Technology Leadership in Native American Schools

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Principals of schools serving Native American students have a unique role as technology leaders. They must be cognizant of technological demands, government mandates, as well as unique societal and cultural needs. In this study, the researchers conducted interviews with nine principals in federally-funded, Bureau of Indian Education schools that serve Native American students to explore various topics related to technology leadership as described by the National Educational Technology Standards for Administrators (NETS-A). We find that these principals are meeting various components of the NETS-A in unique ways but are missing many components of the standards entirely. We find that a lack of professional development on technology training, a dearth of technology coordinators, poverty, and isolation were major challenges to their technology leadership. We conclude that the field of educational leadership must respond to the needs of the marginalized communities to meet their unique demands by focusing on relevant technology leadership training through preparatory and in-service training.

Administrators of K-12 schools are increasingly called upon to be leaders of technological change. Many studies support the assertion that the administrator plays a pivotal role as the district or school technology leader (Anderson & Dexter, 2005; Dikkers, Hughes, & McLeod, 2005; Fletcher, 2009; Gerard, Bowyer, & Linn, 2008; International Society for Technology in Education, 2007; McLeod, 2008; Slenning, 2000). As Anderson and Dexter (2005) assert, "a school's technology efforts are seriously threatened unless key administrators become active technology leaders in a school" (p. 74).

Principals who serve special populations however, such as Native American[1] students, face a unique combination of challenges including but not limited to isolation, poverty, cultural preservation, cultural disintegration, and language maintenance. This article explores technology leadership as defined by the National Educational Technology Standards for Administrators (NETS-A) (International Society for Technology in Education, 2009) within the context of K-12

schools serving Native American students. Two research questions guide this study: (1) What does technology leadership look like in Native American schools? and; (2) What challenges do school leaders of Native American schools face when trying to become effective school technology leaders?

Theoretical Framework

To help guide school leaders as they focus on technology leadership, the International Society for Teachers in Education (ISTE) (ISTE, 2002, 2009) created the National Educational Technology Standards for Administrators (NETS-A). "These standards represent a national consensus of the things PK-12 school administrators need to know and do to support technology integration effectively in schools" (Brooks-Young, 2009, p. 2).The five standards are intended to help school leaders better understand and refine their role as school technology leaders. The first standard is called *visionary leadership*. Included in this standard is that a

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[1]Throughout this study the researchers interchange the terms Native American, American Indian, and Indian. These multiple terms were used to maintain consistency with the terms referenced by the interviewees and/or the literature.

technology leader has the ability to inspire a shared vision among stakeholders and foster changes that maximize the use of digital resources to support instruction, learning, and student performance. Engaging in ongoing strategic technology planning is also detailed in this standard. Finally, the standard of *visionary leadership* details how effective school technology leaders advocate for policies, programs, and funding to support the vision and planning efforts related to technology.

The second standard is titled *digital-age learning culture*. This standard describes how school administrators must ensure that instruction improves digital-age learning and that the school and classrooms are sufficiently equipped with digital technologies that support individual student needs. Additionally, school technology leaders should "model and promote the frequent and effective use of technology for learning" (ISTE, 2009, p. 1). This standard also describes how educational administrators should participate in innovation-focused learning communities at the local, national, and global levels.

Excellence in professional practice is the third standard. This standard focuses on the leaders' role to empower educators to enhance student learning through technology. Standard three describes how school technology leaders must ensure time and resources are devoted to technology-focused professional development of teachers. Technology leaders must also participate in technology-related professional development themselves. Inclusive in this standard is how school leaders promote and model the use of digital-age tools. Finally, standard three stresses that effective school technology leaders should remain current on research and trends in technology as they relate to student learning.

The fourth standard is *systemic improvement*. Central to this standard is data-driven decision-making that includes collaborating to collect data, analyze data, interpret findings, and share results around staff and student performance. The fourth standard also describes how school technology leaders must recruit and retain technology-savvy teachers and staff. This standard also focuses on supporting the infrastructure and creating strategic partnerships to support "management, operations, teaching, and learning" (ISTE, 2009, p. 1).

The fifth and final standard is titled *digital citizenship.* This standard focuses on the school leaders' responsibility for ensuring equitable access to digital tools as well as promoting, modeling, and establishing "policies for safe, legal, and ethical use of digital information and technology" (ISTE, 2009, p. 1). Digital citizenship also includes promoting and modeling responsible social interactions when using digital technologies. The standard of *digital citizenship* details how a school technology leader must also facilitate a school-wide understanding of and involvement in global issues through modern digital communication tools.

Within this theoretical construct, the researchers had two central motivations. First, we wanted to understand what the five NETS-A look like in Native American schools. Second, we wanted to explore the challenges school leaders of Native American schools face when trying to become effective technology leaders.

