought traditional Native tools and weapons made from natural materials (rocks, turtle shells, and sticks). He displayed tools, kitchen items, antlers, and weaponry made out natural elements. He also discussed with the students what type of rawhide is best for each tool, what type of sticks to use, what type of wood (pine is not sustainable) specific to each tool, what antlers were used for, and materials specific for bow and arrows. Ms. Smith recognized the connection to physics and environmental science and was excited about the possibility of collaborating with the science departments for future visits from the elder.

Mr. Roth, Walnut High School, brings in the county sheriff's department and investigators to talk to the students about fingerprinting and forensic science. The ability to connect with experts in the field is a valuable resource for the students not only for the wealth of knowledge that it brings, but for the possibility of unlocking a potential career choice that wasn't previously considered beforehand.

Mr. Brown, Cypress High School, brought in a former Native American student who is now a practicing medical doctor. He discussed with the students the stigma of being Native American and the challenges he faced. He encouraged and motivated students to further their education and served as a role model for Native American students. He also discussed financial

support, educational guidance, and tribal assistance. Mr. Brown expressed the necessity of Native American students to see people like them succeeding.

Ms. Porter, Dogwood High School, brings in engineers each year to talk to the students about career paths. This has piqued student career interests and has led to students becoming excited about the possibility of engineering as a career. She explained that although she is educated, these are experts that have more to offer her students in terms of information and real-life career experiences.

Ms. Anderson, Pine Tree High School, has a guest speaker come in and talk to the students about native plants and the medicinal use for them. She also utilizes the benefits of the Cherokee Nation in her science classes. Cherokee Nation's environmental science office visited her chemistry class and talked about radon testing and the dangers of it in homes. They discussed potential problems from Native American homes that were built before current safety standards. Their office services 14 districts with tests conducted on any Cherokee Nation member's home. She believes that bringing in real world applications into the science classroom not only enhances the content knowledge, but when applicable to their specific lifestyles makes learning more personal. This contributes immensely to the content, their cultural history, and to the possibility of sparking a new career interest. She also has an elder come in and talk about native plants in her biology class. She invites various health care professionals to speak in her classroom as role models, not necessarily tied directly to the curriculum. She explained that:

> I think guest speakers make a personal connection for them and brings another aspect into it besides just the science field. I think it makes it personalized for them. Does it make them become a scientist, chemist, or a doctor; I don't know. But it may help them appreciate the sciences more.

***Table 16: Research Question 2:*** *What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?*

**Strategies—Guest Speakers**

| Teacher | School | Guest | Lesson |
|---|---|---|---|
| Ms. Smith | Walnut High School | Medical Doctor | Diseases |
| | | Cherokee Storyteller | Effigy Pots |
| | | Cherokee Elders | Native Foods |
| | | Cherokee Elders | Tools and Weaponry |
| Mr. Roth | Walnut High School | Sheriff Department | Forensic Science |
| Mr. Brown | Cypress High School | Medical Doctor/ Native American graduate | Careers |
| Ms. Porter | Dogwood High School | Engineers | Careers |

**Collaboration with the community**

Much like having guest speakers in the classroom, collaboration with the community offers a level of opportunities above and beyond the textbook. These extra experiences identify additional expertise that enhances the classroom curriculum. Collaboration builds relationships with the school and community as well as builds connections between community members and students (Gross et al., 2015). Several teachers in the study were able to collaborate with members of the community to offer an additional experience to enhance learning (Table 17).

Ms. Porter and Mr. Williams, Dogwood High School, collaborate with the American Indian Engineering and Science Society. As mentioned previously, this collaboration is responsible for teacher positions, computer science courses, materials, and professional development. Mr. Williams collaborates with a special media network camp on projects in his computer science classes. This collaboration brought in professionals to teach the students about Native American culture, specifically stickball, as well as the technology expertise imperative for the project. He also collaborates with the Cherokee Nation of Oklahoma through a funded grant

that provides his students with LiDAR technology. This technology is used to view aerial pictures/videos of their communities now and back in the ancestral times.

Ms. Davis, Cedar Academy, collaborates with the University of Oklahoma geology department. They came into her environmental science/earth science class and brought a classification of rock lesson. They were able to supply every student with a bag of rocks with an identification page. Upon discussing this activity, she realized the potential for a culturally responsive teaching lesson relating arrowheads and Native American cultural use of rocks for tools, weapons, and kitchenware.

Ms. Anderson, Pine Tree High School, has a former student who is currently in the doctorate program at the University of Oklahoma. His interest in nutrition and diet led him to create the community garden in town. Although not yet confirmed, she is actively seeking his collaboration with her diabetics/genetics project in the future.

***Table 17: Research Question 2:*** *What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?*

**Strategies—Collaboration with the Community**

| Teacher/School | Community Member | Lesson |
|---|---|---|
| Ms. Porter/Dogwood High School | American Indian Engineering and Science Society | Teacher employment<br>Computer Science<br>Materials<br>Professional Dev. |
| Mr. Williams/Dogwood High School | American Indian Engineering and Science Society | Teacher employment<br>Computer Science<br>Materials<br>Professional Dev |
| | Media Network Camp | Virtual Reality |
| | Cherokee Nation of Oklahoma | LiDAR |
| Ms. Davis/Cedar Academy | University of Oklahoma geology department | Rock lessons |
| Ms. Anderson/Pine Tree HS | Former graduate, current doctoral student at the University of Oklahoma | Nutrition/dietitian |

**Challenges associated with Strategies**

Although a powerful tool for classroom engagement, teachers have expressed challenges associated with community involvement. Most professional community members are not financially able to take time off from work during the day to come into classrooms. Many have expressed that time to fully commit as a collaboration partner has been a dilemma. Former students have expressed that time and money for travel and leave of absence from their jobs as a difficulty in collaboration efforts.

## Common Themes

The interviews and surveys revealed common themes teachers experienced working in a majority Native American School. Due to the broad range of commonalities collected from the data, the common themes were further categorized into subcategories and organized accordingly and provided in Table 18 below.

***Table 18: Research Question 3:*** *What common themes do teachers identify related to teaching in a Native American student populated science classroom?*

| **Common Themes** | |
|---|---|
| Factors that Influence Science Teaching | Teacher motivation and encouragement, family financial distress, poor living conditions, poor nutrition, poor technology capabilities. |
| Native American Ethnicity/Identification | 11/14 teachers identify as Native American, Native American role models. |
| Classroom Challenges | Time management, priority, state testing, funding, difficulty in relating the topic to culture, reading, math, and vocabulary deficiencies, lack in resources, lack of cultural knowledge. |
| Family Life Challenges | Poor living conditions, poor nutrition/diets, lack of technology, low economic status, lack of educational value in the home, lack of parental interaction. |
| Personality Traits/Characteristics | Quiet, no eye contact, patience leads to trust, |

*Table 18 (Cont'd.)*

| Common Themes | |
|---|---|
| Personality Traits/Characteristics | reserved, withdrawn and not outspoken, low self-esteem/confidence, lack of student interaction. |
| Teacher Training/Professional Development | 3/14 reported diversity training, all 14 teachers reported no in school professional development, all 14 teachers reported a necessity for additional training and resources. |

**Factors that Influence Science Teaching**

Influential factors identified during the survey and interview process revealed an exceptional level of motivation and encouragement towards the students to ensure aspirations of success and achievements well beyond the classroom. Although teachers aim for success in their students, they are all met with classroom and family struggles evident across all geographic areas in Oklahoma. Mr. Brown, Cypress High School, sadly discussed the dire financial situations of many of his students. Most with poor living conditions, less than ideal diets, and poor technology capabilities. Ms. Porter, Dogwood High School, emphasizes the endless career possibilities for her Native American students oftentimes directing them to tribal government assistance programs and counselors. On many occasions during the interview, she explained how she endlessly encourages and motivates the students to "want more" or that "they can be whatever they want to be."

**Native American Ethnicity/Identification**

Eleven of fourteen teachers interviewed identify as Native American. Ms. Porter, Dogwood High School, explained that:

> Having been raised in an area which is culturally diverse as well as being part of a culturally diverse family afforded me a great advantage when interacting with my students. Being mindful of the different backgrounds our students represent is the key to ensuring each student reach their full potential. If you aren't born here, gone to school here, experienced it, you don't understand what these kids go through. Looking at my

> own background, my grandad was educated at a boarding school in Oklahoma. They were raised to take the culture from them in a way that they thought helped assimilate them better. I can remember being younger hearing my grandad speak fluent Cherokee. We would be in town at the grocery store, and he would never speak Cherokee. I asked him why and his answer was it is not polite to talk like that. I think about that now and how the culture shifts; can you imagine someone's answer being that today?

