Digital Divide in Rural Native American Homes: A Student Perspective

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Abstract

Native American homes located in rural western North Dakota have seen increased availability of broadband and fiber optic Internet but continue to have low access numbers. Native American homes in the region located outside population centers continue to have difficulty accessing the Internet. Many households continue to struggle with economic factors compounded by the cost of a device to access the Internet for personal, educational, or employment use. A qualitative study with semi-structured interviews and the grounded theory method investigated the Native American home environment. Interviews were conducted with Native American students attending a state university with insight into diverse digital environments. The cost of access and technical knowledge continue to be issues in the home. This research deepens the understanding of digital divide factors in Native American households, emphasizing the perspective of Native American students.

Keywords: Digital Divide, Native American, qualitative, home, students, rural.

1. Introduction

Native Americans continue to little attention to reports and scholarship, justifying their exclusion due to low numbers (American Indian College Fund 2019). Inequities and multiple governmental divisions between tribal and non-tribal infrastructure complicate digital divide issues. Other factors include the knowledge, skills, and abilities (KSA) of tribal members as well as socioeconomic, geographical, and cultural that can be difficult to overcome.

Digital divide inequities can be related to a digital environment and the individual experiences with technology in those environments. The experiences can be negative or positive which has an additional influence on what experiences an individual may share with immediate or community family members. A family member may also share the perceptions of influence with the individual. All the factors are affected by the first- and second-generation inequities that may exist in one or all environments. The environments are further influenced by varying economic and sometimes racial factors.

The Digital Divide Individual Experiences Model (DD-IEM) represents the interview transcript data analysis from individuals with a positive or negative interpretation of the data coding. The placement of the individual at the center of the model shows how the individual can influence or be influenced by the different digital environment experiences. The outer regions are divided into positive and negative digital environments. The individual can have interactions with all of them daily. The data analysis using this approach demonstrates a better understanding of where individual experiences are most influential. The transcript analysis is beneficial in identifying overall experiences but also within specific digital environments. The overall themes discovered can then be further examined for positive or negative experiences in one or multiple environments. The data analysis using the model increases the comprehension of how data can be assembled in a graphical representation for greater insights from the analysis. one component of the model can have either a significant influence on the whole environment or no effect at all. The sections are all conditional upon one another to produce a negative or positive impact on the digital divide inequities for an individual or community.

While Fenner, Noteboom, and El-Gayar (2023) used semi-structured interviews with Native American students to research the digital divide experienced by individuals, the study warrants deeper definitions and descriptions to increase understanding of the different digital environments discussed in the DD-IEM. Accordingly, this study examines digital divide issues in Native American households with a focus on the individual home environment interview data analysis. The study also shows that digital divide barriers continue to exist after efforts to increase access to broadband Internet in rural Native American areas. Tribal communities have unique multiple risk factors. These factors can increase the likelihood of having

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digital divide barriers. Native American communities are usually rural, have increased poverty levels, and can have racial inequities. The government's inability and the private sector's unwillingness to assist in closing the gap in these remote environments is a major obstacle (Wynn, 2005). When Native students' needs are unmet, thousands of people have unrealized potential, cascading into potentially tragic personal, familial, social, and economic effects (American Indian College Fund 2019). The House Energy and Commerce Committee shared that broadband deployment was urgently needed in tribal lands (House Committee on Energy and Commerce Memorandum, 2020). Continuing digital divide issues relate to technology availability, education, and KSA in some rural Native American communities.

This research will focus on the digital divide issues that still exist in Native American households with an emphasis on the perspective of Native American students and addresses the question, "What digital divide barriers continue to exist in Native American homes?". Semi-structured interview transcripts with Native American university students were analyzed using open coding. A qualitative grounded theory approach was used to allow the exploration of the interview data to gain deeper insights into Native American university student experiences with the digital divide in diverse digital environments.