Technology Leadership in the Native American Context

The median household income of American Indian and Alaska Native families is the lowest of any major racial or ethnic group (Ogunwele, 2002; United States Census Bureau, 2005). American Indians and Alaska Natives have a greater proportion of individuals living below the poverty level and have the lowest rates of educational attainment and labor force participation than any other racial group (Ogunwele, 2006; United States Census Bureau, 2000).

American Indian educational attainment is lowest on reservations and in designated tribal areas. One-third of American Indians living on reservations have less than a high school education, a rate slightly higher than Indians living outside of tribal areas (Ogunwele, 2006). Over a third of American Indians and Alaska Natives live in just a few states on relatively isolated reservations or in other designated tribal areas (Ogunwele, 2002, 2006). Low educational attainment has been largely attributed to low cultural relevancy of education and limited economic opportunities (Reyhner & Eder, 2004; Reyhner, Martin, Lockard, & Gilbert, 2000). Not only must schools serving Native American students work within the challenges mentioned above, they must work to create learning organizations that facilitate graduate success in a highly-competitive, technology-suffused, globally-interconnected economic environment (Brescia & Daily, 2007).

While creating 21st century learners, principals of American Indian schools must navigate historically distinctive cultures as well as the unique economic, political, educational, and social characteristics of their local communities (Allen, Resta, & Christal, 2002). Walking these educational, cultural, and technological tightrope requires a delicate balance by school administrators in Native American schools. As digital technologies become more prevalent in these communities, it is important to better understand the role of leaders of Native American schools regarding the adoption of new technologies. This study attempts to gain insight into the lived experiences of these school leaders.

Leadership and Technology in Native American Communities

Leadership in Indian communities differs from leadership in non-Indian communities. Wakshul (1997) noted how leaders in Native American communities must know the values and history of both their traditional community

as well as the mainstream community. McLeod (2002) stressed "tribal leadership is the embodiment of a lifestyle, an expression of learned patterns of thought and behavior, values, and beliefs. Culture is the basis; it formulates the purpose, process, and ultimately, the product" (p. 13).

Monroe (2002) noted that digital technologies are increasingly used at the tribal government level and that schools serving Indian majority populations favor the use of multimedia and digital presentation technologies. In a study focused on new media, technology, and indigenous culture, Ramesh (2006) stressed that barriers between indigenous cultures and technologies "will continue to erode and in turn a continued trajectory of ethno-media research will uncover new empowering potential uses of technology within the ethnic and indigenous realm" (p. 516). Nonetheless, Brescia and Daily (2007) concluded that more research is needed that focuses on how tribal leaders can use technologies in ways that best serve their tribe.

In 2005, the Bureau of Indian Education (BIE) (2007) published the Indian Education Technology Plan 2007-2010. The plan is aligned with the National Educational Technology Standards for Students (ISTE, 1998). This executable technology plan was aligned to support the efforts of the Office of Indian Education Programs (OIEP). The plan includes vision, mission, and goals. It describes various national initiatives aimed at addressing the technology needs of Native American schools served by the BIE. This was one of the first major initiatives to directly link technology standards and leadership with Native American schools. The existing body of literature makes it clear that technology leadership in these communities is needed, but fails to explore this topic. The literature does however indicate that the needs, constraints, and possibilities in these communities may be unique with regard to school technology leadership.

Method

A case study approach was used for this study (Merriam, 1998; Yin, 2003) where the design process relied on interviews as the single data source, focusing on the perspectives of principals in a variety of Native American schools. To be consistent with the 12 regional divisions of Bureau of Indian Education (BIE) (formally known as the Bureau of Indian Affairs) schools, this study clustered those divisions into four regions (West, Midwest, Northeast, and South) as defined by the United States Census Bureau (2005).

Sample / Participants

As of 2010, the BIE funded 183 schools, 124 of which are tribally controlled through a contract or grant and 59 of which are operated by the BIE (BIE, 2010a). In the 2009-2010 school year, these 183 BIE schools served approximately 42,000 students in grades K-12 across 23 states (BIE, 2010b). The BIE schools were first divided into the four regions. Using a random sample stratified by region, the researchers invited 26 principals to participate in the study: seven from each of the two larger regions (West and Midwest) and six from each of the two smaller regions (South and Northeast). Nine principals agreed to participate in the study.

Follow-up phone calls and letters were made to all non-responders. One principal refused to participate noting that all studies had to be cleared through the school board. Three principals refused to participate citing their inability to discuss technology issues. These three principals however did attempt to point the researchers to their respective technology point person. Being that this study focused only on principals, the technology coordinator was beyond the scope of the current study. The remaining 13 principals failed to return repeated phone calls and letters.

