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Rural Schools and the Digital Divide: Technology in the Learning Experience and Challenges to Integration

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In this era of rapid technological innovation, teachers in rural public schools employ a variety of educational technology tools to facilitate student learning. However, little information is known about these teachers' usage frequencies and perceptions of effectiveness of technology in the learning process. Furthermore, limited research exists related to the barriers rural teachers face in their adoption and use of technology. Utilizing a quantitative approach, this study investigated these perceptions among rural teachers. Findings revealed rural educators have differing opinions on usage and effectiveness of various web-based technologies and software. Teachers revealed personal trial and error as the most common way of new technology knowledge and skill acquisition. Participants reported budgetary issues as the largest barrier to technology implementation, followed by student internet access at home. Suggestions are provided so administrators and teachers can adopt and integrate appropriate educational technology tools to maximize student learning.

Keywords: **rural schools, educational technology, teacher perceptions, digital divide, barriers to use of technology**

The rise of educational technology as a critical element in the teaching and learning process has presented rural school districts across the country with an invaluable tool for overcoming challenges created by geographic isolations, remote populations, and financial constraints. Crucial to the development of 21st-century skills such as communication, collaboration, and creativity, teachers who actively employ technology produce students with higher levels of critical thinking and communication skills (Schafft, 2016). However, rural schools encounter significant infrastructure-related challenges, such as little to no access to broadband or, in some cases, no internet connection at all. Even for districts with access, students are still disconnected at home, including up to 28% in rural areas (Handal et al., 2018). An example can be found in Pendleton and Mingo counties in West Virginia where 35% of households lack Internet access or a reliable electronic device (American Civil Liberties Union West Virginia, 2020). Access to technology may help to reduce obstacles for rural schools such as outdated resources and access to higher education partnerships. Innovative technology usage can promote a collaborative learning community, provide opportunities to earn post-secondary credits via distance learning, and offer possibilities to move away from teacher-centered strategies such as lectures and individual student work (Yang & Kwok, 2017).

This quantitative investigation aimed to improve understanding of rural teacher usage frequencies and perceived effectiveness of various software programs and web-based technologies. Furthermore, the researcher-designed questionnaire examined ways in which rural teachers acquire technology skills and their largest

barriers to implementation. Previous findings (Croft & Moore, 2019; Gray et al., 2010) investigated rural teachers and technology, but omitted usage frequencies, perceptions, and knowledge acquisition. Additionally, although researchers examined barriers to technology by content area (Makki et al., 2018; McCulloch et al., 2018), little exploration of barriers rural teachers encounter appears in the literature.

For the purpose of this study, usage was operationally defined as the frequency in which educational technology was employed for instruction inside and outside of the classroom. Perception was defined as how rural teachers viewed, comprehended, and construed the effectiveness of technology.

Literature Review

Use of Technology in the earning Process

School systems across the United States encourage the use and implementation of technology for teachers and students alike. Guided by standards and mission statements from national organizations such as the International Society for Technology in Education (ISTE), districts seek to leverage technology to prepare students with knowledge, skills, and dispositions to be successful in a competitive, global job market (International Society for Technology in Education [ISTE], 2014). On the federal level, the United States Department of Education (2010) stated “technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content” (p. ix). However, prior research suggests well-placed intentions and increased connectivity do not necessarily prepare teachers for successful technology adoption (Blanchard et al., 2016). This issue is particularly common in rural communities, especially those located in high-poverty settings, with large numbers of underrepresented students. This lack of effectiveness creates an opportunity gap which further limits achievement levels of disadvantaged students (Harris & Hodges, 2018).

Previous studies found teachers who implemented technology-enhanced innovations achieved better results than physical textbooks themselves. A synthesis of nearly 30 meta-analytic studies (totaling more than 1,000 articles over a 40-year span) revealed significant increases in student achievement when technology was used compared to technology-free instruction at small to moderate levels. Specifically, students in a classroom where technology is utilized performed 12 percentile points higher than those in a traditional setting (Tamin et al., 2011). Links between student achievement and motivation suggest this bond takes on a larger importance for high-needs students than for other students (Jones & Dexter, 2018). Furthermore, teacher expectations and practices have a large impact on students. Technology-based teaching practices have been shown to increase student engagement and motivation, which positively impacts student achievement (Christensen & Knezek, 2017; Knoblauch & Chase, 2015).

