

The Use of Technology by Public School Principals

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ABSTRACT

Technology has always been a part of a principal's daily duties. Whether the technology is a pencil, an intercom system, a laptop computer, or mobile device, it has played a role in the principalship. Questions remain regarding the extent technology influences the principalship, as well as the reasons why principals utilize certain technologies more than others. The purposes of this study were to investigate technologies principals used, the reasons principals used the identified technologies, and the variables associated with the usage. The following variables were studied as factors contributing to the technology usage: knowledge of technology, attitude toward technology, professional development and training, and organizational support for technology. The study consisted of 12 interviews of principals from across the United States: four interviews with elementary school principals, four interviews with middle school principals, and four interviews with high school principals. All 12 principals worked in Apple Distinguished Schools. The researcher found access to technology was high among principals, teachers, and students. The participants wanted technology that made their lives simpler. Principals' dispositions toward technology were favorable, but included mixed and unfavorable dispositions as well. The principals' primary purpose for using technology was to become more efficient with their work. Support for the principal's use of technology existed through district funding of technology purchases, hiring of technical support, and providing professional development. Additional support was provided by grants from private companies. Policies regarding the integration of technology in schools were reviewed. Policies were considered

restrictive or facilitative. Respondents' knowledge of current technologies was evident, but they reported little knowledge about future trends. Most principals spent a majority of their day using technology. Recommendations for additional research include the study of the effect of technology on school culture, additional factors affecting technology use, data security, and the effect of technology on the effectiveness and efficiency of management. Recommendations for practice include: identifying technological devices and applications using the researcher's revised questionnaire, including time for immersion after a training or professional development opportunity, updating acceptable-use policies, and carefully constructing the goals and resources needed to successfully implement technology.

Dedication

To my Bride

To my beautiful bride, Sara. I love you more than I can possibly show you. I'm proud to still call you my bride after all these years and through all our challenges. I could not have done this without your love and support. Thank you, not only for loving me, but for being the best mother this world has to offer.

To Madilyn, Kent, and Josiah

Because of your mother, I have the best children a dad could ask for. I love all three of you more than you'll ever know. You are the pride and joy of my life. Thank you for being such uniquely pleasant and all around fun children. I know you will be successful at whatever you choose to do. Reach for the stars and always keep God and family first in your lives.

To my Dad

I miss you more every day. I hope you are proud. I love you, Dad.

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Chapter 1

The Problem

Electronic technology is inevitable in the daily activity of human lives (Elam, Stratton, & Gibson, 2007; Howe & Strauss, 2000) and has become an essential instructional tool in academia. The technological advances that are widely used for effective teaching and mentoring have significantly transformed education. Technology has become more than a tool for the presentation of the curriculum. It has become an extension of the instructor to the student (Stanhope, & Corn, 2014; Thacker, 2007). The effects are pervasive. A recent study (Eismeier, 2016) found 90 percent of early childhood educators have access to technology in the classroom and use it effectively. Students are being exposed to technology in the earliest years of formal education. The world is increasingly interconnected with technology, which contributes to the economy and achieves social connections among people on a global scale (Meade & Dugger, 2004).

Most schools are Internet-connected, even in kindergarten (Swan et al., 2006). Administrators, teachers, and students have numerous electronic interactions daily and are plugged into global learning networks (Fischer, Mazurkiewicz, Kellough, & Preslan, 2007). This exposure to technological advances is enhancing and reshaping the learning styles of students and adding value to their learning.

K-12 schools in the United States have integrated technological tools into all aspects of administration, teaching, and learning (Florida State Department of Education, 2004). This widespread integration provides all stakeholders with the skills to manage information efficiently and effectively as was required in the No Child Left Behind (NCLB) Act (2002). However, the

competency to respond to these technological demands remains a challenge for some school principals.