We speculate the low response rate is indicative of a few issues. First the topic of school technology may be unfamiliar to school leaders and thus they may have felt they had nothing to add to the discussion. Second, the researchers were non-Native academics. There may be bias against talking to outsiders about local issues. Finally, principals are busy people. It may have been difficult to dedicate time to a phone conversation. By looking at the demographic data found in Table 1, we did not see any systematic bias in responses. The principals in the study represent a wide array of diversity including: experience, years as a principal, race, gender, type of school, school size, grade levels, and location.

Data Collection and Analysis

Qualitative data was gathered using 60-minute guided, semi-structured telephone interviews. Transcripts were coded using Strauss and Corbin's (1990) coding procedures. Using the constant comparative method, the researchers analyzed interview transcripts for themes and grouped the data into categories based on frequency and uniqueness. The researchers determined an initial set of codes through open coding. Axial coding was completed at a second stage to make explicit connections between categories. Through this process, the initial set of codes was refined and expanded based on the data set. Selective coding was used to validate the relationship between themes against the data. The themes were member checked with the assistance of a Native American informant who is an academic and researcher familiar with current issues facing Native American communities. Finally, the themes were categorized according to the five standards of the NETS-A.

Interview questions focused on school demographics, the presence of technology in the school, technology funding, technology access, challenges of technology leadership,

Table 1
Description of Schools and Principals

	School								
	A	B	C	D	E	F	G	H	I
Principal Characteristics									
Ethnicity	American Indian	White	White	White	American Indian	White	White	American Indian	American Indian
Gender	M	M	F	M	M	F	M	F	M
Years of experience	3	24	9	5	17	3	2	6	17
Years as principal at school	3	1.5	9	1	3	2	2	3	7
School Characteristics									
Type of school	BIE, boarding	Contract	Grant	Grant	BIE, boarding	Grant	Grant	BIE, boarding	Grant
Distance to nearest city > 15,000 pop. (miles)	130	30	50	50	115	115	120	90	70
Pop. of nearest city	448,000	31,000	40,000	68,000	53,000	15,000	122,000	20,000	90,000
Grade level	K-8	K-8	K-8	K-6	K-8	9-12	K-12	K-8	K-12
Teachers	20	19	15	140[1]	22	19	15	29	21
Enrollment	150	124	120	684	380	235	81	428	120
Student to computer ratio	4:1	1:1	2:1	5:1	8:1	3:1	5:1	4:1	1:1
F.T. tech. coordinator	no	yes	no	no	no	yes[2]	no	yes	yes
Informal in house tech. specialist	yes	n/a	yes	no	no	n/a	yes	n/a	n/a

[1] Figure includes teacher aides
[2] 3 technology coordinators

and the intersection of technology with traditional Native cultures. The questions did not explicitly focus on the NETS-A. Rather, the questions aimed to create discussions around all aspects of these five standards. The following section describes the schools in the study. A discussion of technology leadership in these schools follows. Finally, we discuss the challenges of technology leadership in Native American schools.

Findings

Participating Schools

For the purpose of the current research, we used the definitions of grant, contract, and BIE schools as described by Synder-Joy (1994). Grant and contract schools are funded by the federal government but operated by the tribe. BIE schools are funded and operated by the federal government. It should be noted that state-funded public schools exist on many Native American reservations. These public schools are identical in form and structure to any other public-funded state school. Since these schools were not included in the BIE database, they were excluded from this study.

Nine principals of schools in Native American communities participated in the study. Six principals were male and three were female. Four were Native American and five were White. The participants included three principals from the West, four from the Midwest, one from the Northeast, and one from the South. This provided representation to each of the four geographical regions defined by the United States Census Bureau (2005). Table 1 provides a full description of the schools and principals.

NETS-A Standards

After coding the interview data, the data themes were categorized by the five NETS-A. Themes related to *Standard 2: Digital Age Learning Culture and Standard 5: Digital Citizenship* were least discussed by the school principals. Themes related to *Standard 1: Visionary Leadership,* which includes funding and planning, were most often discussed. Findings categorized by the five standards are explored below.

NETS-A Standard 1: Visionary Leadership. All of the principals noted vision to be the key to technology leadership. The principal of School I stated that "we made a decision quite a number of years ago that technology was a priority for us … We need to stay abreast in the field of technology and we need to get kids in tune to using computers."

The NETS-A standard of visionary leadership details how a technology leader is an advocate for funding of technology initiatives. All school principals in the study discussed funding, but School G was the only school to receive funds from its respective tribe for technology. The principal noted how "this year, we wrote the [*tribe*]

and said what we wanted to do was get a mobile cart, a wireless cart. They approved the funding for that." Three principals mentioned having a casino on their reservation, but only School D was able to obtain any funding from casino revenue. This casino support was limited however to funding special events such as basketball games and not technology initiatives. With regard to establishing and leveraging partnerships outside of casinos or the tribe to fund technology, the principal of School H noted:

> If you want to do anything, it is going to cost money. If you were close to [*city*] you would have the opportunity to partner with corporations. Out here, there are no corporations for you to partner with. So, it makes it more difficult to get partnerships. It makes it more difficult to get the latest technology, like video streaming.