The research and model contribute to practice by introducing a new data analysis strategy and a reproducible model that can be used for future research with other groups and expanding upon the analysis from the prior study about individual home experiences. The paper begins with a literature review followed by the research design and method. The paper continues with the results section with findings and discussion section ending with the conclusion.

2. Background and related work

Native American students are currently the lowest represented population within the total number of undergraduate students in the United States at less than one percent (> 1%). Native American graduate students are even a lower portion of half a percentage (=> .05%) of the total graduate student population in the United States (National Center for Education Statistics, 2019). Education practices in Native American communities have transitioned back to tribal control in a desire to increase the number of Native American students pursuing undergraduate and graduate degrees (Fish & Syed, 2018). A survey conducted in April 2020 revealed that nearly 60% of low-income households with children in school had issues with remote learning. The leading causes of the issues were unreliable internet, no home computer, or smartphone reliance for completing assignments (PEW Research Center, 2021).

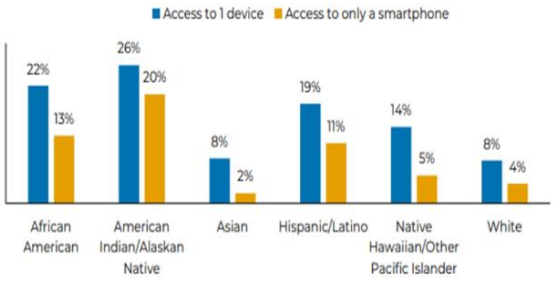

Figure 1. Percentage of students' access to one device at home, including only a smartphone, by race/ethnicity

Native American students encounter a diverse set of disparities related to the inequities of the digital divide. Previous research such as reducing barriers from the digital divide requires addressing operations, economics, or technologies of infrastructure access and consistency (Walts, 2011). Kodaseet and Varma (2012) state that geographical location contributes to issues with access and technical skills and knowledge exposure. Technology adaptations must address indigenous cultural information and social traditions to improve technology practices for indigenous communities (Du et al., 2015). The limited availability of Native American technology experts and access to digital knowledge can restrict the tribal leaders' ability to formulate satisfactory decisions (Chavez, 2017). Winter and Boudreau (2018) indicated that the digital divide research focuses on the benefits of technology for indigenous culture instead of discovering the benefits of indigenous cultures' use and influence on technologies.

Table 1 displays the percentages of students with access to the Internet, broadband, computers, or full in Metro and non-Metro geographical locations. This is relevant to the geographical areas of many Native American individuals. There is only a 4% difference between metro and non-metro internet access but a 14% difference between broadband access. Full access is also a large disparity between metro and non-metro at 14%.

Table 1. National Education Association (NEA) 2018 Estimated Percentage of U.S. Students with Internet, Broadband, Computer, and Full Access by Geography

Urbanicity	Internet	Broadband	Computer	Full
Non-Metro	**91**	**66**	**87**	**63**
Metro	95	80	91	77

Table 2. shows the significant disparities between Native American individuals and other racial groups. There is a 10% difference between Native American students versus access to the next lowest Black American students with Internet access and again a 15% difference between the two lowest for broadband Internet. Only 50% of Native American students have full access to the Internet and a device. Again, with a difference of 14% from the next lowest percentage of Black American students.

Table 2. NEA 2018 Estimated Percentage of U.S. Students with Internet, Broadband, Computer, and Full Access by Race/Ethnicity

Urbanicity	Internet	Broadband	Computer	Full
White	97	81	95	80
Black	91	69	83	64
American Indian/Alaska Native	**81**	**54**	**75**	**50**
Asian American	98	87	96	86
Multi-race or Other	97	82	93	80
Hispanic	92	70	85	66

Necessary considerations for indigenous and Western-influenced societies' intellectualization and utilization of technology are diversely different in practice than currently identified in scholarly articles (Myers et al., 2020). The choice of Native American communities to determine future direction and technology development will affect individual everyday lives (Rekhari, 2008). Innovations in the past have consistently included issues with equity of distribution and access to technology based on economic abilities (Betts, 2009). Understanding the perceptions of Native American students increases insights from household digital divide environments. Prior studies have focused on certain populations, locations, or issues that the digital divide creates for Native American individuals. The same issues are compounded for students within their homes. There continues to be a need for research that looks at the rural Native American households from a participating individual but also one that has experiences in different digital environments with a broader comprehension of how it affects them and their extended family.