Context of the Study

Technology is changing rapidly. Literature related to technology use in schools is abundant. Literature related to the use of technology by school principals is not. Research (Grady, 2011) suggests principals should model the use of technology but does not speak to the technologies principals use or the reasons they are using certain technologies. Grady (2011) speaks briefly about some of the variables associated with a principal's use, such as confidence. The researcher in this study demonstrated that the use of technology by school principals and the use of technology by schools can be directly affected by the principals' attitudes toward technology. Further, principals' attitudes are related to their abilities to personally utilize various technological devices. The level of training received and the amount of time a principal is able to experiment with technological products profoundly affect a principal's technological proficiency (Demski, 2012; Starr, 2009). The implementation of the NCLB Act (2002) influenced educators to integrate information technology within school programs.

By examining the use of technology by principals in schools throughout the United States, the researcher gained a greater understanding of how technology is or is not being utilized. The variables associated with the usage of technology by school principals could provide the basis for changes in policies, revised professional development activities for principals, course requirements for principal preparation programs, increased security measures, and what devices and applications are preferred by school principals.

The use of technology in schools. The NCLB Act of 2001 (No Child Left Behind Act, signed in 2002) was a reform of the Elementary and Secondary Education Act (ESEA) of 1965,

which expanded the federal role in education and became the focal point of federal education policy. The legislation dictated requirements that affected virtually every public school in America. The intent of the NCLB Act was to improve the educational opportunity of disadvantaged students by establishing a number of policies designed to promote broad gains in student achievement and to hold states and schools more accountable for student progress (Olson, 2004). Technology has played a role in providing this opportunity to disadvantaged populations (Nickerson & Zodhiates, 2013).

NCLB required improvement in the academic achievement of students, which placed significant financial stress on school districts (Olson, 2004). As policymakers demanded specific, challenging accountability through high-stakes testing, school principals were forced to implement creative ways to increase student achievement, this included the use of technology, even though many school districts had limited budgets (Hartley & Keckemethy, 2008).

According to Project RED (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2010), school reforms are generally focused on weak change instruments that have limited impact, termed first-order changes. One example of a first-order change might be moving from a 60-minute class period to a 90-minute period. This change in a master schedule can generally be achieved with the people's existing knowledge of teaching and learning. Another example of a first-order change is the use of a computer program to run flash cards (Project Red, 2010). The difference between print flash cards and digital flash cards is nothing more than transfer. Unfortunately, first-order change includes most technology initiatives in education. However, utilizing a computer program that will track students to the point of identifying the root causes of

deficiencies and maps resources and strategies for a teacher to use in addressing those deficiencies saves time and dollars. This is the beginning of second-order change.

Project RED (2010) defined second-order change as doubling student performance levels, at a minimum, while addressing all student demographics. Furthermore, second-order change is sustainable and saves time and money. These changes tend to withstand the ebb and flow of the economic cycle and, therefore, maintain the results they realize in student learning. Project RED (2010) stated, “Learning what works for specific populations can dramatically reduce the cost of remediation by personalizing instruction. If schools know what works, they purchase redundant products and services less often. This is second-order change” (p. 7). Project RED (2013), stated a one-to-one program, where there is one device for every student, creates second-order changes in school culture, teaching, and learning. Second-order change requires new knowledge and skills by all involved in a one-to-one program, including school principals, teachers, and students.

A key finding from Project Tomorrow (2013) is the realization that future teachers will have certain skills to utilize various technological tools, such as social media, in their classroom. In addition, principals have higher expectations for their newest teachers regarding their utilization of technology. However, Project Tomorrow (2013) stated, “The specific technology tools and techniques the aspiring teachers are learning to use in their methods courses however do not match the expectations of those school principals” (p. 3). This is to say, that while new teachers are better equipped to use technology, principals are expecting a different type of use. In accordance with Project Tomorrow (2013), Project RED (2010), stated that schools are experiencing a technology implementation emergency. Best practices regarding the use of technology are inconsistent. Project RED (2010) identified nine significant factors strongly

affecting the implementation of technology and its educational success. The ninth factor on their list is principal training. Greaves et al. (2010) described principal training in teacher buy-in, best practices, and technology-transformed learning.