Mr. Baker, Dogwood High School, is of Cherokee heritage and knows all too well the struggle kids face. As a young child, he grew up poor, survived on commodities, and lived in a home that Cherokee Nation built. By sharing this with his students, he relays the similarities to draw connections. Similarly, Mr. Wilson, Pine Tree High School, expressed that:

> Because of my Native American heritage, I believe that the students feel more comfortable having a Native American role model to look up to and that they can confide in. To me, it's just about building relationships finding something they can relate to.

Mrs. Edwards, Pine Tree High School, explained that she believes that for some kids it makes a big difference to see someone that looks like them. "Sometimes there is resistance against a non-Native teacher, but that's usually because of how parents have brought kids up."

**Teacher Motivation/Encouragement**

One common theme that was wonderful to hear from all the teachers was the sincere fondness and respect they have for their students. Mr. Brown, Cypress High School, recalled an issue that transpired with one of his students:

> Do your homework, get your education, because there will be a day you will regret you didn't take this opportunity and I'm not going to let that happen. Because I was once in this situation, I will never leave anyone behind. You may fall flat on your face, but I will be right there to pick you back up.

Ms. Porter, Dogwood High School, reiterated this sentiment:

> I just want our students to have the experiences to know they can do anything they want, and it would be great to come back here and apply all of that, and to feel like they can. I want them to know it's not unattainable. I don't do all of this because someone tells me I have to, I do it because I feel like this is home and this is "us" and I know they can do anything they want to do. Any of our students can.

Ms. Porter explained that with all the tribal hospitals and clinics here, their schooling would be paid for, and they could give back to the community. They ask her if they could actually go to school. Her reply, "Why couldn't you?" She recalled:

> As a student myself, I always thought if you wanted to go to school, you went to school. It didn't matter if you were native or not if your parents went or not. That's just your mindset. Now as I am older, and I have come back, I feel like maybe that's not exactly how it was. Maybe that was just my experience and my friends. What about these students I didn't know whose home life was different than mine and what my group of friends had?

Mr. Baker, Dogwood High School, believed that the kids get this mentality they "can't do this or that." He tells them, "I came from the same place that you did, and I did it so why can't you?" Because Cedar Academy is a boarding school, the students spend a lot of time with staff and administration. The superintendent has become a role model for many of the students. Being Native American himself, he knows and understands the challenges and struggles the students face. Ms. Miller, Cedar Academy, explained that they really look up to him. He lets them know that they have an "out". She emphasizes:

> What we say is hopefully your prayer would be that you instilled something that they could draw from later. Yes, they may end up back there, but at least for 6 years, they were ours and we were able to do something. They mean well and they want to do well, but oftentimes end back up in the same group.

Ms. Anderson, Pine Tree High School, explained that overall, they are telling the kids they can do it. She explained that:

> They grow up hearing they can't. You'll be back. We are telling them they can. Whatever path they choose you can do it. Just be productive and go for it.

Mrs. Edwards, Pine Tree High School, explained the importance of her students, especially female students, to see a Native American woman that looks like them teach a subject that is normally taught by men. She tells her students, "Your ancestors did not survive for you to be mediocre. You think about their struggle to survive, and you want to be worthy of that struggle."

Success stories are what ties us to the teaching world. It's what keeps teachers waking up every day to do the job that is sometimes exhausting. Pine Tree High School teachers have proven that effort and commitment to their students will pay off. They have several students who are now attending a vo-tech school studying Heating, Ventilation, and Air Conditioning (HVAC) training. Another student who is going to school for welding. One student attended Stanford and is now teaching English as a second language in Japan. One student just started medical school, two in optometry school, one graduate from Harvard currently applying to law school, and many who went in the nursing field.

Ms. Anderson reported that:

> We have a student at the University of Oklahoma who is working on his doctorate and wants to come back and work with the community. We have several at OU looking into Native American law. They want to come back and work in the tribe as a lawyer.

**Classroom Challenges**

Challenges incorporating culture into the curriculum garnered several common dilemmas, most notably time management. Mrs. Jones, Walnut High School, explained that you must make it a priority. The state prioritizes what she must get done and that it would require her adding it in to one of her other standards. "It wouldn't be that hard to do, but just have to do it" she stated. She also regretfully added that she has never thought about bringing in different cultures into the curriculum. Not just Native American, but African American or Asian cultures. She explained that:

> I never noticed until now that I usually just go through and teach the topics. I have an Asian student who does not speak in class at all unless spoken to. They are much quieter than my Native American students.

Ms. Anderson, Pine Tree High School, explained that biology has state tests and limits what she can teach. She stated, "You can incorporate some culture but it's very limited because you have

to get all this stuff in to prepare them for state tests." Ms. Smith, Walnut High School, stated that her greatest challenge is funding. Mr. Roth, Walnut High School, sadly expressed that it is all he can do to teach the content much less try to add in extra material; however, we did address the struggle related with culturally responsive teaching in chemistry. An overwhelming consensus among science teachers presented the same struggles in the chemistry classroom. Ms. Anderson, Pine Tree High School, agreed that chemistry is a difficult topic to pull in chemistry. Ms. Smith, Walnut High School, explained that chemistry is hard because it is a universal science, "elements are elements." Mr. Brown, Cypress High School, echoed that sentiment:

> I haven't been able to fit it in with chemistry. It has been perplexing to me. Chemistry is where we are all weak, and we need a lot more culture-based learning. I haven't been able to find any Native American relation to elements, chemists, or anything else.

Ms. Porter, Dogwood High School, explained that:

> What they usually do in chemistry is just instruction based where you must have the foundation to keep building. I use the curriculum and when I pull something new in, I'm not really thinking of anything culturally based. It's hard to incorporate culture into chemistry.

Cedar Academy struggles with academic challenges that inhibits them from teaching much science at all. Ms. Davis explained that they do not do a lot of science because they do so much reading. Reading and vocabulary are severely lacking in her students, so much that they only have science on Friday afternoons and even that is not a priority. So many of her students don't attend kindergarten. They usually begin school in the first grade and have never attended any type of schooling prior. She stated that reading standards are so much of a priority and so intense that most teachers in the school have a hard time delegating more time to science. Ms. Johnson, who teaches at Cedar Academy, restated this position. She clarified that they are pushed so much in teaching math and reading that they will only cover reading in science, specifically science comprehension. She stated that about two days a week they will try to read

science-based passages of some kind. She tries to do STEM every week but usually ends up occurring every other week. Friday afternoon is science day. "The students are so far behind in reading that the school pushes reading so much." Ms. Miller, who teaches 5th and 6th grade at Cedar Academy, supported these claims stating that her students' vocabulary is so limited. A lot of them are very behind because they miss so much school, and some may not even go to school. This presents the biggest barrier because it restricts them from a lot of stuff. For example, she explained that when she is preparing for state testing:

> We will say, analyze this or correlate this and they will not know these terms. They don't know the vocabulary to answer the state test questions correctly. I don't use normal spelling words at the beginning of the year. I use test words that they will see on the state test like inform or persuade and teach a lot of the test terms they are not familiar with or even heard of. I focus on vocabulary. It is so surprising to me that it is hard to understand that they haven't heard of these words, but I can't let that show because I don't want to belittle them since it is not their fault. Every chance I get if there is something that comes up, I will stop and ask if they have heard of that. Most of the time they haven't, and I will stop and give them an example they can relate to.

She said the students are interested in science and love watching experiments, but sadly they don't spend near the amount of time on it.

Lastly, an overall challenge is having the resources available for teachers. Ms. Anderson, Pine Tree High School, stated that there is not much out there for science. There is a local author who wrote a Cherokee story about how the world was made and some children's books but as far as movies, there's not much out there. Ms. Anderson added:

> What you will run into in public schools are teachers who are not Native American, and they aren't comfortable teaching something cultural because they don't know it themselves. Even Native American teachers don't know everything either but being Native American, I guess I am comfortable enough teaching it.

**Family Life Challenges**

At the beginning of the pandemic, Choctaw Nation of Oklahoma sent each Choctaw student a stipend of $600 to be used for technology, specifically computers and/or printers. Mr.

Brown, Cypress High School, heard that a few of the students found a loophole to return the items and get the cash. He shared this story with me:

> I had a Native American student who was failing. I had a conference with him and his mom. When I brought up the issue of the technology grant, he looked at me and replied that it was either buy a computer or eat, I chose to eat.

Heartbreaking to Mr. Brown and his wife, they purchased a laptop for him to use. This small act of kindness was very happily accepted by the student and began a special connection between student and teacher. This student is a Native speaker and has 5 siblings living in a home with a dirt floor. It is hard for most of us to believe that there is a still a world like this. Most of us take small things for granted; however, for a lot of Native American students, this is reality and the only reality/life they know.