Although teacher access to technology has improved, concerns remain about the perpetuation, or widening, of a digital divide amongst teachers and students in rural areas. The digital divide is defined as “the inequality in access to technology that exists between communities due to regional and demographic differences, particularly socio-economic groups” (Tustin, 2014, p. 4). studies revealed teachers of rural and underrepresented students were less knowledgeable about techniques to effectively implement technology (Davis & Hall, 2018; Kalonde, 2017). A 2015 study in Washington state examined student achievement and teacher quality; a wide range of quality measures, including licensure exam score, experience, and effectiveness, revealed low-income schools featured unequal distribution of quality teachers. The most prominent disparities were found in seventh grade reading and mathematics (Goldhaber et al., 2015).

Technology in Rural Schools

While some educational research focuses on rural contexts, there is little with an emphasis on the usage of technology in rural schools (Blanchard et al., 2016). Rural communities have been associated with uneven educational opportunity and development, especially related to change brought about by technological advancements (Islim et al., 2018). In the learning process, technology is an

essential tool in the acquisition of 21st-century literacy skills, regardless of income, language, or geographical setting. For rural schools, technology may provide students with options, experiences, and resources which promote attainment of these abilities on par with their urban and suburban peers (Kalonde, 2017; Miller, 2010). Technology can be used to promote critical thinking and support student expression of their own perspectives and voice. Encouraging students to explore identity in a conscious manner of their rural contexts may increase development of identity and voice (Wang et al., 2019).

Rural districts, from Appalachia to Native American reservations in the West, face unique financial barriers which present large challenges to satisfy their students' most basic needs. Often, poverty is more prevalent in rural American than urban areas. According to the 2010 Census, poverty rates were much higher in rural areas (up to 57% of the local population) than in cities (up to 37%). Schools considered to be "completely rural" as opposed to "partly rural" feature higher rates of child poverty and students living with grandparents instead of the parents (Holder et al., 2016). These factors, combined with gaps in the Elementary and Secondary Education Act such as funding for new programs to help poor children instead being used to fill holes in budgets, put rural schools in a disadvantageous position when it comes to securing funding for their teachers and students. Although unintended, the Title I formula allocated more resources to larger, but less poor, school districts and disproportionately flowed away from small, rural schools. This stemmed from a lack of adequate oversight of how money was used and poorly crafted language allowed for school administrators to use money for purposes other than the original intention (Weiss & Ellerson, 2014).

A lack of financial resources influences schools in a variety of ways. High poverty rates in rural settings negatively impact teacher salaries, technological resources, and teacher training (Eppley, 2017; Goldhaber et al., 2015). Previous research revealed rural schools are more likely to face significant obstacles related to financial resources from dwindling tax bases, technological access, quality of teaching and supply, and disciplinary problems than schools located in suburban settings (Knoblauch & Chase, 2015; Kormos, 2018).

Rural schools are also presented with a myriad of logistical challenges. These schools often feature limited support staff, which are assigned to cover multiple schools over dozens of miles (Weiss, 2019). Recruitment of staff and faculty is another challenge facing rural schools. Districts located in remote areas particularly struggle to attract new employees, and when they are successful, they suffer high turnover rates. Rural schools face higher turnover rates than urban and suburban schools, which leaves vacancies often filled by underqualified teachers (Tran et al., 2018). A lack of experienced teachers with the use of technology may hinder future implementation. New faculty who lack an experienced and qualified mentor are less likely to use technology in an effective manner in their teaching practices (Redding & Walberg, 2012).

Logistical issues are also prevalent related to Internet access. Rural areas may struggle to implement technology due to limitations brought upon by slow bandwidth. In many rural areas, school and home access to internet providers remains spotty, leaving schools to find new ways to deliver learning materials (Weiss & Reville, 2019). Slower internet speeds may limit teacher access to instructional materials such as images, videos, and document downloads (Redding & Walberg, 2012). However, innovative school districts have devised ways to combat a lack of internet service at home and local access to public libraries. Clay County Elementary School in Kentucky, with support from Partners for Education, purchased tablets for each student which provided access to a 10,000-book digital library. Students download age-appropriate books and materials onto their device while at school to provide access at home, over the summer, and during school closures such as snow days (Croft & Moore, 2019).