The annual *Horizon Report* is a description of the ongoing work of the New Media Consortium's Horizon Project (Johnson, Adams Becker, Estrada, & Freeman, 2015). Three adoption horizons are identified in the report. The three horizons are labeled one-year or less, two-to-three years, and four-to-five years. Six emerging technologies likely to have an impact on teaching, learning, research, or creative expression within educational organizations are identified and described in each report.

The increasing value of creativity and innovation, both for the student and the worker this student will become, was described in all reports since 2009. The authors (Johnson et al., 2015) highlighted the changing learning environments students are experiencing. The reports contain ways in which technology profoundly affects communication and collaboration in both work and play. As a result, success in these areas has become increasingly dependent on such technologies.

Each version of the *Horizon Report* (Johnson et al., 2013, 2014, 2015) emphasized student empowerment, as well as the risks involved in a progressively evolving, technological world. The need for this empowerment to be fostered properly and the necessary steps to keep students safe are both aspects referenced in the last three reports (2013-2015).

The technologies highlighted in the 2013 version of the *Horizon Report* only slightly changed from the 2010, 2011, and 2012 versions, but represented a moderate change from the 2009 version. The 2013 technologies included cloud computing, bring your own device, mobile learning, and online learning during the time-to-adoption horizon of one-year or less. The two-

to-three-year time-to-adoption horizon technologies included electronic publishing, learning analytics, open content, and personal learning. Technologies included in the time-to-adoption horizon of four-to-five years were 3D printing, augmented reality, virtual and remote laboratories, and wearable technology.

The 2014 and 2015 editions of the *Horizon Report* (Johnson et al.) had both similarities and differences from the 2013 edition. Bring-your-own device models of technology integration remained in the one-year or less horizon. However, 3D printing was categorized in the 2013 report as four-to-five years away from adoption. 3D printing was not referenced in the 2014 *Horizon Report* (Johnson et al.). 3D printing was again referenced in the 2015 report within the two-to-three-year adoption horizon. Notably, wearable technologies were listed in the three-to-five-year horizon for all three reports from 2013 through 2015.

Johnson et al. (2014) examined the following technologies and their impact on the K-12 environment. First, as in the three prior reports, cloud computing was identified. The report estimated the adoption of cloud computing to be one-year or less. However, this adoption has not become embedded in public school systems throughout the United States. The relatively low cost of hosting content in the cloud is one potential benefit of cloud computing. As the report emphasized, traffic currently costs pennies per gigabyte. Cloud-based applications such as word processing, spreadsheets, and presentation tools are now available. A second important driver for innovation and growth are products like Google Apps, which is used in some K-12 settings. An opportunity has been created for schools to save money in areas that have been affected by recent budget cuts. Although security may be compromised somewhat, schools can outsource their data centers rather than having to buy expensive software.

Mobile learning was integrated in all *Horizon Reports* since 2010. The main catalyst for mobile learning is the expansion of mobile devices. One example of the expansion of mobile devices is the use of iPads in schools. Apple Inc. has made a significant investment in K-12 education, as exemplified with Apple's contribution to President Obama's ConnectED initiative. ConnectED, launched in 2013, is designed to enrich K-12 education for every student in America. ConnectED empowers teachers through technology and training, and empowers students through personalized learning opportunities.

Personalized learning opportunities include the enhancement of iTunesU. iTunesU is filled with education texts and research capabilities that turn the iPad into a complete resource for students. Since its inception in 2006, iTunesU has had an effect on student learning. For example, programs like Khan Academy and iBooks encourage students to use devices, such as the iPad, for help in their studies. Through private investors, Apple has been able to capitalize on the growing demand for these educational applications, thus their devices are popular. Another driving factor for Apple is the easy adoption of these devices. With each launch of Apple products, students are shown in videos easily exploring the devices without needing in-depth instruction from teachers or parents. For example, iPads come without an operating manual. As noted by Kit Eaton, researcher for Fast Company, the iPad is a \$500 kids' game. "Think about it," Eaton stated, "Apple even sells them at Toys'R'Us" (Eaton, 2011, p. 1).