Ms. Porter, Dogwood High School, explained some difficulties with a few topics we discussed that could potentially incorporate culture into chemistry. She added:

> Thinking of bringing in some of the "norms" in Native American homelife to use in chemistry classes such as nutritional value in commodities, I don't know how that would go over. Sometimes I pull back…. There are times when I know I can push them and say, yes, you can and then there's times that these students look at you and think we really don't know what is happening in their homelife. Sometimes we don't want to cross the line. If you aren't a product of living here, born here, raised here, and lived through it, you don't know when those pull back moments are. I think if you do overstep that line, then they will pull back from you. Some issues are too sensitive to bring into the classroom for everyone else to know about.

Ms. Johnson, Cedar Academy, shared what she has noticed in their homelife is that education is not valued. If they were at home, they wouldn't go to school half the time. The teachers preach to them about an education and about how important it is and then they go home and it's not important. She explained that:

> You get them on the right track, they go to college for a year or year and a half, and then they end up back home. They go back to what they know. I don't know how to break that cycle.

Ms. Miller, Cedar Academy, reiterated this sentiment. She believes that pulling in culture into the science classroom might provide an interest in science or have an impact; however, she said:

> The saddest part is their environment they go back to every time. Other teachers talk about several students who have graduated from the academy who have received scholarships for various abilities and were given opportunities and they go back to their home environment. They look at their home and it is normal to them. They have a house and food. They don't know any different.

Because most students don't go home over Christmas break, she brought her sewing machine and they made stockings. Some of them had either never had a stocking before or had even heard of stockings. She also put a Christmas tree up but noticed that the students did not pay much attention to it. She said this doesn't just happen one year, it's every year. She said that most of them come from bad situations, and she fears there is no tradition of Christmas like we have. They don't volunteer a lot of information and she doesn't ask them about it. Most people might look at this issue as somewhat dysfunctional, but it is normal for them because it is all they have ever known. She recounted a story about a student who had an individualized education plan (IEP) who needed a parent conference. When the principal called her mother, she answered the phone and denied she was the mother. Ms. Miller said that "if parents do not know the reasoning behind the call, they will not answer for fear of their child being sent back home." She said teachers are lucky if parents answer the phone during regular parent teacher conferences. Sadly, she related that she misses the interaction with the parents. Ms. Miller also expressed her frustrations when it involved the stigma the academy faces. She said everyone always asks why she works there because they think it's a foreign school or a juvenile detention type school for bad kids. She said she remembers being at the movies and the students would show up and she would hear the comments of "there are those Cedar Academy kids." For the longest time she thought it was a bad school where kids are sent to much like a bootcamp. As an adult now and

teacher at the school, she shared stories of taking the students on field trips where they are met with stares and whispers about the students. She gets defensive because she said, "they are really good kids, and they already have a hard time." The hardest part for her is knowing that these kids don't have a choice and they didn't choose their circumstances. "They are enduring bad situations in their homelife AND from people who don't even know them." She said, "it is sad, and you just really want to speak up for them." It is almost unbearable to hear the compassion she feels for her students. She concludes:

> I hurt for them because when I go to a restaurant, they don't do this to me. I wonder if the students noticed it and are just used to it or didn't pay any attention because they are used to it. It would definitely kill your confidence. I often wonder if this could be a reason for their mindset of not amounting to anything.

The pandemic proved very rough for the students and teachers. Cedar Academy was only able to house in-state students which was detrimental for the out of state students. Most of them did not have internet, so the school sent the students home with hotspots. Ms. Miller said that out of the 5 students who were homebound, she only had one who would answer the call. She explained that when he would call in through teams, even she was distracted by his surroundings. She said people were yelling, cursing, he had siblings crawling on his back, yet he was zoned in on the screen the entire time. "How he was able to drown all that out was beyond me. He was evidently used to it." Mr. Wilson, Pine Tree High School, echoed these same concerns. He said in the beginning of the pandemic, they made the students turn on their cameras, but many times the cameras would be pointed to the ceiling. Fearing the students might be embarrassed by their homelife, they decided against this rule. He described a time when he was at his previous school (high minority population), he would give students a ride home from athletic practice or games and witness their living conditions. One in particular had a hole through the wall of the house and you could see in the students living room where it wasn't

covered up. "Just poor living conditions." Mr. Wilson explained that Pine Tree High School ultimately decided that they just wanted the students to feel comfortable in a difficult situation.

**Personality Traits/Characteristics**

True to the literature in this study, the consensus observed by most of the teachers interviewed described Native American students as "quiet". Mrs. Jones, Walnut High School, explained one student who is "super quiet". She said if asked a question, the student will answer but otherwise she is not going to volunteer that information. She does believe that the more the students are around each other, the more comfortable they are with her. Ms. Porter, Dogwood High School, described a specific student that would not "look up" for the longest time. She never drew attention to that because she said this is common with Native American students. She believes that:

> What made him finally come around is the fact that I did not draw attention to him, and he knew I was not going to push him. It's not something that happened overnight but if you try to make it happen overnight or were just hard-nosed about it, he probably wouldn't have opened up.

Ms. Porter believes you must be patient and let them trust you and let them know that they are just as valuable as anyone else in the room. "In my experience, you can't treat them differently because there's this stigma, you just have to gain their trust." Mr. Wilson, Pine Tree High School, believes the characteristic of being quiet stems from their culture and how they are raised. Ms. Anderson, Pine Tree High School, explained they are quiet until they get to know you and that "they are reserved but once they are comfortable, some of them won't quit talking. Once you've gained their trust, they are comfortable with you." Ms. Davis, Cedar Academy, has observed them to be withdrawn and not outspoken. They will not tell you their emotions. She was not aware of this and believed that knowing Native American personality characteristics would have been helpful before teaching in this environment.

Ms. Johnson, Cedar Academy, said that it took her a while to figure out that when they do not make eye contact it is not being disrespectful. She explained that this is something she had to learn on her own and would have been helpful to know beforehand. Ms. Miller, Cedar Academy, also stated that eye contact is characteristic of her Native American students. She used to think it was disrespectful but has since realized it's just their culture and not anything personal. Her biggest challenge is interaction with the students. A lot of them don't have confidence to answer questions. When they are more comfortable with her, they will let their guard down and she can see a big change in their personalities and academic performance. In her previous school she said she "was used to kids coming up to her and hugging her, but they do not do that here." That was a big adjustment for her.

**Teacher Training–Professional Development/Continuing Education**

Out of fourteen teachers interviewed, three have attended conferences or received certification in diversity training, but all fourteen teachers reported that they have not attended any professional development in their schools pertaining to multicultural training or diversity education. All the teachers agreed that since these schools are majority Native American student populations, professional development opportunities would deem appropriate and beneficial for the teacher and the students' successes. Mrs. Jones, Walnut High School, explained that if you are from Oklahoma, you might have more understanding from the classes you took in high school (Oklahoma history or from elective classes).

> I grew up in Philadelphia, I went to Penn State. I didn't come here until I had been teaching for 5 years. I've not had any additional classes or workshops that would have adequately prepared me to make these extra connections with my students or the knowledge I would need to feel comfortable enough to incorporate culture. This is something I will educate myself on.

Mr. Roth, Walnut High School, explained that he recently finished reading the book, *The Killing of Sitting Bull"* by Bill O'Reilly. In the book, he talks about Native American culture in relationship to white men. This helped give him insight into some things his students might think, do, or believe. He mentioned that he is trying to understand where they are coming from.

Ms. Miller, Cedar Academy, explained that she learns a lot from the students themselves, but that she reads and researches information on the tribes of her students. She did not know very much about Native American culture when she first started at Cedar Academy, but upon arrival, had teachers who shared detailed information about what to expect and to not be surprised by specific characteristics.

Ms. Davis, Cedar Academy, expressed the role and importance that preparation plays in understanding and connecting with Native American students. She said there were some practices that she was not used to. For example, she did not know that owls are extremely superstitious to Native American people. At one time, owls were a popular decorative item that she had considered for her new classroom.

> I didn't, but things like that you don't know and would have been helpful to know beforehand. You don't want to be offensive. It's not intentional, you just don't know. These students have grown up immersed in their Native American culture, that's all they know.

Ms. Johnson, Cedar Academy, expressed that:

> If I could get resources, I would love to work on doing things a little differently increasing my knowledge so that I can pass that on to my kids. If there were resources of ideas, then we could all share them amongst teachers.

## Summary

The continuous effort of the participants in this study, their school's commitment for rich cultural history, and the extensive Indian education programs presented are indicative of above average state proficiency scores and graduation rates for Native American students in Oklahoma.