Rural student demographics, such as a high frequency of English language learners, special needs students, and lower percentage of college-bound students highlight additional challenges. For ESL learners in under-funded rural schools, educational technologies can close language and

learning gaps for students with disabilities and English language learners (Pazilah et al., 2019). Furthermore, rural schools may be isolated geographically with limited access to higher education learning partnerships, such as dual enrollment courses, and resources (Harris & Hodges, 2018). However, the small size of rural schools offers benefits for teachers and students. Teachers in rural schools have reported high levels of autonomy and greater work satisfaction. In addition, teacher/student relationships have been found to be typically closer than those in urban and suburban schools (Tran et al., 2018).

Teacher Perceptions of Technology Integration

Teacher beliefs and attitudes regarding technology's role in teaching and learning impact the manner in which technology is incorporated. Prior research found teacher attitude is the most essential element in technology implementation (Chung, 2011; Yang & Kwok, 2017). Khlaif (2018) affirmed any successful educational practice transformation needs an establishment of positive attitudes from users of the technology. A 2018 study by Islim, Ozudogru, and Sevim-Clark found teachers with a positive perception of technology reported high comfort and confidence levels with integrating technology into their teaching practices. There is also a need for teachers to be able to achieve what they consider reasonable technology-related goals. For technology to be successfully integrated on a large scale, objectives should not be distant in scope, and there should be a reconciliation between teachers and technology (Heath, 2017; Prasojo et al., 2019).

Teachers from all grade levels who believed students benefit from technology use are more likely to incorporate it into their teaching than those who did not (Edwards, 2016). Even though administrators may often perceive that technology is used as a way to occupy students' time and attention or as a reward for good behavior (Jones & Dexter, 2018), a 2011 survey of 126 teachers revealed participants believed technology helped students demonstrate higher order learning skills and become more efficient (Goldman & Kabayadondo, 2016).

Teacher perceptions about the impact of technology in learning reflects how it influences the learning process. Whereas knowledge about the usage of technology in teaching generally refers to understanding, beliefs refer to suppositions, commitments, and ideologies about the role of technology in teaching and learning (Domingo & Garganté, 2016). A better understanding of teacher perceptions can foster increased dialogue and collaboration between colleagues to promote coordinated technology practices across grade levels and content areas. Prior research found teachers are likely to acquire new technology skills and implementation ideas from colleagues, which may lead to an increase of independent internet searches related to technology acquisition (Alt, 2018; Blanchard et al., 2016). Based on the available literature, this study seeks to better understand the use of technology by rural teachers in terms of usage frequency, perceptions of effectiveness, and obstacles to implementation. The research questions are: How do rural teachers acquire new technology skills? How frequently do rural teachers use educational technology? What is the perceived effectiveness of educational technology according to rural teachers? What are the largest barriers to integration of educational technology for rural teachers?

Methodology

Instrument

This quantitative study utilized survey research methodology to examine K-12 rural schoolteachers' acquisition of technology skills, usage frequency, perceived effectiveness, and barriers to effective practice. For the study, *rural schools* were operationally defined as those located in a small town or rural area with less than 25,000 people (National Center for Education Statistics, 2014). A State Department of Education list of email addresses for each K-12 building principal provided contact information. Qualtrics served as the survey instrument system and disseminated all emails. Content of the email included the purpose of the study and a request for the principals to forward the email to their faculty members. The email also contained a hyperlink to the informed consent and survey.

The survey remained active for 28 days. The questionnaire totaled 28 items and included three from prior research and survey instruments used by Kotrlik and Redmann (2009) and Coley et al. (2015). The initial part of the survey consisted of nine items related to teachers perceived level of satisfaction with student and teacher access to technology and administrative support. The next section featured 19 items and investigated frequency of use and perception of effectiveness of software programs and web-based applications. For each construct, Likert Scale responses were employed. In this section, teachers also identified barriers to usage and sources of knowledge acquisition. The final portion featured demographics such as age, gender, years of full-time teaching experience, grade levels taught, and content areas. A panel of teachers in the field established content validity. To establish reliability, 20 public school teachers took the survey and responses were recorded. Two weeks later, these participants retook the same survey to ensure responses were similar. These respondents were not eligible to take the final survey which included the data presented in this article.