The principal in School B demonstrated vision through his ability to raise technology funds through grants. He stated:

> We have gone out and sought some grants and have done a lot with grants. The one thing that I have noticed here versus the public sector is that I have tremendous access to opportunities if we want to do the work. We get the financial resources necessary to not only put in the infrastructure, but also for the training and upkeep.

The principal at School B was able to secure Indian student grants and also Title III, Title VII, and bilingual funds. After recently completing a $250,000 grant for technology training of teachers, this principal went on to say:

> I think there are a number of grants that are available to Native students and indigenous people that public schools would never have access to. I think the financial situation of many of the families of our kids opens up some avenues that we would not have had. We make good use of E-rate money as well… I have never had the amount of funding or the ability to operate programs that we do here.

The principal of School I was being strategic when he said "technology changes so fast, you have to stay on top of things. You have to be prepared to upgrade, which means dollars. You have to have that flexibility… a dollar spent is a dollar well invested."

The principal of School H expressed a keen interest in applying for grants. At the time of the interview, the school had a job opening for a federal projects coordinator. This person will apply for grants including technology grants. The principal expressed concern that this position remained vacant too long. The principal of School D agreed that

funding options and autonomy greatly impact technology leadership in Native American schools. With regard to technology and funding, he said, "I think we are doing rather well… we have more flexibility maybe in how we spend our funds than public schools."

The principal of School C also noted the advantages of being a grant school when it came to technology funding. "Since we are a grant school, we have some leeway. I will just be honest with you. The Bureau [BIE], as a whole, has not been able to keep up. We have moved ahead of them because we cannot wait for them."

NETS-A Standard 2: Digital Age Learning Culture. Standard 2 was the NETS-A least discussed. This standard focuses on modeling and promoting the use of technology for learning, providing resources to meet the needs of diverse learners, infusing technology across the curriculum, and promoting and participating in local, national, and global learning communities. One tangential example did arise, however. The principal in School B is very tech savvy and is currently running three servers out of his home for his own personal use. During the interview he mentioned having a cyber-dinner the night before with his wife who was vacationing in the Caribbean. Although not directly linked to learning, it was evident that this school leader was effectively using modern digital technologies in his personal life. No other principal explicitly discussed ways in which they embraced a digital age learning culture either inside the school or in their personal lives. This is indicative of the fact that the respondents were not raised with digital technologies and thus were still trying to understand how new technologies fit into their current lifestyles.

NETS-A Standard 3: Excellence in Professional Practice. The findings indicate that for these nine Native American schools, technology training and professional development was often piecemealed and generally came from within the school organization itself. As the principal of School C noted, technology leadership and technology training have been "homegrown." The principal of School B noted technology training for most of his staff came from state mandates to obtain a given number of college credits per year. These credits are usually obtained through in-service training provided by technology coordinators or technology savvy teachers from within the school. Other principals also reported using their technology teachers as the technology trainers. The principal of School I said "we have gotten our training here and there, bits and pieces through other sources. If we get a new program, we will have our tech person train them [the teachers]."

A challenge noted by the principal of School C was funding a full-time technology coordinator. To overcome this challenge, this school decided to "grow our own here" stating that "because we are small, we wear many hats." This principal went on to say:

> It started out as a couple of teachers who were just interested and we were self-taught and did some professional development. We learned what we had to learn…we moved along with the technology. Now I have a classroom teacher who has shown an extreme desire in the technology area. He has just continued his own professional development, taking courses and classes.

School B's principal admitted to having no real formal training to be a technology leader; he only had his personal interest in computer science. Nonetheless, he took advantage of many opportunities for personal professional development. This principal stated:

> I have gone to a lot of workshops administratively on the integration of technology with learning. I also provide opportunities for my staff to do that as well. I think that is the important part here. Sometimes we have these things and teachers do not know what to do with them or how to involve students. As an administrator, if you do not get the training yourself, you are not going to understand what is out there and what people need. I try to do that.

The principal at School F formed a building leadership team as well as a technology team and made technology integration a prime focus of the entire school. This demonstrates her ability to facilitate learning communities that stimulate technology integration. No other principal discussed creating technology teams to nurture and support the use of technology in the school.

NETS-A Standard 4: Systematic Improvement. The principal of School I described having complete faith in his technology person and giving this person free reign to choose appropriate technologies, implement systems, conduct internal professional development, and upgrade hardware. He said:

> I fully support technology. I make sure our budget provides money for technology. I make sure we have a highly qualified tech coordinator on board. I make sure we have a systems person come in if we have a systems problem.