Although there were several teachers who acknowledged minimal knowledge of culturally responsive teaching, all teachers interviewed expressed the necessity of culturally responsive teaching in the classroom. Additionally, each school observation displayed and demonstrated rich cultural history and traditions embedded into the school and classroom environment. Eleven of fourteen teachers interviewed identified as Native American which allows them the ability to relate to the learning styles of Native American students and the potential to employ culturally responsive teaching techniques effectively. Three public schools with at least a 50% Native American student population participated in the study, Walnut High School, Dogwood High School, and Cypress High School. Two Bureau of Indian Education schools (100% Native American student population) participated in the study, Cedar Academy and Pine Tree High School.

Data collected was coded and analyzed according to grounded theory (Charmaz, 2006) and case studies (Yin, 2018). Each teacher served as a case study researched. Teacher surveys and interviews were transcribed, arranged in main categories via line-by-line coding, then further placed into subcategories through axial coding pursuant to the central research questions.

The interview stage highlighted numerous lessons that teachers are incorporating culturally responsive teaching into the curriculum. Some of these lessons included making teepees, discussing genetics, and relating health issues to the Native American cultural identity, DNA analysis, population ecology and the overpopulation of animals during the Trail of Tears movement, and computer science projects incorporating cultural history and traditions. These discussions led to a recognition of many science topics that proved to be exemplary culturally responsive teaching lessons and activities. Utilizing cultural traditions like the game of stickball, bow and arrows, and blowguns; cradleboards and teepees for physics lessons materialized into

future lessons. Incorporating foods and agriculture in environmental science was developed and planned. Understanding and acknowledging the culture of Native Students as well as applying culturally responsive teaching into the classroom contributes to a smooth transition to the school environment and science classes and develops a sense of belonging (Ladson-Billings, 1995).

Strategies in place at several schools that greatly enhanced the school curriculum and proved to increase Native American student engagement included educational field trips, inviting guest speakers into the classroom, collaborating with the community, collaborating with the Native Studies class, and participating in projects in the class. Educational trips to the National Cowboy & Western Museum in Oklahoma City and the Cherokee Nation Tribal headquarters were favorites among the students and Ms. Smith, Walnut High School, looked forward to continuing her museum visits at the First Americans Museum in Oklahoma City. Ms. Smith explained that "students take my class because they have heard from other students what we get to make in class and the trips we get to take."

Factors that influence teaching science in Native American schools revolve around the challenges faced by teachers and the students. If teachers are not aware of Native American culture, they could be faced with frustration, misunderstanding, and miscommunication. Certain characteristics like quietness, non-eye contact, and trust issues could potentially lead to the perception of disrespect and behavioral problems. Students are also challenged with discrepancies in their homelife and their school life. If education is not valued in the home, it will not be valued in the school environment. Students benefit greatly when they have Native American role models to motivate and encourage them as well as the familiarity and connection to their heritage.

Data collected through the survey and interview stages of the study confirmed the necessity of multicultural training and professional development opportunities. Although many teachers are incorporating culturally responsive teaching into their classroom, some are not, others recognized missed opportunities, while others immediately began processing and planning future lessons. Sufficient training in diversity education, specifically Native American culture, will lead to cultural awareness, implementation and improvement of culturally responsive teaching, guidance in specific strategies to enhance the science topic, and building a classroom conducive to cultural perception and practice.

# Chapter 5: Conclusion

## Overview of Research Study

The overwhelming lack of Native American teachers (National Centers for Education Statistics, 2017; Price et al., 2010) and lessons that incorporate the heritage of Native American students is evident in the overall educational achievement gap of Native American students across the United States (The Education Trust, The state of Education for Native Students, 2013; McCarty & Lee, 2014). The National Center for Education Statistics (2017-2018) reports the national racial demographic of teachers consist of "79.3% White, 9.3% Hispanic, 9.7% black, 2.1% Asian, 1.8% two or more races, 0.5% Native American, and 0.2% Native Hawaiian/Pacific Islander" (para. 3). The adjusted cohort graduation rate of Native American students is 74% compared to 89% of white students and the national average of 86% according to 2018-2019 NCES data. In fact, the Native American student graduation rate was below all other ethnicities reported. Of 50 states + the District of Columbia, graduation rates for each state for white students included 2 states reporting in the 70-percentile graduation rate, 26 states reporting in the 80-percentile graduation rate, and 23 states reporting 90 percentile graduation rates. Graduation rates for each state for Native American students included 4 states reporting in the 50-percentile graduation rate, 11 states reporting in the 60-percentile graduation rate, 15 states reporting in the 70-percentile graduation rate, 16 states reporting in the 80-percentile graduation rate, and 1 state reporting in the 90-percentile graduation rate (3 states reported no Native American student graduation rates). This research study focused on science teachers (and one Native American Studies teacher) in predominantly Native American majority schools in Oklahoma which reported a Native American graduation rate of 83%. The Nations Report Card in Science 2015 State Snapshot Report for Oklahoma (National Center for Education Statistics, 2015) reported

student performance in 8th grade for Native American students compared to white students showed a significant difference in achievement scores. These statistics show substantial evidence confirming the educational gap across the nation. This study aimed to uncover such inequities and what exactly teachers in majority Native American student populated schools in Oklahoma are doing to engage and motivate our Native American students and propel them to the next level of education. Due to the increasingly diverse classrooms recognized in the 1980's and 1990's, culturally responsive teaching became a popular form of teaching pedagogy focusing on bridging cultural traditions and the school environment (Pewewardy, 2003). Pewewardy (2003) and Powers et al., 2003 explain the crucial aspect of bridging the student's culture to achieve success. They argue that to effectively succeed at this task requires a level of cultural awareness and knowledge that is missing in high density Native American student populated schools where most teachers in public and Bureau of Indian Education schools are non-Native American teachers. Research has shown the effectiveness that cultural similarities play in the classroom (McCarty & Watahomigie, 1999; Erickson & Mohatt, 1982; Boon & Lewthwaite, 2016). When teachers and students share cultural identity, they can strengthen learning, build strong relationships, and enhance the educational experience (McCarty & Watahomigie, 1999; Erickson & Mohatt, 1982; Lopez et al., 2013). Therefore, this research examined and explored teachers' perceptions of teaching practices exclusive to Native American students, specifically culturally responsive teaching. The research consisted of interviewing fourteen teachers in five schools in Oklahoma focusing on the three main research questions:

1. What science topics do teachers of Native American students report teaching in culturally responsive ways?

2. What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?
3. What common themes do teachers identify related to teaching in a Native American student populated science classroom?

Because this research focused on culturally responsive teaching in majority Native American schools and the effectiveness of implementation, schools were chosen according to their Native American student population. Three schools reported 50% or more Native American student population and two schools reported 100% Native American student population. Initial surveys were sent to teachers to obtain information that would lead to more comprehensive interview discussions. Interviews were conducted in teacher classrooms to assess teacher authenticity, cultural observations, and for a more in-depth conversation with the teacher. Surveys were sent using Google forms and interviews were audio recorded for further analysis.

## Key findings

### Learning and Communication Styles of Native American Students

#### Personality Traits/Characteristics

Several personality traits of Native American students were identified by their teachers. Native students exhibit a quiet persona symbolic of their cultural upbringing which is sometimes coupled with not being outspoken. Lack of eye contact is another cultural custom experienced by teachers. Understanding that this trait is a deep-rooted custom of their heritage and by no means disrespectful allows the teacher less frustration and an increased level of patience for their students (McMahon et al., 2018; Powers et al., 2003).

## Importance of Incorporating Culturally Responsive Teaching

### Culturally Responsive Teaching

According to the national averages reported from NCES data, Oklahoma Native American student graduation rates rank in the 80th percentile range (83%) which is not too far below the national average of 86% and their white counterparts of 89%. The research aimed to uncover what science topics teachers are incorporating culturally responsive teaching into their curriculum to engage and motivate students. Much thought and consideration are put into the lessons the teachers discussed during the interview process and it is obvious that students are benefiting from these opportunities. Although not a science class, the Native American Studies class at Walnut High School is indicative of rich cultural history incorporated into the students' curriculum. Projects such as making effigy pots, teepees, and basket weaving are excellent activities that integrate the cultural heritage and science aspect of the lessons. An elective course taught at Walnut High School, forensic science, investigates DNA analysis and identifying types of evidence related to ethnic differences in fingerprinting, blood type, and hair samples. Numerous teachers incorporated Native American culture into their population ecology unit emphasizing the Trail of Tears journey. These lessons teach overpopulation of specific animals and their habitats from their original environment, along the Trail of Tears, and to their final destination in Oklahoma. Ecosystems and biomes were utilized integrating animal environments specific to their tribal geographic area. Scratch coding in computer science courses at Dogwood High School incorporated cultural relevance in numerous projects. For example, students were encouraged to obtain authentic Native stories from family members to code an animation project. Engaging virtual reality activities incorporated cultural language and history to build a virtual Cherokee village pre-colonization, evolution of a vehicle, and a stickball arena. Within the LED

matrix lesson, students were able to program a Native bead design for a bead project. Botany has presented itself as an excellent course to incorporate cultural lesson activities related to plants, specifically the importance plants played in food use, medicinal use, fabric use, and fabrication use. DNA, genetics, and diseases are topics in biology that several teachers discussed implementing in a culturally responsive teaching classroom. One project in particular combined genetics with the prevalence of diabetes in the Native American community. This project was taught in conjunction with the Native American History classes and proved to be an exceptional cross-curricular activity. Students developed and created a website that would provide a tool available for students to recognize the impact unhealthy diets contribute to diabetes in Native Americans.