Johnson et al. (2015) identified and examined personal learning environments (PLEs) and learning analytics. Personal learning environments have content that is integrated with the student's personal learning style. This is the "true" definition of personalized learning. Personal learning environments are promoted to increase student control over learning and to increase higher-order thinking among learners through student-designed learning approaches (Valentine,

2007). The assessment of student learning is a key to addressing student learning needs. With technology, student-learning assessments are more readily available and easier to embed into the classroom instruction (Martin & Ertzberger, 2013; Rodriguez, 2004).

Learning Analytics, a method used to measure student engagement, was a major advancement in educational tools in 2013. It made the abundance of educational data available in a useable form for assessing needs and making changes in the learning environment. One example of the tools, the Instructional Practices Inventory (IPI) (Valentine, 2007), measures student engagement in learning. Valentine's (2007) measure of student engagement assesses student involvement with a given assignment. Within the IPI there are six categories. Categories five and six relate to student learning conversations and student active, engaged learning. The data may be used to change instructional delivery or to facilitate change in the curricula of a school or school district. The IPI is an infant model of personal learning environments, but the same question exists for school districts: How does one make the leap from teacher-directed instruction to personalized, self-teaching mechanisms?

The 2015 version of the *Horizon Report* (Johnson et al.) included the use of wearables and badges in the four-to-five year adoption horizon. Wearable technology refers to devices that can be worn by users. Examples include fitness trackers, watches, and medical necessities. Badges refer to an internal reward system for keeping students motivated. Much like earning merit badges through boy or girl scouts. Khan Academy is integrating badges in order to keep students motivated while utilizing their application.

The annual *Horizon Report* (Johnson et al.) also identified key trends and challenges likely to affect the mainstream use of the six identified technologies within educational organizations. Key trends and challenges occur simultaneously with the introduction and

implementation of emerging technologies. Key trends are organized by the following categories: fast trends that drive educational technology adoption in schools over the next one-to-two years; mid-range trends that drive educational technology adoption in schools within three-to-five years; and long-range trends that drive educational technology adoption in schools in five or more years. Challenges are categorized as solvable, difficult, or wicked. Solvable challenges are defined as those we understand and know how to solve. Difficult challenges are defined as those we understand, but solutions are elusive. Wicked challenges are defined as those too complex to define and address.

One difference noted from the 2009 version was within the trends section of the 2010 version; it included a subsection highlighting the increasing interest in non-formal avenues of instruction. The avenues were online education, mentoring, and independent study. This trend continued in the 2012, 2013, 2014, and 2015 reports with the discussion of personalized learning and personal learning environments (PLE's).

Key trends and significant challenges were noted in the 2013 report, but not categorized in the same way as the 2014 and 2015 report. For example, the 2013 *Horizon Report* (Johnson et al.) listed key trends in rank order, rather than a time frame, and all listed challenges as significant. This was important to the researcher because of the timing of the researcher's study and the rapidly changing world of technology. One key trend listed in the 2013 report referenced declining costs of technology with the bring-your-own device model, yet school district policies were not in line with this type of technology implementation model.

As previously defined, the *Horizon Reports* (Johnson et al.) identified challenges facing the entry of specific technologies into the mainstream educational world. The challenges within the solvable category identified in the 2014 and 2015 reports included creating authentic learning

opportunities and integrating personalized learning. These two areas are specifically referred to as learning platforms by respondents within the current study. The *Horizon Report* (Johnson et al., 2015) identified complex thinking, communication, and increased privacy concerns within the difficult challenge category.

A challenge in the 2013 *Horizon Report* (Johnson et al.) targeted policy makers at all levels. Legislators and school boards across the country believe that deep educational reform is needed, but there is little agreement on the method to reform. Reform is interwoven within most of the challenges listed. Johnson et al. (2013) identified the aforementioned key trends and challenges to promote awareness and to encourage the development of action steps to address those challenges. This particular trend changed little in the 2014 and 2015 versions of the report. Project RED (2013) noted policy changes were necessary. Project RED (2013) highlighted acceptable-use policies as important to how technology will or will not be used by school principals, teachers, and students. These acceptable-use policies must include specifics regarding applications, filtering, and allowable access to quality educational content (Greaves et al., 2013). Policy and state code will continue to be important issues as technology use expands in our nation's schools.