The principal demonstrated the ability to maintain technology infrastructure as well as recruit and retain highly competent staff.

The principal of School F noted that "it has been years in the coming" to get resources to build a second computer lab and hire two technology coordinators. She said "we have been given permission by the board to solicit several different grant writers in the area of technology." This principal demonstrated her ability to recruit the right personnel, as well as, her ability to put the right people in

place who could establish partnerships in an effort to support systematic school improvement.

School C had a technology plan that is reviewed every five years. This school made a commitment to set aside part of its annual budget for technology. This school also exhibited creativity. The principal noted the school does not throw away any computer hardware. School C was using 12-year old Macintosh computers as dissection projects to understand the internal workings of a computer. Students graduating from 8th grade in this school know how to take apart computers and how to upgrade the hardware. School C also accepts donations of older computers, such as a recent one from the state's Department of Justice.

The principal of School C demonstrated this standard of technology leadership by researching, investing, and adopting PowerSchool, a web-based student information system. This tool allows parents to access student grades, attendance records, and other information on a daily basis. The principal decided to invest in PowerSchool as a replacement for the existing Administrator's Plus software due to PowerSchool's accessibility and stability. This principal exemplified the systematic improvement standard because she was working to maximize the achievement of learning goals through researching and adopting the use of appropriate technologies.

School-level technology access was not an issue in the nine Native American schools in the study. Each principal reported that school-level access was adequate or good but community access was poor to nonexistent. In most instances, the school served as the technology center for the community even opening the doors to the community after hours. Six of the nine principals ranked their school to be technologically richer than local state-run public schools. All nine leaders, therefore, were doing well ensuring the school had access to resources.

NETS-A Standard 5: Digital Citizenship. The principal of School B admitted he "was always fascinated with technology." He discussed using modern communication technologies in the schools saying "I just think that if we cannot get our kids to New York City physically, we can get them there" through virtual means. Here, he demonstrates his ability to model and facilitate involvement in issues outside of the reservation using modern communication tools.

Meeting the unique needs of the Native American student body was discussed by the principal of School I. This school recently began experimenting with "literacy boxes" utilizing laptop computers and workbooks that students can take home to practice reading and math. The school sends a teacher into the home to train parents and students on how to use these literacy boxes.

Challenges to Technology Leadership

Seven major challenges were discussed by the principals in this study. As detailed in Table 2, six of the nine principals mentioned having a staff that was unwilling to embrace technology. Five of the principals were unable to secure a school-level technology coordinator, while four of the principals said that isolation and poverty were the main hindrances to technology leadership. Other challenges included poor physical facilities, family problems, outdated technology, and unfamiliarity with school technology standards and technology leadership standards. The three most prevalent challenges are discussed in more detail below.

Challenge #1: Unreceptive staff. The principal of School E noted that the community's technology literacy was generally poor. While the school amassed a large inventory of various digital technologies along with networking infrastructure, he felt that "we are limited a lot by not having the technical support that we need." This school was hampered by outdated and non-functioning technology because the BIE funding formula does not include technology maintenance and repair.

School E's principal also expressed concern about his staff's inability to effectively use the technology. "You have to realize our staff would have difficulty mastering the technology skills at an 8th-grade level. Do you see what I am saying? We are still in the formative stages of building technology capacity." Additionally, he went on to say, "it is a pragmatic use of technology - to practice to be able to use it. We don't have any formal training … we don't teach technology per se … as we learn [technology skills] we teach the children. It is a slow process." The principal of School D noted that his biggest challenge was getting all the staff to use technology. "Some teachers are more technologically literate than others. Sometimes this is based on age. New teachers in [*state*] are required to take courses in technology and develop a technology portfolio."

The principal of School B discussed his frustration with staff members who were unwilling to learn how to effectively use the technology available to them.

"You can only beat a dead horse so many times. I guess that is the frustrating part.… If we get this school reform grant … we are going to be looking at doing electronic portfolios and things of that nature. We have people here, that I think, who we are going to have to pull them along. They are not going to be jumping on with us. We are going to have to drag them with us. I think that is a frustration... Especially in veteran schools with older people who do not like to see change. I think it is something we just have to keep working on. If we go to electronic portfolios they are going to have to change."

This principal noted that persistence and training were the only ways to effectively facilitate technological change. In regard to implementing electronic grading, he mentioned, "we did training after training and he [the technology coordinator] had to sit down and actually do it" with each individual teacher. The necessity to engage in one-on-one training was stressed by each principal in the study.

The principal at School H noted that one of the reasons her staff was not using technology was "that teachers themselves are uncomfortable with using technology… I think we can improve. We are constantly improving. We have a technology manager and I know that he is constantly trying to find new ways to get people more comfortable with using technology."