**Strategies that Engage Native American Students**

Culturally responsive teaching strategies related to Native American students have enhanced and enriched the science classroom curriculum. Educational field trips to the National Cowboy & Western Museum in Oklahoma City, Cherokee Nation headquarters, pow wows, and a group trip to a reservation in South Dakota have proven to be exceptional learning experiences well beyond textbook and lectures. Students were able to view cultural artifacts, hear Native storytellers, and talk directly with elders. These experiences expose Native American students to cultural identity and heritage familiar to themselves and their specific surroundings. Guest speakers have also impacted students' educational and career aspirations. Inviting elders into the classroom to share rich cultural heritage and display traditional Native tools gave students the opportunity to meet the elders in a more intimate and safer environment. Many teachers collaborated with community members by inviting them to their classes. The county sheriff's department and investigators, former Native American students who are now professionals,

engineers, environmental science departments, and other community members have shared knowledge and insight for potential careers and student interests. Special interest groups such as AISES, media network camps, and the University of Oklahoma geology department have collaborated directly with teachers on classroom projects. These collaborations offer support to the teacher to enhance projects.

**Factors that Influence Science Teaching**

Influential factors observed by science teachers in different Native American tribal areas in Oklahoma include a notable level of motivation and encouragement from all teachers (Native and non-Native alike), Native American teacher and student identification, classroom and family struggles/challenges, common personalities and traits, and the level of preparation necessary for teaching in a high diversity school. Among all fourteen teachers, the devotion and passion for teaching students was witnessed across all tribal geographical areas and varying level of Native American student populations. Teachers who identify as Native American have emphasized the advantages associated with having such deep similarities to their students. The main argument pertained to personal experiences directly related to conditions and situations their students face. Teachers believe the level of comfort the students feel having a teacher of the same ethnicity leads to a sense of security and confidence otherwise not present. Incorporating rich cultural traditions, history, and heritage into the curriculum is optimal; however, all teachers interviewed stressed numerous challenges associated with the ability to meet this feat. Challenges revealed from all teachers included time management, lessons, and money. State testing requirements add extra pressure to prioritize specific content limiting potential culturally appropriate lessons (McMahon et al., 2018). Teachers also emphasized lesson ideas and activities related to culture are usually not in the forefront of their teaching resources. They stressed the need for a resource

(online site) that would be available for teachers to access. For teachers who don't possess a deep knowledge of cultural history, this resource would prove to be beneficial. Funding unfortunately inhibits planning of educational field trips, materials for projects, research materials, and lesson materials. Family challenges faced by all teachers included instilling a sense of educational importance. Many students are not able to break the cycle of their homelife and although may excel in the school environment, this does not cross over outside of the classroom.

### Teacher Training

Lastly, the lack of adequate preparation was commonly seen throughout this study. Of the fourteen teachers interviewed, only three had attended continuing education on diversity. All fourteen teachers participating in this study reported no professional development provided within the school system; however, they all mentioned the need and willingness to participate in future workshops. The knowledge level of culturally responsive teaching reported by many of the teachers was consistently low. Sufficient training in culturally responsive teaching could provide teachers with the appropriate tools to identify, create, and implement an effective lesson incorporating Native American culture.

## Reflections Relative to the Literature Review

### Native American Educational Statistics

Education not only prepares Native American children to become successful members of society, but also prepares them to become productive members within their tribal communities (National Congress of American Indians, *Education,* 2019; McCarty & Lee, 2014). Pine Tree High School has proven that there is a vital role in our communities for Native American people. With strong ties and close location to the Cherokee Nation, opportunities abound in the health

care profession, government positions, and higher education. Students attending Stanford, optometry school, Harvard, and the University of Oklahoma to name a few, are among the many success stories. Ms. Porter, Dogwood High School, boasts that many have stated the intention of coming back to their community to give back to the Native American peoples.

**Learning and Communication Styles of Native American Students**

According to Cajete (1999) and Morgan (2009) and others, to fully understand and diversify learning experiences for Native American students, teachers need to increase their knowledge of Native American behaviors, learning styles, and educational approaches. Because minority students' learning and communication styles don't always align with what is represented in the classroom, they tend to perform below the average academic levels, view school negatively, and tend to have disciplinary issues (Morgan, 2010; McCarty & Lee, 2014; Powers, 2015). This misalignment leads to misunderstanding between teacher and student often resulting in perceptions of disrespect, learning disabilities, and low expectations (Morgan, 2010; Powers, 2005; Powers et al., 2003). Such cultural values and associated behaviors evidenced by the data include quietness, patience, nonverbal orientation, and caution. Cajete (1999) states that quick response questioning and answering provokes extreme anxiety and pressure on Native American students and should be avoided in the classroom. Native American students will exhibit caution when proceeding with such learning strategies and will result in an all-too-common quiet behavior. Native American students with profound cultural values are taught to learn through observation and listening; not asking questions or analyzing situations (Garrett et al., 2003; McCarty & Lee, 2014). This oftentimes results in being labeled slow, uncooperative, or lazy (Garrett et al., 2003). Ms. Porter, Dogwood High School, reiterated this sentiment clarifying that if "you overstep a line, then they will pull back from you." Traditionally, Native

Americans prefer listening to speaking (Morgan, 2009). True to this literature review, the consensus observed by the teachers interviewed described Native American students as "quiet". Ms. Porter described a student that would not "look up" for the longest time. She addressed this by not drawing attention to it. Being of Native American culture herself, she understood that this is a common trait among Native American people. Several teachers observed this trait but learned that it's just their culture and not a form of disrespect. Furthermore, social interaction is a large part of American culture (Garrett et al., 2003). Without knowing this information, teachers might misidentify Native American student interest and classroom engagement. Exhibiting patience with the Native American student will result in trust and confidence for the teacher (Garrett et al., 2003).

**Importance of Incorporating Culturally Responsive Teaching**

The literature review focused on varying levels of acculturation for Native American peoples. While some Native Americans live an "American" lifestyle, others still live a traditional Native American lifestyle, but most fall somewhere in the middle (Price et al., 2010). The realization that Native American students still live in a world of dirt floors, no running water, and sustaining on commodities is unbelievable yet unfortunately all too common. Mr. Brown, Cypress High School, shared a heartbreaking story of a young Native American student in his class that was forced to choose between a prized technology possession and food, ultimately choosing to eat. This student currently lives in a home with a dirt floor. Ms. Miller, Cedar Academy, recalled mainstream American traditions such as Christmas as a nonexistent ceremony for her Native American students. Whether just not participating in this tradition or not having the money to be able to participate in the tradition was not explored by the teacher for obvious reasons. Ms. Miller said that she is bothered by the stigma the academy and the students

face. For example, comments made like "there are those Cedar Academy kids" and obvious stares and whispers must have a negative effect on their confidence in school and beyond. Not only are they experiencing a challenging homelife but are met with unfairness from people who don't even know them. Ms. Porter, Dogwood High School, explained that sometimes these students look at you and think teachers really don't know what is happening in their homelife. Although we have several spectrums of Native lifestyles, it seems that a lot of the public still regards Native Americans as a stereotype. Mr. Wilson, Pine Tree High School, described his concerns relating to the students' homelife. He said, "requiring the students to turn on their cameras during the pandemic seemed detrimental to student's educational success when faced with embarrassing conditions."

Researchers argue that there is a large difference between students' home and school environment, and all too often results in low success rates in the school environment (Cajete, 1999; Morgan, 2009; *Vistas Multicultural Issues in Counseling*, Parrish et al., 2012; Powers, 2005). Powers (2005) reinforces this sentiment and claims that although Native American children remain academically proportionate to their white peers through the lower grades, by the time they reach later grades, academic achievement lags by at least three years. She explains that this "crossover" effect is more than likely representative of the cultural discontinuity between school, family, the students' characteristics. The social context from which Native American students derive their frame of references also play a role in challenges Native American children face in public schools and will inhibit student performance (Morgan, 2009). Ms. Johnson, Cedar Academy, shared that what she has noticed is that education is not valued in their home. "If they were home, they most likely would not go to school half the time." Teachers do their best to motivate the students and reinforce the importance of education, but then they go home, and it is

not seen as important. Teachers have expressed this frustration because students ultimately go back to "what they know" and cannot seem to break this cycle. Ms. Miller, Cedar Academy, recalled several students who received scholarships to attend college, but sooner or later returned to their home environment. She explained that "they look at their home and it is normal to them. They don't know any different."