The term digital divide was first introduced in the late 1990s as a division between individuals with access to devices and the ability to connect to broadband Internet (Dijk, 2012). This divide is referred to as the first-generation digital divide. The second-generation digital divide expands to include technical skills and use (Hargittai, 2002). The expansion of the digital divide began with a lack of access to devices and the Internet. This divide progressed into a second-generation digital divide which is the ability to be productive using devices and the Internet. A third-generation digital divide was later introduced that emphasized the use of the Internet and devices to produce outcomes or tangible benefits (Wei et al., 2011; Van Duersen & Helsper, 2015).

The ability of groups to utilize digital environments to share time-sensitive information with community members is greatly influenced by digital technology use and access. In times of emergency or disaster, digital technology has become the preferred method for sharing critical information with members of the community and other information-sharing entities. The use of digital media, such as social media platforms, for information access about services, activities, and emergencies is only beneficial if the community has access to or knowledge of how to utilize digital technologies. Geographic location and socioeconomic conditions are significant motivators for potential issues with sharing that information with others. The importance of understanding the disparity among Native American households is necessary and can be identified through the experiences of the students in the homes. The researcher desires that this study contributes to reducing and possibly eliminating digital divide barriers in Native American homes.

The research lens (Figure 2.) provides insight into the area of investigation. It includes theoretical perspectives such as Digital Divide Theory (Dijk, 2012), Modernization Theory (Hwang, 2006), Adoption Theory (Straub, 2009), Diffusion Theory (Straub, 2009), and Individual Differences Theory (Trauth et al., 2004). The previous theories allow the ability to possibly produce themes related to different interview perspectives and relationships without influencing the results. The research will explore possible influences, including culture, socio-economic, race, and individual experience, to assist in developing digital divide themes from the interview data.

Digital divide research theories expand on the identification of digital inequities based on economic

and location access disparities. Dijk (2012) discusses the inequities in social and economic distribution as the foundation of digital divide disparities. Increased research into second-generation digital divide research. Early modernization theory by Luyt (2006) describes digital adaptation in groups where technology is part of a deterministic thought process. Hwang (2006) expanded early modernization theory into the social and economic representation model of modernization theory. Diffusion theory by Straub (2009) states that innovations that are shared by the entire group reduce the digital divide. Straub (2009) also introduced the adoption theory that studies the reduction of the digital divide due to a chain of actions, not a singular change. These theories are beneficial for the examination of interview data coding and data analysis. The findings are influenced by the different theories for the creation of themes and propositions.

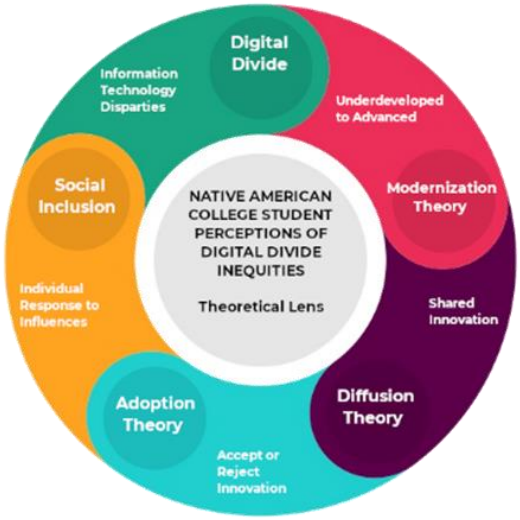

Figure 2. Perceptions of Digital Divide Inequities - Theoretical Lens.