School districts must bring their electronic technologies in line with those being used by students and faculty. Prensky (2006) posited that to improve the relevancy of the educational systems in the U.S., the interface between student lifestyles-- lifestyles that include intense immersion in text messaging, email, gaming, multitasking, social networking, and access to the Internet-- must be incorporated into the curriculum, referred to by the researcher of the current study as digital citizenship. Unfortunately, the educator's perspective on technology immersion

in the educational system is often limited by personal attitudes toward technology, limited experiences with technology, and the inability to purchase and integrate devices and applications.

It is necessary to effectively implement technology within a school district (Waxman, Boriack, Lee, and MacNeil, 2013). One of the more important factors for the successful implementation of technology in schools, according to Project RED (2010), is the integration of technology throughout intervention programs which may include: English Language Learners, Title I, special education, and reading. The report drew this conclusion from the assistive technologies and applications available to address the learning deficiencies of special populations. Project RED (2010) further stipulated the importance of students using “technology daily for online collaboration” (p. 12). Prensky (2006) concluded that K-12 educational leaders must address the difference between how students learn and how they are currently being taught. Teachers must understand that the factors in students’ motivation to learn are evolving so quickly they must create new ways of viewing their professional roles.

Principals and the use of technology. The use of technology to facilitate learning in K-12 education correlates with leadership in improving the quality of education (Coca & Allensworth, 2002; Felton, 2006; Thacker, 2007; Vesh, 2003). In a study over two decades ago, Armistead (1989) explored the administrative use of computers in senior high schools in the Commonwealth of Virginia. He found that approximately 51% of the secondary principals in Virginia received technology training through in-service programs. The issue of adequate training and professional development continues with this study.

About ten years after the Armistead study, Celata (1998) explored the use of electronic technology by high school principals to identify changes in the magnitude of computer use. She found that a key factor in the use of technology by principals was the level of confidence they

possessed in using technology. Specifically, Celata found the higher the level of confidence principals had in their personal abilities to use technologies, the more success they achieved as role models for all stakeholders. She concluded that principals require time and training to become confident in computer-related abilities. Time and training influence the principal's ability to integrate technology in schools. In addition, Celata reported that confidence levels are related to the amount and type of training the principals receive and concluded that:

In-service training was listed as the most common training received by principals. Those principals who reported having participated in any training have more confidence in their own ability to use a computer, more positive beliefs and attitudes about computer use, a greater likelihood to own and use a home computer, and higher levels of comfort regarding 100% of the 17 skills included in the survey. (p. 95)

Furthermore, Celata (1998) reported that in addition to having a strong personal interest in computers and related technologies, principals with the highest confidence levels were likely to have a computer at home. At the time, Celata reported that 76.9% of her respondents had a computer at home. The current study found that all participants had access to a computer in the form of a mobile device or laptop.

The confidence of principals is related to the use of technology in their personal lives (Coca & Allensworth, 2002). Coca and Allensworth reported that principals primarily used (in 2002) computers to send and receive email; however, principals who had used new technologies over a four-year period experienced an increase in confidence with technology-based resources, thus allowing those principals to become more capable of modeling technology for their teachers.

By 2005, the use of electronic media by elementary school principals had expanded in applications and frequency. At the time, Felton (2006) studied the use of computers by elementary school principals in all 50 states and the District of Columbia to determine usage levels, attitudes, nature of use, and the prominence of technology in elementary schools. Felton posited that the term *technology* is often interpreted as *computer*, but also refers to a broader range of equipment such as video equipment, digital cameras, iPods, MP3 players, and others. This expanded definition allowed Felton (2006) to report that in 2005 principals used technology frequently for professional work, such as completing administrative record keeping or analyzing school performance data. Felton noted by 2005, 62% of elementary school principals used computers for administrative record keeping every day, and 98% did so at least occasionally.