**Native American Identification**

Cajete (1999), Gilbert et al., (2011), and Boon and Lewthwaite (2016) state that Native American children who are exposed to cultural traditions in their science curriculum can have a lasting effect on their motivation for educational success. Price, Kallam, and Love (2010) and McCardle and Berninger (2015) argue that the cultural piece imperative for academic success is missing in most Native American student populated classrooms as well as the absence of Native American teachers. They believe that the teacher/student connection can develop relationships that will lessen challenges faced by students as well as teachers. Although only eleven of the fourteen teachers interviewed identified as Native American, all of them presented a strong interest in their students and their educational success. Ms. Porter, Dogwood High School, suggested that "being part of a culturally diverse family afforded me a great advantage when interacting with my students." She also stated that "If you are not immersed in their world, you don't fully understand what they are going through." Mr. Baker, Dogwood High School, is of Cherokee heritage and understands all too well the struggles his students face. Similarly, Mr. Wilson, Pine Tree High School, believes that because of his Native American heritage, students feel more comfortable having someone who looks like them as a role model that they can look up to and one that they can confide in. Mrs. Edwards, Pine Tree High School, explained that for some kids it makes a big difference to see someone that looks like them.

**Revitalization of Native American Culture**

Revitalization of Native American cultures, languages, and traditions is common for Native American students and parents (Cajete, 1999; Huaman, 2020). Revitalization can be an important aspect in student success in school as evidenced by the addition of Native American Studies courses (Rodriguez, 2018) and Johnson O'Malley programs (Bark, 2022). These courses are responsible for re-teaching students the heritage that has been lost throughout history and providing an environment of school and home continuity. Not only does this course renew cultural heritage, but it is also an excellent means of cross-curricular teaching with the science department. Activities taught in this class include making effigy pots, teepees, and basket weaving. Ms. Smith, Walnut High School, invites a Cherokee storyteller into her classroom to share stories with the students. Native American culture is known for its oral tradition over written language to document stories. Students were able to hear stories relating to their tribal history for engagement and to preserve their culture. Mr. William's computer science class at Dogwood High School incorporated cultural heritage into a virtual reality project that allowed his students to learn their heritage while learning to code. This project is not only teaching the students Cherokee language, but it is teaching them what the Cherokees' lives were like pre-colonization. They also learned the Native American game, stickball, which most had not had any knowledge of beforehand. Several lessons by teachers that specifically included cultural history into the curriculum included learning about the Trail of Tears as many students were not familiar with the history. Mrs. Edwards, Pine Tree High School, has been instrumental in introducing cultural heritage into her botany class. Teaching the importance of the relationship between science, the environment, and the knowledge preserved by the Native American people is important in fundamental Native American history, tribal sovereignty, and sustainability of

natural resources (Kimmerer, 2000). Demonstrating and discussing plant use by Native American peoples such as river cane for blow guns, and plants for medicinal and food use, Mrs. Edwards has used her own experience and Native background. Native American students become more involved in school when they can relate their school environment to real-life experiences (Nelson-Barber & Johnson, 2019). Cultural trips within the community provided an enhanced learning opportunity. Ms. Smith's Native American Studies class at Walnut High School had the opportunity to visit the National Cowboy & Western Heritage Museum in Oklahoma City to view their extensive Native American Indian artwork and artifacts. This trip further fostered and cultivated learning of cultural heritage not attainable from a textbook or lecture. Students saw real life artifacts, ceremonial dance costumes, and cultural pieces such as cradleboards. Ms. Davis, Cedar Academy, visited and toured the Choctaw Nation headquarters. Students were able to learn about the Trail of Tears, traditional Native outfits, watch demonstrations on blow guns, Native bowls, and how their food was made. Ms. Anderson, Pine Tree High School, took a group of students to a reservation to volunteer and learn about different Native American culture. Teachers across the geographical Oklahoma area and tribal areas expressed the extensive benefits these educational trips contributed to the educational and cultural learning of their students.

## Connection to the Research Questions

The focus of this research study was to understand and identify Native American student's classroom experience and the inspiration to continue their educational experience. Numerous statistics and studies have been presented in this paper reporting the below average achievement scores of Native American students compared to all other ethnicities, most notably their white peers. It has also been discussed the importance of instruction and support necessary

for student's success. This research set out to uncover the extent of diversity preparation and professional development, culturally responsive teaching knowledge and implementation in the science classroom, and common themes observed across a specific geographical area, specifically Oklahoma. Because of the nature of a qualitative study, research questions were formulated and approached through a blank lens; consequently, several ideas were generated from the data collected and are presented below.

**Research Question 1: What science topics do teachers of Native American students report teaching in culturally responsive ways?**

The focus of this study pertained to science classes; however, while interviewing science teachers, it became evident that limiting culturally responsive teaching to specific topics greatly narrows the benefits of the culturally responsive teaching strategies. The ability to collaborate with other disciplines would broaden learning at all levels and introduce purpose across the curriculum. Through this study, it has been realized that science and cultural history is universal and is not exclusive. Courses that have been identified in this study that would allow for excellent cross curricular lessons and activities include art, Native American History, Native American Studies, Native American Language, Family and Consumer Science (food studies, sewing projects, and more), Agricultural Science, and Computer Science.

Because science can encompass several disciplines and courses in a school setting, the research identified directed the study to incorporate these courses. These courses included botany, forensic science, environmental science, and computer science and provided a wealth of culturally responsive teaching lessons. Although several teachers expressed their lack of culturally responsive teaching knowledge and implementation in the classroom, the interview

process proved significant in developing future lessons and activities integrating culture into the science curriculum.

**Research Question 2: What strategies do teachers of Native American students perceive to help them teach in culturally responsive ways?**

Motivation doesn't take place from culturally responsive teaching lessons alone, rather they come from a multitude of sources. Teacher motivation, educational field trips, guest speakers, collaboration with community members and professional organizations, and strong Native American education programs along with culturally responsive teaching collectively accounts for optimal student success thereby directly resulting in higher-than-average achievement scores for Native students in Oklahoma.

**Research Question 3: What common themes do teachers identify related to teaching in a Native American student populated science classroom?**

All teachers are capable of adequately educating themselves on Native American culture by attending community events outside of the classroom, researching online, reading books, or obtaining the information directly from their students. Becoming aware of the different ethnicities within the classroom is not only important but imperative for educating Native American students to achieve success (Gilbert et al., 2011; Price et al., 2010). Although being of Native American descent provides an advantage in the classroom, it isn't necessarily essential. All teachers (Native and non-native) can effectively motivate, encourage, teach, and lead Native American students towards greatness. However, Native American teachers do possess a wealth of knowledge gained from personal experiences, hardships, and success that serves as a positive role model, confidant, and familiarity.

## Practical and Theoretical Implications

Certain research studies have great intentions for solutions, resolutions, or simply to make a change. Although it may sound ideal on paper, it is often met with challenges. This research is no exception. Theoretically, as an in-service teacher, the information in this study would be extremely helpful and useful and in fact could be implemented. It would obviously make learning science topics along with the cultural aspect exciting and fun and would induce the revitalization piece of culture that has unfortunately been lost throughout time. Educational field trips are also an advantage to enrich textbook and lecture beyond the classroom with real world experiences. As a researcher, providing teachers with a list of funding options to supply much needed materials to implement projects and execute meaningful and essential trips is crucial for culturally responsive teaching. Creating and maintaining a website of lessons and activities that teachers could access for resources custom to cultural content would prove significant. Lastly, providing in-person, hands-on workshops for teachers would be invaluable and provide an opportunity for partnerships with schools across Oklahoma. On the contrary, the greatest intentions might not always be practical. Because of time constraints and flexibility in the classroom, culturally responsive teaching can be a challenge to implement (McMahon et al., 2018). However, it is possible to slowly introduce culturally responsive teaching into the curriculum allowing for special projects and activities periodically throughout the semester/calendar year. These strategies can be incorporated in between major unit transitions and/or in conjunction with appropriate holidays (Native American Heritage month, in lieu of Columbus Day and Thanksgiving, and more). Although a website is an excellent resource for teachers, time and ability might hinder the actual construction; however, creating a forum for

teachers to collaborate with other teachers, share lesson strategies and activities, and provide support could be possible.