3. Research Design and Methodology

This research used a qualitative grounded theory method to examine Native American students' interaction with the digital divide. Qualitative research was chosen due to the need for a deeper understanding of Native American students' insights. The Eisenhardt (1989) approach is utilized with semi-structured interviews as the approach enables concepts and relationships to be arrived at and assessed using the 'enfolding the literature' and the theoretical sensitivity from open coding. Theoretical sensitivity gives the research insight and meaning to the events and happenings in the data. It allows being able to sift through the data and discover new insights.

Theory discovery is systematically obtained data for social research (Glaser & Strauss, 1967). The collection of data for analysis through breakdown, sorting, and synthesis is a major component of grounded theory (Charmaz, 2006). The substantive theory is limited to a particular area and formal theory is fundamental and possibly encompasses multiple areas of study (Glaser & Strauss, 1967). The formation of theory from the continuing digital divide issues among Native American communities is the focus of this study. Furthermore, grounded theory is utilized using the Unlu-Qureshi four-step coding instrument for data handling, coding, and results (Qureshi & Unlu, 2020).

3.1 Participants

The sample population was derived from a population of students attending classes at a state university in North Dakota who self-identified as Native American or Dual races with one race being Native American. Participants were recruited until theoretical saturation was achieved.

3.2 Data Collection

The interviews were open to all majors and created a unique perspective to speak with students from all majors instead of only information technology (IT) students. The why and why-not perspective of perception analysis developed an understanding at a deeper level of complexity and comprehension. The research was IRB-approved #20220421-CF. There was also a review by an independent expert in Native American culture to ensure proper practices were used in the research and the dissemination of findings.

3.3 Data Analysis

The initial analysis step used a semantic open coding of the data from the individual interview transcripts. The identification of significant portions of information from the transcripts was analyzed and marked using descriptive verbal open code tags. The codes are repeatably reanalyzed to ensure the final codes are used to derive meaning from the interview transcripts or portions of the interview transcripts. The Atlas.ti 22™ application was utilized as a repository for all audio and text files.

The Unlu-Qureshi four-step coding instrument was applied to the data analysis of the interview transcripts. The instrument begins with initial open coding of the data from interview transcripts. The second stage concept contrasts and compares the codes to create greater generalizations. Categories are part of

the third stage, which examines the concept of relationships. The final element is the review of all codes, concepts, and categories to create an encompassing theme or sometimes also referred to as a core category. The process is shown in Figure 3.

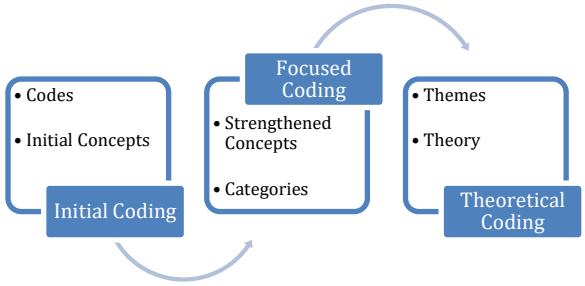

Figure 3. Unlu-Qureshi (2020) – Four-Step Coding Instrument Stages

During the interviews, reflections and observations are systematically documented using digital audio recordings and digital transcription to preserve the accuracy of information from participants. Continuous reflection, field notes, and other documentation will be crucial for achieving the best possible findings. The researcher's inductive interpretation of information was unbiased and evolved as the research was designed, developed, conducted, recorded, and finally analyzed.

3.4 Researcher's Point of View

The researcher does not come into this study without prior knowledge of the population or cultural stereotypes. The researcher has lived near and has been involved in different environments with Native American communities. This factor will be considered as the data are collected, coded, and analyzed for this research to maintain accurate data analysis without personal influence. Careful consideration will be given to the collection and interpretation of the findings. Every attempt was made to disseminate the data without influencing the interpretation of the data in the final analysis.