Challenge #2: Lack of technology coordinators. Each of the principals mentioned a major challenge in their school revolved around a building-level technology coordinator. School C's principal mentioned that the greatest challenge she faced was being unable to afford a full-time technology coordinator. Over the past few years, she personally served in dual roles as both the principal and the technology coordinator. She reported:

> It was very challenging as a principal and all the things that a principal is responsible for to be the one troubleshooting computers, loading software, determining what kinds of hardware to purchase, and writing the technology plan pretty much by myself.

The principal of School E mentioned, "We are limited a lot by not having the technical service that we need. A lot of our computers may sit idle unless we ask a consultant or technician to come in, and that is quite expensive." In School B, where a technology coordinator was available, students were reportedly using technology frequently and effectively. School B, however, was part of a statewide laptop program that gave laptops to each 8th grader. The program will soon be expanded into the 7th grade.

School G's principal noted the advantages a technology coordinator would bring to his school. "If you have someone on staff that is well-versed in technology… [he/she] knows about alternative funding and would be willing to pursue it. It helps out too." Technology coordinators were reported to serve multiple useful roles including systems analyst, trainer, and fundraiser.

Some principals sought creative solutions to the technology coordinator issue. School G began to investigate belonging to a consortium of schools that would share a common technology coordinator. The big issue for this principal was accessibility. "Do you want someone from the outside or someone we know we can call up and have here in a day? What is it we really want?" These hard questions need quick solutions since the technology needs of School G

exceeded the ability of their part time, in-house technology person.

As School A's principal described, "buying into a multi-school technology person does not always solve the problem." Her school is part of a 17-school agency that shares a technology coordinator. This person is located three hours away from the school. This school, thus, has chosen to train an existing teacher to accept some of the technology responsibilities. The principal estimated the consortium technology coordinator visited the school on only three occasions in the last year.

Tangential to a lack of a technology coordinator was the discussion about having adequate, timely funding to fund such positions. The principal at School E said that his biggest challenge was flexible spending. "A public school or grant school can write a check. Their money is in a nearby bank. They can write a check for whatever they need. This is one of the hindrances because we have to go through the federal tracking system." The principal of School E noted that "funding wise, we got a ways to go. I think somewhere, at some point in time whoever makes those [technology funding] decisions has to put that into the funding formula." This principal expressed his frustration at the "pittance" he can spend per year on technology which is around $16,000.

Challenge #3: Isolation and poverty. When talking about the challenges faced by his school, the principal of School I said, "We have poverty and the issues with neglect, just like all the other schools with high American Indian student populations." Upon reflecting on the technology use, access, and skills of teachers and principals in less isolated reservation schools, the principal of School H noted that "the vicinity makes it so they can get all that stuff there. Proximity plays a major role."

Poverty was a challenge reported by a majority of the principals in these Native American schools. The principal of School F noted that, prior to arriving at her school, she worked in a BIE school that would experience brownouts when the air conditioning came on. The school was so old it did not have adequate wiring for computers. The principal of School I also mentioned frustration with having poor facilities. "Basically, the facility challenge is a big headache of mine. Right now, I am looking at a flooded library and [I am] trying to figure out how to get us by until we get the new school." The principal at School A mentioned not applying for E-rate this year due to the condition of the school. Since it is slated for demolition in the next two years, the money spent on building infrastructure would be foolhardy.

When discussing poverty, the principal of School G noted how the school never asked for state assistance. The response demonstrated the schism between state-funded and federally-funded schools that serve Native American students. This principal said:

> One thing you have to remember is we do the

state accreditation process. We are just like a public school as far as that is concerned. But there are things we can do being an American Indian school that the public school would not be able to do. But it is a matter of weighing your options. Do you want to open the door for the state to come in and give them the opportunity to say you have to do this, this, and this in order to get this, or do you want that kind of struggle? That is a good question to ask. We are getting to the point where we ask, 'do we want to keep struggling along or do we open that door?'

The discussion about opening the door to state funding revolves around tribal sovereignty. By accepting state funding, these schools accept the regulations of the state. This would essentially remove all power the tribe has to self-determine its own future through the education system.

In response to why her school was investing heavily in technology, School H's principal said, "What we want is connectivity with the outside world. That is what we really want." Similarly, School A's principal noted, "I think the one thing that puts us way back is the isolation. I do not know how much you want to put emphasis on that. The isolation really hurts us." The remoteness of this school also impacted internet accessibility and, thus, restricted some options.

Discussion

The first research question focused on understanding technology leadership in Native American schools as described in the NETS-A. We found that the school leaders in the study exemplified various aspects of these standards. In general, the principals had a good grasp on technology leadership at the systems level. Most respondents spoke of fully understanding issues of access, funding, professional development, planning, and technology hardware.