## Future Research

This research study leads to endless possibilities for me, as the researcher, and the in-service teacher. Teaching is a lifelong learning process that is never finished; therefore, this research will continue for as long as there are teachers and students. Specific tasks going forward will include submitting grant proposals to fund culturally responsive teaching workshops and professional development opportunities, creating a resource guide for teachers, designing culturally responsive teaching science lessons, and creating a cross-curricular culturally responsive teaching guide. All fourteen teachers interviewed expressed a strong interest in attending continuing education opportunities to better enhance their knowledge base of their students, develop lessons that would integrate their cultural traditions and heritage, and to create lessons that would help them transition to the science classroom. A thorough resource guide will provide a plethora of culturally responsive teaching appropriate lessons and activities, list of educational field trip opportunities, contact information for guest speakers, and a listing of funding opportunities. It is crucial to our Native American students and communities to educate the next generation of tribal leaders, health care professionals, business leaders, and productive citizens.

## Limitations

Limitations of this study include the following:

1. Limited to schools in Oklahoma and is not representative of other geographic areas (states) and tribal affiliations. Initially, five different tribes were contacted to participate in the study; however, due to teacher hardships surrounding Covid-19 issues, school

regulations surrounding Covid-19 issues, and teacher availability, the study was limited to two tribal affiliations.

2. Limited to schools with a high density Native American student population (50% or more Native American student population) and a Bureau of Indian Education school (Funded and operated by the tribe or tribal government via a contract or grant) and is not representative of all schools in Oklahoma. Due to issues surrounding Covid-19, this study was limited to two of the five Bureau of Indian Education schools in Oklahoma.
3. Limited to five schools and fourteen teachers. An in-depth analysis including surveys, observations, and interviews necessitated the limited number of participants. Due to teacher hardships surrounding Covid-19, school regulations surrounding Covid-19 issues, and teacher availability, this study limited the number of participants.
4. Limited to the participating teachers and is not representative of other science teachers or of their schools.
5. Time and travel constraints limited the number of participants and geographical area.

**Delimitations**

A research study collecting and analyzing school data in states other than Oklahoma with large numbers of Native American students is ideal for complete and comprehensive data. All public schools in Oklahoma that report a 50% or more Native American student population is ideal data to represent the entire state's Native America student data. All five Bureau of Indian Education schools in Oklahoma is ideal to represent tribal schools that are funded by the tribal governments and indicative of a 100% Native American student population. A larger sample size would provide a more comprehensive list of resources; however, an adequate amount of data was collected with the sample size researched.

## Summary

Educational data statistics from the National Center for Education Statistics (NCES, 2017-2018) and the National Assessment of Educational Progress (NAEP) reports substantial wide achievement gaps between Native American students and their white peers. Reports show lower proficiency scores in science and lower graduation rates. According to NCES data, white students' graduation rates report that 49 out of 51 (including the District of Columbia) states (96%) have graduation rates in the 80$^{th}$ percentile and above compared to Native American students' graduation rates of 17 out of 48 (3 states reported no Native American student graduation rates) states (35%) have graduation rates in the 80$^{th}$ percentile and above. In fact, 30 of 48 states (63%) reported graduation rates in the 70$^{th}$ percentile and below. Oklahoma reported a Native American graduation rate of 83% which directed this research to study and uncover what Oklahoma teachers and schools are doing to consistently maintain proficient scores and encourage students to obtain high level education and career goals.

Culturally Responsive Teaching was the focus of this study. Culturally responsive teaching can have a profound effect on Native American student relationship with their homelife and school environment and can promote student achievement and success that can lead to decreasing the achievement gap (Hammond, 2015). When used effectively, culturally responsive teaching can expand on and enhance intellectual magnitude (Hammond, 2015; Gilbert et al., 2011; Boon & Lewthwaite, 2016). The data presented in this study evidenced effectiveness of culturally responsive teaching in teacher classrooms that participated in the study. Science lessons discussed involved genetics relating to diabetes and heart disease prevalent in the Native American people and DNA analysis, environmental topics associated with plants used for medicinal, food, and fabrication use and land and soil testing, computer science projects that

combined technology with cultural history, forensic science incorporating Native American DNA analysis, and biology teaching overpopulation during the Trail of Tears movement in population ecology studies and diseases. Strategies that enhance educational learning and cultural revitalization revealed include educational field trips to museums and cultural centers, collaborations with the community, and guest speakers. Although culturally responsive teaching is integrated into many of the teachers' curriculum, all teachers interviewed recognized numerous lessons that would be indicative of cultural relevance, missed opportunities from previously taught lessons and guest speakers, and insightful discussions that would connect and engage Native American students. For example, utilizing blowguns, bow and arrows, and making teepees and baskets constructed in Native American Studies class and taught in physics class is an excellent cross curricular lesson.

Data collection included an interview with each teacher in person in their natural school setting. This approach proved beneficial because of the observations made by me. Field observations documented a rich cultural presence in the school and classroom environments. Native American statues were observed, student artwork, and student projects. Displays of culture included dream catchers, baskets, beaded keychains, Indian territorial maps, corn husk dolls, and language depictions relative to the tribal affiliation.

Although the teachers are faced with numerous challenges beyond their control (family life, educational struggles, and cultural differences), they all strive to encourage and motivate their students. They are willing to be patient with the discrepancies to gain their trust. Most importantly, they are willing to go beyond to further their students' education and to provide an extra cultural piece to ensure an environment of safety and security. Through teacher discussions, it was apparent that continuing education was crucial as they quickly began to plan

accordingly for the future. Teachers expressed their intentions of building stronger connections and relationships with their Native American students along with incorporating culture into their lessons. With meaningful workshops, professional development, and teacher resources, the capability and implications are possible. Mrs. Edwards', Pine Tree High School, sentiment is all too relevant:

> Your ancestors did not survive the Trail of tears for you to be mediocre. You think about their struggle to survive, and you want to be worthy of that struggle. It doesn't matter how things started. You must seek that inner strength.

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# Appendices

## Appendix A

### Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma

### Survey

This survey will be in google forms and will consist of short answer, multiple choice, and Likert style questioning.

1. Participant name, school, and email address:
2. Administrator name (principal) and email address:
3. List the science subject(s) you teach and grade levels during the 2020-2021 school year.
4. Estimate overall ethnicity percentages of students in your classroom. (or by class periods)
5. Tribal affiliations by class periods (If possible. Otherwise, "No Answer"). This is for statistical purposes only.
6. Ethnicity you most closely identify. (If you choose not to answer this question, put "No Answer")
7. What is your knowledge level of teaching students of diversity in the classroom?
   (1) No knowledge……...(3)……(5) Extremely knowledgeable
8. What additional courses/classes/workshops (outside of your school such as undergraduate, graduate, conferences, etc.) have you had in diversity education or culturally responsive teaching? (if applicable)
9. What professional development opportunities (in your school) do you participate in pertaining to teaching diverse students? (if applicable)
10. Do any of these professional development opportunities include teaching to Native American students? Yes or No?
11. Are you a part of a network of teachers that work together to design culturally responsive science lessons? Yes or No?
12. Describe any experiences or explain how you have been educated to understand the history of different ethnicities within your classroom (if applicable).
13. How often do you incorporate cultural traditions into science curriculum?
    a. Once a week
    b. Once a month
    c. Once a semester
    d. Never
    e. Other
14. What science topics lend themselves to being taught in culturally responsive ways unique to Native populations?

15. Briefly describe learning strategies that best effectively teaches the topics to Native populations.
16. What challenges do you face incorporating cultural traditions into a science lesson?
17. What other resources do you utilize in building a culturally responsive teaching science lesson?
18. How often do you participate in community events relating to Native American culture?
    a. Once a week
    b. Once a month
    c. Once a semester
    d. Never

## Appendix B

### Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma

### Interview

The initial survey was used to guide the researcher and teacher through a more in-depth interview.

1. How often do you incorporate cultural traditions into science curriculum? (from initial survey). Tell me what you incorporate and how that aligns with science curriculum.
2. What science topics lend themselves to being taught in culturally responsive ways unique to Native American populations? (from initial survey). Discuss.
3. Briefly describe learning strategies that best effectively teaches the topics to Native American populations. (from initial survey). Discuss learning styles/strategies.
4. What challenges do you face incorporating cultural traditions into a science lesson? (from initial survey). Discuss.
5. What other resources do you utilize in building culturally responsive teaching science lesson? (from initial survey). Discuss.
6. How often do you participate in community events relating to Native American culture? (from initial survey). Discuss.
7. Explain a lesson (or lessons) that you teach that incorporates culture. How was this lesson developed? (on own, outside resource?)
8. Are there any hardships that could prevent or hinder student learning or engagement in curriculum?
9. Do you believe the students relate to you better as a Native American teacher? Why or why not?
10. Do you feel incorporating culture into the classroom could be coupled with any other learning strategy to engage the students?
11. Does this lesson promote an interest for Native American students in science beyond the classroom? What evidence could support this claim (either way)?
    a. Family life?
    b. Beyond secondary education? (College? Trade school?)
12. How do you communicate effectively and respectfully with varying degrees of beliefs, behaviors, and backgrounds?
13. How do you see opportunities to improve the learning environment to better meet the needs of students from different backgrounds? Could we brainstorm some lessons that could be taught in your curriculum?
14. Describe your experience or explain how you have been educated to understand the history of different ethnicities within your classroom.
15. Describe your experience in serving or teaching underrepresented communities.