4. Results

This research addresses the question, "What digital divide barriers continue to exist in Native American homes?". Eleven Native American student participants ranged in age from 18 to 54 and included new and transfer students. The interviews resulted in 203 pages of transcribed text that was based on 237 total minutes of audio interview recordings. A demographic summarization table (Table 3) is included below.

Table 3. Interview Summary

Demographic Information	
Number of students	11
Age range	18 to 54
Degree	3 Associate; 8 Bachelor
Gender	2 Male; 8 Female; 1 Two Spirits

The student interview transcripts showed insight into individuals within different digital home environments. The results consisted of negative and positive experiences. The main category instances (Table 4) showed digital home use issues related to distance education issues such as reliable broadband Internet, devices, and technical support for students.

Table 4. Home Digital Divide Category Creation

Interview Data Excerpt	**Codes**	**Concepts**	**Categories**
More than three devices are hooked up and the Internet will be slow	Internet speed reliability with home device use in rural homes	Internet Reliability Speed Home Location	Negative Internet speed and reliability in rural homes Positive Internet availability
Knowledge of how to use and utilize computers	KSA is an issue in many Native American homes	Knowledge Device Use Home Use Production Age	Negative KSA by individuals and family members in some homes

Data analysis of the students who participated in the survey showed the importance of technology for increased production and the convenience to continue to pursue higher education degrees. Education during the pandemic exposed how difficult the process of online education was for many families with data codes showing first-generation digital divide issues for distance education participation.

4.1 Positive aspects of coded interview transcripts

The availability of broadband Internet has increased for most Native American communities in the more populated locations. The rural home availability has increased for most locations depending on the distance from population centers or mainline locations. Access to devices and the Internet

has seen the greatest growth in educational facilities. Smartphone access was shown to be the main device used for Internet access in most homes.

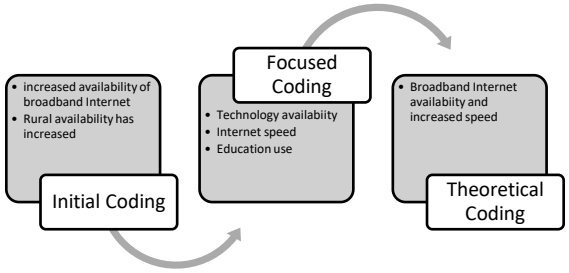

Figure 4. Home Digital Divide Positive

4.2 Negative Aspects in coded interview transcripts

Interview transcripts showed negative coding instances identifying economic barriers to access of devices and the Internet in the home. If home access and availability were possible there were negative codes for lack of necessary support or assistance with technology applications in the home. The cost of access for homes was one of the highest negative code instances for Internet access because it was beyond what most household incomes can afford or deemed necessary versus other necessities. The cost of the continued access paired with the cost of the device is seen as a necessity by students, but the analysis still shows technology access as a luxury purchase. The cost for some home access, whether in the community or rural, was an additional high negative code instance due to the unreliability and speed of broadband access. Most access in the rural areas was still dial-up or digital subscriber line (DSL) connections, which meant slower speeds and unreliable Internet access.

Socioeconomic factors are considered the most significant issue with Native American communities and digital divide inequities. Location is a contributing cost factor to access and availability. Individuals fortunate enough to have access are more knowledgeable than other community members. Economic differences codes in the interview transcript data are the most recognizable barrier for Native American communities. The student data also shows greater availability and access in urban areas than in rural locations. The interview transcript data show cost issues related to limited providers and repeatedly referenced the affordability of Internet and device access for homes.