Using the NETS-A in the Native American context proved to be a robust conceptual framework. These helped us understand that technology leadership in Native American had many commonalities with rural schools across the United States (Hawkes, Halverson, & Brockmueller, 2002), but there were a variety of unique issues. First, the funding streams were unique to these schools. Most external technology funding came from federal grants versus corporations, state funding, or even the tribe. Casino revenues did not provide any additional technology funds. In these schools therefore, having a competent grant writer on staff was a pivotal concern. Issues with technology funding were also interwoven with the nature of the school structure (i.e., grant, BIE, or public). These principals must learn to navigate their unique system and at the same time compete for student numbers with schools that can be more responsive with regard to technology funding. It was also evident that Native American schools compete for students with neighboring public schools. BIE and grant schools get a predetermined number of dollars for each student while public schools get these dollars and additional dollars through Impact Aid for serving Native American, at-risk students. Thus, those public schools can use the additional dollars to support technology initiatives, whereas, the BIE or grant school does not have that option.

Another unique aspect to being a technology leader in Native American schools is that these school leaders had to find creative solutions to technology professional development. The principals in the current study who experienced the most success as technology leaders tended to develop their own technology capacity including internally training technology savvy teachers as well as developing local technology coordinators. This aspect is quite similar to that of many rural school districts across the United States.

We also found that these principals tended to consistently neglect vital components of the NETS-A. When investigating the nuances of technology leadership, all of these principals indicated they were not prepared for the role. General trends included that these leaders did not fully understand digital age learning, rarely adopted technologies for their personal use, failed to focus on technology integration at the classroom level, did not actively use technology to improve teaching and learning, and did not fully comprehend digital citizenship.

The idea of embracing a digital age culture was almost totally neglected outside of one instance. The principals did not discuss topics such as using technology to improve learning, using data to inform and improve instruction, infusing technology across the curriculum, or promoting global learning communities. Some principals, however, did indicate hope in using digital technologies to meet the diverse needs of their students in the future. For example some principals noted how using innovative software, such as dissection simulations, would allow students to gain a virtual experience and not touch dead animals, which is taboo in some Native American cultures. Another idea discussed was using technology to better teach the native language and to digitally record elders telling traditional stories. No principal, however, described using these innovations in their school.

Digital citizenship was the other standard that was generally not present in these interviews. There were no discussions about using digital technologies to meet the needs of all students (outside of providing literacy boxes for home use), promoting the ethical use of information and technology, modeling responsible social interactions, and using digital tools to engage in global issues. Additionally, no principal discussed issues such as the safe and legal use of information.

The second research question focused on the challenges

Table 2

Frequency of Technology Leadership Challenges Noted by Participants

| | School | | | | | | | | |
Challenge	A	B	C	D	E	F	G	H	I
Unreceptive staff		X	X	X	X	X		X	
Lack of a technology coordinator	X		X	X	X		X		
Isolation/poverty	X				X	X			
Poor facilities					X	X			X
Family problems							X		X
Unfamiliarity with technology leadership standards								X	
Outdated technology					X				

of technology leadership in Native American schools. We found three main challenges: lack of professional development opportunities around technology issues, a lack of technology coordinators, and isolation and poverty. The issue of a lack of professional development hindered successes on many levels. Without access to professional development networks and teachers willing to learn new technologies, principals were forced to piecemeal training and do as much as possible internally with the interested teachers. These challenges mirror national studies of principals in off reservation schools. Anderson and Dexter (2000) found that "both teachers and, at other times, administrators initiated technology innovation. From the point of view of a learning organization, the most important thing is that both groups share vision and work together supportively" (p. 2). This idea of a shared vision, however, was not evident through these interviews.

The issue of not having a technology expert on hand was a major challenge for many of the principals in this study. Ronnkvist, Dexter, and Anderson (2000) found that building-level technology coordinators are instrumental in providing impromptu, one-on-one help and professional development workshops or in-service training for teachers. Principals in the current study, who experienced the most success as technology leaders, tended to develop their own technology coordinator. Internally developing technology expertise, however, is a double-edged sword. Warner (1998) stated that "administrators [in Native American schools] rely on the efforts of an individual in the system who chooses to add computers to their responsibility of teaching. When this individual moves, and teachers in Indian Communities are among the most mobile professionals, the expertise is lost until a new expert emerges" (p. 77).

The issue of isolation and poverty had many repercussions on these schools. As the principal of School H stated, "It is totally different if you live in a remote area. What I find when I read a lot of these studies is they throw them [rural, urban, and boarder schools] all together. I think to myself, good grief!" Few businesses are located on or near Native American reservations, thus, a school leader cannot simply ask for donations from local businesses to support technology innovations. Isolation also impacts technology infrastructure such as Internet speed which are usually slower in these communities as well as the ability to get repairs made quickly from outside venders who may be hundreds of miles away. Additionally, isolation and poverty impacts what technology resources that are likely available to students outside of the school day.