Participants

The questionnaire resulted in volunteer responses of 937 K-12 teachers employed in a rural public school system. A dropout rate of 9% resulted in 860 usable responses. Females comprised 68% (*N*=584) of responses compared to 32% males (*N*=276). The average age of respondents was 42 years old and employed as a full-time teacher an average of 13 years. All grade levels were represented in the data. Middle grades had the highest number of respondents (*N*=439; 51%), followed by grades K-4 (*N*=396 46%), and 9-12 teachers (*N*=310; 36%). Middle grades and 9-12 teachers identified which subjects they taught. Math teachers (*N*=206; 24%) had the highest frequency of responses, then English (*N*=189; 22%), Social Studies (*N*=163; 19%), Special Education (*N*=120, 14%), and Science (*N*=43; 5%).

Findings

Respondents identified the processes in which they acquired new information and skills of educational technology. For this study, a descriptive statistical analysis was employed comparing mean scores and standard deviation of responses. Rural teachers selected personal trial and error as the best method (*N*=520; 64%) of acquisition. Other faculty and staff served as the second most likely source, followed by Internet searches. Teachers were more likely to learn new technologies from students (*N*=228; 28%) than in-service professional development or workshops (*N*=154; 19%). Undergraduate or graduate coursework (*N*=495; 61%) and online training modules (*N*=447; 55%) were never or rarely used for technology acquisition. Most (*N*=552; 68%) never used social media communities such as Facebook, compared to 11% (*N*=89) who did so often or always (Table 1).

Table 1
Sources of Technology Acquisition

Source	*N*	*M*	*SD*
Personal trial and error	812	3.41	1.02
Other faculty/staff	814	2.86	1.13
Internet searches	812	2.82	1.08
Students	813	2.02	1.23
In-services or workshops	810	1.96	0.98
Undergraduate/Graduate coursework	813	1.58	1.04
Online training modules	811	1.46	1.01
Social media communities/groups	812	1.40	1.07

Notes: 1=never, 2=rarely, 3=sometimes, 4=often, 5=always.

Table 2

Comparison of Rural Teacher Technology Usage Frequency

Technology Usage	*N*	*M*	*SD*
Incorporate technology into lesson plans	860	3.08	0.94
Access web-based technologies to conduct class	853	3.04	0.99
Require students to access Internet in classroom	857	2.37	1.02
Communicate with parents of students outside school hours	857	2.37	0.89
Assign classwork that requires web-based technologies	860	2.21	1.02
Communicate with students outside school hours	861	1.65	0.91
Assign out-of-class work on web-based technologies	859	1.47	0.79

Notes: 1=never, 2=1–2 times a week, 3=3–4 times a week, 4=daily

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The third objective explored usage frequencies of web-based learning technologies. Teachers revealed document creation programs, such as Google Docs, as most likely (*N*=505; 62%) to be used at least once per week, followed by class websites (*N*=350; 43%), video sharing (*N*=293; 36%) and asynchronous communication (*N*=253; 31%). Formative and summative assessment technologies produced the highest standard deviation of responses. The majority (*N*=529; 65%) utilized assessment programs at least once a month. However, only 13% (*N*=106) employed assessment tools on a weekly basis. Podcasts (*N*=716; 88%) were least likely to ever be used (Table 3).

Table 3

Comparison of Technology Usage Frequency of Web-Based Technologies

Technology Type	*N*	*M*	*SD*
Create/edit/share documents	814	3.86	1.93
Class/teacher website	813	3.44	2.08
Video sharing	813	3.30	1.76
Asynchronous communication	815	2.70	2.02
Online classroom calendar	813	2.48	1.99
Formative or summative assessment	814	2.44	1.67
Learning management system	814	2.10	1.83
Photo sharing	810	1.48	1.08
Social networks	815	1.43	1.11
Microblogging	813	1.19	0.67
Podcasts	814	1.12	0.98

Notes: 1=never, 2=a few times a year, 3=a few times a semester, 4=monthly, 5=weekly, 6=daily.

Table 4

Comparison of Rural Teacher Perceived Effectiveness of Web-Based Technologies

Technology Type	*N*	*M*	*SD*
Create/edit/share documents	807	3.91	1.25
Class/teacher website	805	3.65	1.25
Video sharing	804	3.43	1.27
Formative or summative assessment	799	3.42	1.34
Asynchronous communication	802	3.38	1.37
Learning management system	800	3.01	1.35
Photo sharing	796	2.65	1.22
Microblogging	798	2.53	1.21
Social networks	803	2.28	1.25
Podcasts	798	2.16	1.32

Notes: 1=not at all, 2=slightly, 3=neutral, 4=moderately, 5=extremely.