16. How well do your students accept culturally diverse curriculum?
17. At what degree do you see a culturally responsive lesson as an effective lesson delivery tool?
18. What comments do you have on the successes and failures of a culturally responsive classroom?
19. What would you like to add to this interview in regard to the classroom observation? (Topics/issues I may not have discussed/asked that would have relevance to this study/research)
20. Do you believe that CRT is making an impact on overall student achievement/motivation/aspirations? Why or why not?

## Appendix C

## IFORMED CONSENT FORM FOR INTERVIEW PARTICIPANTS

*Title:* Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma

*Researcher:*

Michelle Childress, M.Ed.
University of Arkansas
College of Education and Health Professions
Department of Curriculum and Instruction
763 W. Maple Street
Fayetteville, AR 72701-1201
479-935-7150
Mjc1219@uark.edu

*Compliance Contact:*

Ro Windwalker
IRB Coordinator
University of Arkansas
109 Martin Luther Kind, Blvd
Fayetteville, AR 72701
479-575-2208
irb@uark.edu

*Faculty Supervisor:*
Stephen Burgin, Ph.D.
University of Arkansas
College of Education and Health Professions
Department of Curriculum and Instruction
Fayetteville, AR 72701-1201
479-575-4283
srburgin@uark.edu

*Description:* This research study investigates and identifies the level of culturally responsive teaching in Native American high school science classrooms, science topics associated with culturally responsive teaching, and how the science topics are taught integrating culturally responsive teaching. The study will be conducted in ten Oklahoma schools to include 3 high density Native American student population schools (majority of 50% or more American Indian population) and 2 Bureau of Indian Education schools (Funded and operated by the tribe or tribal government via a contract or grant). The study includes an initial survey that will be sent to all schools in Oklahoma meeting the Native American student population criteria and all Bureau of Indian Education schools. This survey will serve to supply the researcher with background knowledge that will be used to select participants for the research. Selection of participants from the survey will be indicative of specific criteria necessary for data collection during the observation and interview phase of the study. Upon selection for the study, the teacher will be interviewed in the classroom one time during the Spring 2021 semester. The researcher will discuss lessons incorporating Native American culture in the science curriculum. The researcher will identify cultural opportunities presented to the students as well as any activities related to scientific topics/issues. The interview will be conducted according to teacher availability (At the end of the school day, evening, virtually, etc.) and location (classroom, conference room, etc.). Interview will be recorded with video for further analysis. The participant and school name will be kept confidential as will all pertaining documents and will be identified by pseudonyms.

*Risks and Benefit:* There are no risks associated with this project. The potential benefits include identifying culturally responsive teaching in a Native American high school science classroom to enhance teacher education and promote Native American student learning. Teachers will have access to lessons for use in their classrooms.

*Voluntary Participation:* Participation in all surveys, interviews, and observations during this research project is voluntary. By choosing to participate or not participate in this research study will have no effect on employment or relationship with the researcher or the University of Arkansas.

*Confidentiality:* Your name and any other identifying information, pictures, videos, and recording of interviews will remain confidential to the extent allowed by law and university policy. All names will be identified by pseudonyms. All documents will be kept in a locked filing cabinet in the researcher's office and will be destroyed after five years as well as on a google document file accessible only to the researcher and will be deleted five years after the study.

*Right to Withdraw:* You may choose to not participate in the study at any time during the school year and therefore, withdraw your consent. At that time, all documentation will be destroyed and will no longer be available or used for data. There will be no negative consequences should you choose to terminate participation.

*Contact:* If at any time during the study questions or concerns arise, you may contact the researcher, or the IRB coordinator listed above.

*Informed Consent:* I _____ (please print your name), have read the description of this study. I understand the purpose of the project, the procedures to be used, the potential risks and benefits, how confidentiality will be established and maintained, as well as the option to withdraw. My signature below indicates that I freely agree for my information to be recorded and analyzed as participants in this project.

_____ _____

Participant Date

## Appendix D
## Initial Correspondence to School Administrator

BIE Administrator name here
Address of BIE Administrator here

(BIE Administrator name here),

I am a doctoral candidate at the University of Arkansas. I am currently working on my dissertation, "Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma". I am from Oklahoma and a member of the Seminole Nation of Oklahoma tribe; however, I am also registered Choctaw and Creek. I graduated with my bachelor's degree in chemistry at the University of Arkansas, master's degree in education at Arkansas State University, and a current Ph.D. student at the University of Arkansas. This topic was of particular interest to me when I recognized the extremely low numbers of Native American students enrolled in college as well as in the teaching profession. This began my research into the importance of culturally responsive teaching. My focus topics of research are the integration of science and the culture of Native Americans in the science classroom. More specifically, how teachers are integrating the cultural aspect of the students' tribes into science education.

It is my hopes to be able to observe public school districts with a majority Native American student population as well as Bureau of Indian Education schools. I would love to have the opportunity to visit all BIE schools, interview science teachers, and possibly observe their classes. I understand concerns surrounding Covid-19 and am willing to attend virtually and/or utilize zoom interview protocols for my data collection. According to my IRB correspondence, it says that Cherokee, Chickasaw, and Choctaw Nations have their own Institutional Review Boards that may need to review my protocol since I am hoping to include the BIE schools in my research. Is there anything specific I need to do in order to include the schools as part of my research?

Thank you for your time. If you have any questions, I am available to speak by cell (phone number here), email (email here), or in person.

Michelle Childress, B.A., M.S.Ed.
University of Arkansas
Fayetteville, Arkansas

**The following email will be sent to all BIE school administrators and public-school administrators with majority Native American student population in Oklahoma:**

To Whom It May Concern:

I am a doctoral candidate at the University of Arkansas. I am currently working on my dissertation, "Science Teachers' Perceptions of Culturally Responsive Teaching in Majority Native American Schools in Oklahoma". I am from Oklahoma and a member of the Seminole

Nation of Oklahoma tribe; however, am also registered Choctaw and Creek. I graduated with my bachelor's degree in chemistry at the University of Arkansas, master's degree in education, and a current Ph.D. student at the University of Arkansas. This topic was of particular interest to me when I recognized the extremely low numbers of Native American students enrolled in college as well as in the teaching profession. This began my research into the importance of culturally responsive teaching.

It is my hopes to be able to observe public school districts with a majority Native American student population as well as Bureau of Indian Education schools. I would love to have the opportunity to visit (school here), interview science teachers, and possibly observe their classes. I understand concerns surrounding Covid-19 and am willing to attend virtually and/or utilize zoom interview protocols for my data collection. My focus are topics that integrate science and the culture of Native Americans in the science classroom. Would it be possible to include (school name here) into my research? If you have more questions or concerns, I would be happy to talk to you by phone (phone number here), email (email here), or in person at your convenience.

Thank you for your time,

Michelle Childress, B.A., M.S.Ed
University of Arkansas
Fayetteville, Arkansas

# Appendix E

## IRB Approval Letter

UNIVERSITY OF ARKANSAS

| | |
|---|---|
| **To:** | Michelle J Childress<br>BELL 4188 |
| **From:** | Douglas J Adams, Chair<br>IRB Expedited Review |
| **Date:** | 01/27/2021 |
| **Action:** | **Expedited Approval** |
| **Action Date:** | 01/27/2021 |
| **Protocol #:** | 2004263534 |
| **Study Title:** | Culturally Responsive Teaching in the Native American Science Classroom |
| **Expiration Date:** | 01/26/2022 |
| **Last Approval Date:** | |

The above-referenced protocol has been approved following expedited review by the IRB Committee that oversees research with human subjects.

If the research involves collaboration with another institution then the research cannot commence until the Committee receives written notification of approval from the collaborating institution's IRB.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date.

Protocols are approved for a maximum period of one year. You may not continue any research activity beyond the expiration date without Committee approval. Please submit continuation requests early enough to allow sufficient time for review. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study closure.

Adverse Events: Any serious or unexpected adverse event must be reported to the IRB Committee within 48 hours. All other adverse events should be reported within 10 working days.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, study personnel, or number of participants, please submit an amendment to the IRB. All changes must be approved by the IRB Committee before they can be initiated.

You must maintain a research file for at least 3 years after completion of the study. This file should include all correspondence with the IRB Committee, original signed consent forms, and study data.

cc: Stephen R Burgin, Investigator