Researchers (Armistead, 1989; Celata, 1998; Coca & Allensworth, 2002; Felton, 2006; Thacker, 2007; Vesh, 2003) reported the importance of a school principal's leadership in the evolution of technology within a school. Chemers (2000) contended that a supportive leader would likely motivate subordinates. Inevitably, the principal who uses and demonstrates the use of technology in the school environment motivates subordinates to learn and use technology as well. This point was reinforced by Grady (2011). Boudreaux, Martin, and McNeal (2016) stated that effective technology use requires long-term planning and should be integrated into the curricular and instructional framework. Principals should model this type of systemic technology use. Principals who act as role models become more effective and encourage effectiveness among the members of the professional communities they manage (Kouzes & Posner, 2010).

Coca and Allensworth (2002) concurred with Celata's (1998) and Armistead's (1989) conclusion that teachers depend on principals to model the use of new technologies. Felton

(2006) reported that principals recognize the importance of modeling the use of educational technology and computers for all stakeholders in the educational community. Felton stated, “The principals noted that it was important to become role models if they expected teachers and students to use computers; this is especially true for new technologies” (p. 15). Although Felton investigated the daily implementation of individual technologies by elementary principals, she did not explore the efforts of principals to demonstrate the use of technology in the learning environment. Vesh (2003) suggested that principals must be willing to model and support the use of computers in schools through concrete actions. Project RED (2010) found that the participation of principals with their teachers in technology training is a key factor in the successful implementation of technology in schools.

Principals must consider several factors related to access to technology in schools. Coca and Allensworth (2002) believed principals must accommodate students who come from different socioeconomic backgrounds. Principals in the current study agreed. Some students come from more affluent families and are exposed to a wide variety of technologies. Students from less affluent backgrounds are less likely to have a computer at home and are without access to technology that would provide similar learning opportunities as more affluent students. Coca and Allensworth (2002) referred to this phenomenon as the *digital divide*. Recently, the digital divide involves the types of technology usage rather than access (van Deursen & Van Dijk, 2014). Eastin, Cicchirillo, and Mabry (2015) further examined how the digital divide has shifted from access to differences in the use of digital media use across populations. Alston, Diaz, and Phillips (2015) studied millennials and their digital fluency with information and communication technologies (ICTs). Digital fluency refers to the knowledge, skills, and cognitive capabilities needed to maximize the use of ICTs. Principals should help ensure all students have the

opportunity to attain a level of digital fluency and have the same opportunities to learn the skills necessary to survive in a technological society. In addition to providing these opportunities, principals must develop strategies to deter student abuse of technology, such as cyber bullying, social networking problems, pornography, information theft or alteration, and other non-instructional activities. Awareness of such abuses of technology must be developed.

Technology and education of school principals. Nearly two decades ago, Celata (1998) recommended that graduate programs include technology training for educational administrators. Some technology skills needed in the education profession are not fully addressed by schools of education (McLeod & Richardson 2011). In the past, schools of education primarily focused on technology in a general way, such as personnel evaluation, finance, and research, despite the fact technology was and is critically important for the preparation of K-12 leaders (Hess & Kelly, 2005). The 2015 *Horizon Report* (Johnson et al.) noted integrating technology in teacher education programs as a solvable challenge. Since the vast majority of principals are former teachers, the same case could be made for solving technology problems in principal preparation programs. Although the skill sets of teacher technology use and principal technology use are different, principals leading technology implementations should have an awareness of technology trends (Storey & Asadoorian III, 2014). Both teacher education programs and principal preparation programs can help develop the needed technology skills.