Respondents then assessed perceived effectiveness of web-based technologies. Document creation was viewed most positively, as 43% (*N*=351) viewed it as extremely effective. compared to just 9% (*N*=69) who felt it was not effective at all. Class or teacher websites (*N*=410; 51%), video sharing (*N*=438, 54%), assessment tools (*N*=436; 55%), and asynchronous communication (*N*=424; 53%) were also viewed as either moderately or extremely successful by the majority of teachers (Table 4). Respondents perceived learning management systems (e.g. Google Classroom, Schoology) as a neutral (*N*=263; 33%) educational technology. While 37% (*N*=299) perceived LMS as either moderately or extremely effective, 22% (*N*=179) perceived LMS as "not at all" effective. Most teachers perceived social networks to be either not at all (*N*=359; 45%) or slightly (*N*=152; 19%) effective. Podcasts were not perceived positively, as only 22% (*N*=176) viewed it as moderately or extremely effective.

The fifth research interest evaluated usage frequency and perception of instructional software (Table 5). On average, only internet browsers (e.g. Google Chrome, Mozilla Firefox) were used weekly or daily by the majority of teachers (*N*=713; 86%). Other software used at least once a month by over half of respondents were word processors (*N*=678; 81%), presentation programs (*N*=602; 72%), and educational games (*N*=546; 66%). Photo (*N*=476; 57%) and video editing (*N*=560; 68%) were most likely to never be incorporated.

Next, teachers disclosed attitudes related to the effectiveness of the same software programs. Internet browser (*N*=746; 90%), word processing (*N* = 672; 81%), presentation programs (*N* = 676; 82%) and educational games (*N* = 640; 77%) were viewed by the majority as either moderately or extremely effective. Photo and video editing reported the lowest usage frequencies and perception mean responses. Although respondents viewed photo (*N*=322; 40%) and video editing (*N*=329; 41%) as either slightly or not at all effective, 51% (*N*=416) perceived audio/video players as moderately or extremely effective (Table 6).

Table 5

Comparison of Technology Usage Frequency of Software Programs

Technology Type	*N*	*M*	*SD*
Internet browser	833	5.38	1.16
Word processing	833	4.78	1.65
Presentation programs	833	4.29	1.66
Educational Games	832	3.95	1.61
Video/audio player	830	3.12	1.81
Spreadsheets	830	2.95	1.70
Photo editing	830	1.97	1.38
Video editing	827	1.60	1.06

Notes: 1=never, 2=a few times a year, 3=a few times a semester, 4=monthly, 5=weekly, 6=daily.

Table 6

Comparison of Rural Teacher Perceived Effectiveness of Software Programs

Technology Type	*N*	*M*	*SD*
Internet browser	832	4.50	0.83
Word processing	828	4.23	1.08
Presentation programs	824	4.20	1.02
Educational Games	832	4.00	1.08
Video/audio player	817	3.34	1.31
Spreadsheets	818	3.16	1.34
Photo editing	814	2.67	1.27
Video editing	811	2.64	1.27

Notes: 1 = not at all, 2 = slightly, 3 = neutral, 4 = moderately, 5 = extremely.

The final research area assessed rural teacher perceptions of severity of selected barriers in the technology integration process. Respondents identified financial cost as most significant, as 33% (*N*=268) felt it was a moderate barrier, while 39% (*N*=316) labeled money an extreme barrier. Teachers perceived time to incorporate technology into lesson plans to be the second largest barrier. Two out of three respondents (N=536; 66%) felt time was either a moderate or extreme barrier, compared to only 9% (*N*=76) who stated it was no barrier at all. The findings suggest teachers lack technology not because of an absence of knowledge or need, but rather the requisite time to create lesson plans which incorporate technology. Student access to the internet at home was found to be the third most significant barrier. Student interest in technology was viewed as the smallest barrier. Specifically, 68% (*N*=553) had no barrier at all, while only 24% (*N*=191) viewed it as somewhat of a barrier. With appropriate levels of interest and knowledge, students are more likely to use

technology during the learning process in an effective manner. Additionally, teacher interest, administrative support, and student knowledge of technology were perceived as minimal barriers (Table 7).