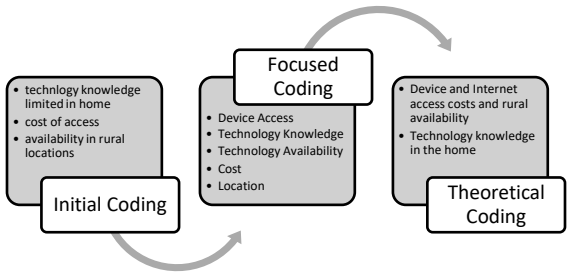

Figure 5. Home Digital Divide Negative

5. Discussion

This research aimed to discover emerging themes from the analysis of interview data from Native American students at a state university and their perceptions of the digital divide in different environments. The analyses of the interview transcripts produced several categories which have been grouped into different themes discussing the positive and negative responses. The information concluded with the dissemination of the interview transcripts from initial coding to focused coding and then themes. The themes identified included different environmental codes relating to community and education influence on the home environment. Additional themes focus on digital experiences in the home.

The themes that were identified from the general categorization of the data from the interviews had a large number of instances related to home access to broadband, device access, cost, rural geographical location, KSA availability, and public access outside the home. The cost of access in Native American communities has fewer service providers which can increase costs due to no competition. Reliability of the Internet coupled with speed continues to be an issue and lack of training, access, and knowledge by elders and within the community creates barriers to information, services, employment, and other online content. Open access to devices, the Internet, and the ability to get assistance for low-income households increases the difficulties in KSA.

5.1 Home digital environment

Home environment interview transcripts described many digital divide inequities and issues that exist due to financial and geographical issues. Some interview transcripts revealed issues with digital knowledge for the support of students at home and use by some members of the community. Internet speed

and reliability were discussed positively by all Native American students in multiple interview transcripts about the digital divide environments and some educational discussions. Access to the Internet was seen as adequate for most environments but remained expensive and unreliable in rural areas of the communities. Internet availability cost, speed, and reliability are still digital divide negative inequities due to the lack of high-speed access for the reason of the geographical location and obstacles that exist at some homes. It is not an option at some locations. The home environment was mostly an issue due to the cost of access that is influenced by geographical distance or a limited selection of reliable providers. There were also issues with home devices and knowledge of how to use technology. Many of the communities' younger members have greater access to devices in educational settings but lack adequate access to the Internet at home.

5.2 Perceptions

Some students stated that white individuals have the greatest access and knowledge but considered Native Americans in the same situation as other minorities whom all struggled while only white individuals had technological advantages. A few did not see a difference between the races even though research data shows that there is a difference. Over 20% of the households are below the current poverty level in Native American communities in comparison to other minority communities and nearly a 40% difference compared to white American communities (PEW Research Center, 2021).

The majority of interview transcripts focused on economic factors for access to technology for families. The additional barrier of income in the household creates an additional divide that would need to be addressed when Internet access is available. The ability to have access does not reduce the ability to afford the access. There are additional barriers related to getting access continuously month to month but also the ability to afford a device to connect to the Internet.

Interview transcripts codes showed an inability to access technology being the largest factor of geographical location compared to other races and community settings. The ability to access and use technology is seen as a necessity for addressing first-generation digital divide inequities but does not address second-generation digital divide issues. The KSA to utilize and contribute to technology is an even more difficult inequity to address. KSA requires the resources of a community to learn how to utilize technology.

5.3 Themes

The themes in the Unlu-Qureshi process are created from general categories abstracted from the coding instances. The categories identify codes in different digital environments which include community, education, and home. The categories in the themes are also derived from codes within each of the environments. Sentiments from the transcript codes were also considered for the identification of positive or negative themes. The following themes are discussed in order of relevance from the code instances and importance to decreasing digital divide barriers for Native American households.

5.3.1. Income Compounds Digital Divide. The economic factor is considered the most significant issue with Native American communities and digital divide inequities. Location is a contributing cost factor to access and availability. Individuals who are fortunate enough to have had access are more knowledgeable than other community members. Economic differences were mentioned in the interview transcripts as the most recognizable barrier for Native American communities. The student interview transcripts codes also show that there is greater availability and access in urban areas for other minorities and also reduced pricing because of more provider selections. The interview transcripts repeatedly referenced the cost of Internet access and the ability to afford the cost of a device for their home. Students in rural locations have limited options for open Wi-Fi opportunities in comparison to students in urban areas with libraries, coffee shops, or other access options. The second-generation divide is addressable with additional KSA that could be obtained in the educational environments for students but is limited for non-student community members.