Conclusion

The principals in this study tended to be transactional leaders who stressed that their leadership was constrained by systematic challenges such as regulations of the BIE,

isolation, culture, and funding streams. The leaders in this study also hinted at being transformational leaders who had a vision of technology for their schools and were working to make changes within an array of confines. Thus, leaders in these specific schools were generally cognizant of the change process and were actively working to become better technology leaders. In their own context, each leader noted how staff, students, or communities were somewhat resistant to change. As transformational leaders, many discussions in the interviews revolved around creating a paradigm shift that honors the culture and infuses it with the benefits of digital technologies.

This study found that principals in Native American schools face numerous challenges with regard to modern digital technologies. Often hampered by inadequate facilities and restricted funding, these principals must combat the negative effects of geographic and cultural isolation from mainstream American society. This study strongly indicates that the principals in these Native American schools want and need a roadmap of successful technology leadership. As discussed above, by using the NETS-A as a tool for analysis, we were able to isolate areas of need. Native American schools, policy makers for Native American education, universities that serve Native Americans, and the BIE can make better use of their technology related objectives by using the NETS-A as a guide.

Although there has been some research on technology in Native American schools, much of it is dated and/or centers only on access and infrastructure. The intersection of technology, leadership, and education in the Native American context has been ignored in the research literature. This study contributes to the fields of technology leadership as well as Indian education by providing an up to date examination of technology leadership and challenges facing leaders in Native American schools today.

Innovations in modern technologies may offer unique solutions for Native American schools. WiMAX is a wireless alternative to DSL or cable Internet access. It is often discussed as a viable option to provide Internet access to the most isolated communities. Delivering telecommunications technologies to the most rural populations such as Native American reservations is often referred to as the "last mile problem." WiMAX is being used to provide mobile broadband internet access to entire cities and countries and represents a promising technology for Native American reservations. This technology also opens up solutions involving wireless, handheld technologies including the use of netbooks or the tablets. These are inexpensive options that will get computers in the hands of Native American students and teachers who predominantly reside in "last mile" communities.

We found that these Native American schools need effective technology leadership training to better incorporate

technology throughout the school. This need for technology leadership in all K-12 schools, not just Native American schools, is supported by numerous studies (Anderson & Dexter, 2005; Davies, 2010; Flanagan & Jacobsen, 2003; Gosmire & Grady, 2007; Leonard & Leonard, 2006; Prensky, 2006). Providing appropriate tools is just part of the solution. Without adequate training, these tools will go unused or underutilized.

Online learning offers solutions to issues of isolation and scalability. In some schools where there are only a few teachers or where the distance is too great, paying for expensive face-to-face training on technology integration is not possible. In schools on American Indian reservations, this option is all but nonexistent. However, tapping into online trainings can drastically reduce the costs while increasing the breadth of professional development opportunities. Online learning offers localized solutions too. These trainings could be supported by tribal experts or local community colleges that understand the culture, the schools, and the communities. Online technology training via wireless technologies can be scaled up and spread to the greater community. This may spark innovation, encourage entrepreneurial activity, and thus help Native American communities determine their own future through local economic development.

A limitation of this study is that we cannot generalize the findings to other Native American schools across the country. This study represents only nine schools on seven American Indian reservations. Reservation schools are extremely diverse and host a variety of political, cultural, geographical, technical, and societal differences. Thus, more research needs to be conducted on technology leadership in Native American schools. Suggestions include looking at technology successes in rural Native American schools separately from semi-rural or border schools. It would be interesting to fully explore the relationship between casino funding and technology integration because the general population often overestimates the impact of these monies. It is often assumed that a majority of Native American tribes receive casino funds. Understanding if and how these funds are used and if their use impacts technology initiatives on Native American reservations would thus shed some light onto this misconception. Finally, state government relationships with tribal governments may be an important factor in technology leadership as this relationship varies from state to state. Other areas of research that could help foster unique culturally-relevant solutions include the role of wireless technologies, one-to-one laptop initiatives, online learning, and virtual schooling within the context of Native American schools.

Manette (2004) emphasized that technology can provide power that overcomes constraints of geography and history but it requires leadership. Poverty, isolation, staff unreceptiveness, and lack of professional development as well as societal and systemic issues were found to be limitations to school technology leadership in these Native American schools. Nonetheless, the successes, optimism, and determination displayed by the participants in this study indicated that they are committed to the idea of effective school technology leadership. Moving forward, scholars must assist both in providing a thorough research based on the technology initiatives in these schools, but also in providing learning opportunities and assistance to these leaders regarding their unique challenges. Technology is driving the cutting-edge of educational practice, yet Native American schools are once again finding themselves an afterthought. It is only by resourcing these schools with the latest technology and supporting leadership that we can assist in bringing world-class opportunities to these frequently forgotten children.

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