Table 7

Rural Teacher Perceptions of Technology Integration Barriers

Barrier	*N*	*M*	*SD*
Financial cost	812	3.04	0.94
Time to incorporate technologies into lesson plan	812	2.83	0.93
Student access to Internet at home	812	2.70	0.89
Class time for students to utilize technology	810	2.60	1.00
Student access to technology at school	814	2.43	1.07
Lack of training	814	2.37	1.00
Teacher access to technology	813	2.15	1.05
My knowledge of technology	814	2.00	0.87
Student knowledge of technology	813	1.82	0.80
Administrative support	814	1.76	0.90
My interest in technology	814	1.51	0.74
Student interest in technology	811	1.41	0.70

Notes: 1 = not a barrier, 2 = somewhat of a barrier, 3 = moderate barrier, 4 = extreme barrier.

Discussion

Limitations

Study participants were limited to rural K-12 public school teachers in a Mid-Atlantic state. A second limitation occurred when the researcher was unable to contact participants directly and relied on voluntary responses. The researcher contacted building principals via email, who then forwarded the survey to their faculty members.

Conclusion and Implications

The findings extend the literature related to knowledge and skills acquisition, usage, and perceived effectiveness of various educational technologies used by rural teachers. From the results, it was evident rural teachers utilized a variety of methods to acquire technology knowledge and skills. However, results indicated teacher usage and perceptions varied widely. Through a more developed understanding of how rural teachers use and view technology, researchers and administrators may develop approaches which focus on incorporation and innovation. An additional contribution is identification of barriers rural teachers face related to technology. More specifically, responses offer a chance for researchers to develop new strategies to alleviate challenges such as financial support and lack of student internet access at home. A focus on rural teachers, rather than educators as a whole, presented a more distinct glimpse of technology usage within these schools.

Differences existed between respondents' perspectives of technology availability in and out of the classroom. Findings revealed approval of teacher and student access to technology at school. Prior research indicated teachers and students in rural schools were less likely to have computer

access and slower Internet speed than suburban and urban students (Fowler et al., 2013; Handal et al., 2018). Additionally, a shortage of appropriate technology only further discourages teachers from acquiring and learning new and existing technologies (Blanchard et al., 2016). Student access to technology influences the capability and effectiveness of instructional strategies during and after class time. Teachers revealed student access to internet access at home as the third largest barrier. This may suggest continued lack of access for rural students based upon geographic constraints. One potential solution may be training and implementation of smartphone-friendly technologies. Though internet connections may be spotty or non-existent at home, students may use smartphone data plans to perform school-related work if available. Also, the purchase of tablets may provide students with digital resources outside of school via download capabilities (Croft & Moore, 2019). If teachers use smartphones effectively, they may communicate with students outside of school hours. Prior research found mobile applications can promote accountability and provide a channel for students to ask questions they may not in the classroom (Marshall, 2016).

Respondents considered financial cost as the most significant barrier. One way to work around budget restraints may be the usage of free or low-cost education software or mobile apps. District and building technology administrators should design professional development workshops and in-service training on specific platforms which are compatible with a variety of devices. Many financially strapped rural schools may be incapable of providing teacher stipends for subscription-based technology. This further demonstrates the importance of teachers to integrate technologies that permit stakeholders—including students and parents—to use at no cost. In particular, this may be of significant relevance to school districts geographically located in economically depressed communities.

Analysis suggested rural teachers were most likely to obtain innovative skills and adopt new technologies through personal trial and error. Additionally, fellow faculty and staff served as an important acquisition resource, as the majority of teachers revealed they often or always acquired new abilities through conversations with colleagues, which is consistent with Edwards' (2016) assertion that dialogue with coworkers related to technology facilitated improved excitement and efficiency. Applying these findings to the classroom, rural school administrators may create shared planning periods to examine and model technologies, promoting consistency and helping new faculty. For example, professional learning committees (PLCs) may be incorporated into the course schedule to foster cooperation by grade level or content area. Formation of faculty social media communities designed with the purpose to share and examine technology in an asynchronous, school-monitored setting may provide additional support for teachers outside of school hours (Jones & Dexter, 2018).

Differences existed between usage and perceptions of effectiveness of formative and summative assessment tools; although participants viewed them positively, many teachers did not employ them on a regular basis. Playposit and Quizlet, for example, provide student or teacher-created measurements of learning in low and high stakes settings. In the classroom, these platforms permit teachers to collect student thoughts on school policies, create an interactive environment, and evaluate learning during instruction (Marshall, 2016). Furthermore, by creating a collaborative classroom, rural teachers can replace drill and practice instruction and introduce higher order thinking skills (Ryan & Bagley, 2015).