5.3.2. Community Access is Still an Issue Portions of the population may have the availability of the Internet but additional factors such as cost, location, device access, and technology knowledge are obstacles to beginning the use of technology. Technology would need to be seen as beneficial to justify the cost. Community access reduces exposure to individuals to use or obtain knowledge about using technology. The first-generation digital divide is reduced if you are a student or work in the educational system. Community members' learning, utilizing, or accessing technology is limited.

5.3.3. Internet Access is a Human Right First-generation access should be an individual right or availability as a community service such as food

assistance for individuals who are unable to afford access to technology. It should not be something any individual should be without.

5.3.4. Remote Education Accessibility Device access in educational facilities is available to attending students, faculty, and family. Individual student access increased for personal laptops or tables during the pandemic for distance education using the device and availability to broadband Internet for individuals with the ability to access at home. Location was a large factor in availability for students. After the pandemic, students have digital devices for education but many are limited to use in educational facilities.

5.3.5. Home Technology Knowledge Knowledge in the home was identified as a digital divide inequity discovered during the pandemic. Families were able to get a device and access to the Internet but children usually stayed with elders who do not know how to use or troubleshoot issues for students attending distance learning programs.

There is a need for technological support according to the data analysis. The ability to troubleshoot and secure devices is something that would require individual knowledge or options for education. Community access codes showed reduced opportunities for individuals to use or obtain KSA about using technology. Access for community members to learn, utilize, or access technology was indicated as limited by the interview transcripts' data. The inability to access technology was seen as being a large factor in digital divide codes. Knowledge codes related to the home were identified as a digital divide emphasized during the pandemic. Families were able to get a device and access to the Internet but children usually stayed with elders who have limited or no KSA about how to use or troubleshoot issues for students attending distance learning programs were coded in the data analysis.

6. Conclusion

The research uncovered emerging perception themes from the analysis of interview transcript data from Native American students related to the digital divide. The analyses of the interview transcripts resulted in several themes including cost barriers to technology and lack of KSA in the home. The interview transcripts were coded from the student experiences discussed during the interviews. The findings highlight opportunities for research within Native American households to gain deeper insights into the digital divide affecting Native American individuals within their households.

The perceptions from the Native American student interview transcript data and the development of themes from the interview transcript data indicate the presence of digital divide inequities at different levels and different environments. The issue of access to devices and support at the community level is another area for additional research into successful strategies to increase availability and access to technology and support. Centers with assistance for using and utilizing technology can reduce costs for healthcare, applying for services, and virtual interactions that may otherwise include the cost of travel. Remote or virtual employment, job searches, online applications, device need, and KSA are barriers to employment opportunities.

The research aim is to assist with the successful reduction of digital inequities by revealing how and what disparities continue to exist in different rural Native American homes. Scholars have realized digital divide inequities are culturally different. Rural geographical location and economic disparities continue to be issues that are unique to Native American individuals versus inequities experienced by other races. Native American communities continue to be family and community focused at a level that is difficult to compare to other cultures and communities.

This study has provided insight into the perceptions of the digital divide by Native American students discussing the impressions and environments of individuals. Study limitations include the limited group of individuals that would be able and volunteer to participate and the nature of the Native American students attending a state university e.g., being highly educated. The results of the small sample size may not be generalizable to other populations. A larger sample group and increased representation of students could add further validation to the study.

Additional qualitative studies would be beneficial in different geographical locations and with different groups. Research could expand on qualitative research within different Native American communities. The investigation of the opportunities for access and knowledge of Native American elders within tribal communities would also add to this body of knowledge. Different factors and influences are associated with Native American communities and other indigenous populations. Some individuals are aware of technology but choose not to use digital environments. Future research could examine community concerns about technology and how it could influence community cultures and traditions.

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