Results showed document creation, class websites, and video sharing received the highest perceptions of effectiveness. Rural teachers used these technologies on a more frequent basis than prior findings from a national study of public-school teachers (Gray et al., 2010). These new findings highlight the need for continued professional development of technologies, such as Google's G-Suite for Education, which promotes Universal Design for Learning principles to offer students a chance to demonstrate mastery in a medium of their liking (Weiss, 2019). When utilized properly, these tools foster student collaboration and increase cognitive ability. Learners engrossed in cooperative-based activities are more liable to partake in group discussion, encourage shared formation of knowledge, report higher achievement

levels, and foster increased enthusiasm than students who work independently (Eppley, 2017). Video sharing technology, such as YouTube, allows for delivery of content through multiple media, rather than paper-based textbooks or documents. Typically, rural school districts feature higher levels of students learning English who may prefer to use visual learning, in addition to subtitles, to develop understanding (Yentes & Gaskill, 2015).

Results showed most teachers rarely utilized learning management systems (e.g. Google Classroom). However, despite lack of use, respondents perceived the technology to be effective. Based on responses, it appears low usage frequencies are more likely to be attributed to an absence of financial resources necessary to purchase district-wide access rights across rural districts than lack of teacher interest. The findings were comparable to prior research which suggested school districts located in lower socioeconomic communities were less likely to use LMS (Blau & Hameiri, 2017). Conversely, rural schools, which may feature high rates of learning disabled and transient students, may particularly benefit from LMS (Ryan & Bagley, 2015).

Findings of this study revealed rural schools utilized and perceived technology to be effective, however a number of obstacles to successful integration exist. It is imperative teachers are trained and provided an opportunity to familiarize themselves with various technologies, their benefits, and integration strategies by their school administration (Jones & Dexter, 2018). For rural schools, the following recommendations may be used to guide the adoption and implementation process:

1. Develop goals and objectives for technology adoption and implementation early in the adoption process.
2. Clearly articulate the purpose, goals, and objectives of technology integration at building and district-wide levels through multiple communication channels.
3. Address barriers to technology usage promptly and thoroughly.
4. Develop and provide multiple, continuous professional development opportunities for faculty.
5. Create a faculty mentoring system, especially for first-year teachers, for sustained support.
6. Provide numerous avenues for training, such as video tutorials, in-person trainings, and opportunities for one-on-one assistance.
7. Develop a plan in the early stages of adoption to ensure teachers have sufficient time to hear about new technology and support systems to integrate these tools into their teaching practices.
8. Utilize teachers within each building as leaders to provide support for peers in formal and informal training.
9. Consistently highlight benefits of educational technologies for all stakeholders, including parents. Furthermore, develop a showcase of effective use across the district.
10. Recognize many students may not have regular internet access and develop a plan to ensure alternative methods of content delivery are available for this population.
11. Regularly evaluate the technology integration process and use data-driven decisions to build upon strengths and address barriers to implementation.

Future Research

Results provide multiple areas for the continuance of scholarship. Although the study analyzed usage frequencies and perceptions of various technology programs and barriers, respondents provided a foundation for further research and practice. Further investigations may be implemented in other American communities based upon socioeconomic status, as well as foreign countries. Classroom observations and focus groups composed of teachers from a more diverse set of backgrounds may provide additional understanding of expectancies of technology usage. Additionally, interviews with district

administrators may help examine ways in which school districts adopt new technology and evaluate overall effectiveness.

These findings can lead to the development of resources to provide opportunities for teachers to learn technologies at their own pace. More specifically, districts should develop multiple ways to familiarize and train faculty on technologies offered within the school. In addition, schools should adopt a research-based implementation process which provides adequate time to effectively integrate technology. It is also imperative that districts create a transparent accountability mechanism to hold teachers and administrators responsible for utilization of specific technologies. Through an emphasis on continuous improvement, administrators can nominate teacher-leaders to direct training sessions and model innovative techniques. By placing a value on faculty mentors, teachers may effectively use their time to collaborate and foster a shared learning environment, including the creation of a resource bank to share and showcase ways to use technology to maximize student learning.

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