Project RED (2010) highlighted the principal's role in leading a large-scale technology initiative. The Project RED researchers identified 11 Education Success Measures (ESM's). ESM's represent a balanced view, as defined by Project RED, since there is a lack of national consensus on measures defining a successful school. This balanced view includes: (1)

disciplinary action rate; (2) dropout rate; (3) high-stakes test scores; (4) paper and copying expenses; (5) paperwork reduction; (6) teacher attendance; (7) AP course enrollment; (8) college attendance plans; (9) course completion rates; (10) dual enrollment in college; and (11) graduation rates. Greaves et al. (2013) provided evidence suggesting a principal is one of the most important variables within these success measures. They did not clearly indicate whether leadership training for principals should focus more heavily on first and second-order change processes or whether technology integration was pertinent, but Greaves et al. (2013) did highlight the need for principal preparation programs to address both.

The Internet significantly changed how students approach learning (Prensky, 2006). Educating students born into a world suffused with technology, which Prensky (2006) termed *digital natives*, presents a challenge for educational leaders who may still be what Prensky termed *digital immigrants*, those who were not raised with certain technologies such as smartphone, texting and handheld computers. In 2010, Wang identified school principals as the key to technology integration in schools. Wang's presentation began with the acknowledgement that her training as an educational administrator did not prepare her for the level of technological knowledge the profession required. The acknowledgement demonstrated the need for school administrators to have the necessary skills in technology to be more productive and successful in their roles as school principals.

A broad focus on technological competencies is reflected in the curriculum of schools of education as they prepare administrators with broad standards at the expense of comprehensive training in key areas (Hess & Kelly, 2005; Lashway, 2002; Van Patten & Holt, 2002). Schrum, Galizio, and Ledesma (2011) stated that overall most states and institutions do not require any formal preparation in understanding or implementing technology for instructional purposes.

Schrum et al. (2011) further stated, the omission of formal technology training by states and institutions of higher education, likely results in their graduates not being prepared to systematically implement technology in their schools. Recent standards for school principals include broad areas of technology use under instructional leadership. For example, the National Council for Accreditation of Teacher Education (NCATE) (2014) used the Educational Leadership Constituent Council's (ELCC) 2011 standards for evaluating principal preparation programs. Within the ELCC standards, technology is specifically referenced in Standard 2.0. The use of technologies for improved classroom instruction, student achievement, and continuous school improvement are all aspects of the school principal's job. Furthermore, ELCC Standard 2.0 listed personalized learning, differentiated instructional strategies, and the promotion of equity as professional leadership skills. As evidenced by the 2015 *Horizon Report* (Johnson et al.), these are all ways technology could be utilized.

Statement of the Purposes

The primary purposes of this study were to examine the use of technology by school principals and to identify variables associated with that use. If variables could be identified that explained the variation in principals' use of technology, these variables could then be altered in preparation programs or the work setting to encourage a greater use of technology for the benefit of students, teachers, and schools. Armistead (1989), Celata (1998), and Felton (2006) studied the use of technology by administrators, but educational technology has changed significantly since these studies were performed. Devices and applications have evolved, and resources on the Internet have burgeoned. Search engines such as Google, Yahoo, and Bing have opened a global marketplace of information. New challenges for principals have arisen with the increased access to social media, cloud-based applications, and mobile devices. Among these challenges is the

security of information about students, parents, and personnel; cyber-bullying; libel; child pornography; peer pornography; cheating; plagiarism; and the quality of information. These challenges affect the lives of teachers, students, faculty, administrators, parents, and the community.

Research Questions

The development and implementation of the study was guided by the following research questions:

1. What technologies are school principals using?
2. Why are school principals using the identified technologies?
3. What are the relationships between each of the following potential explanatory variables and school principals' use of technology:
 - Organizational support provided to the principal.
 - The principal's knowledge base.
 - The principal's training and professional development.
 - The principal's attitude toward technology.

A theory of technology use by school principals. The theory explaining the use of technology by school principals has two parts: Part I is a general framework for the use of technology by principals in schools. Part II is a theory explaining the use of technology by school principals.

A framework for the use of technology by school principals. The background for the use of technology by school principals has seven parts that are discussed individually: (1) the meaning of technology; (2) the globalization of technology; (3) types of technologies; (4) the role shift of school principals; (5) principal certification requirements; (6) identified

technological strengths and weaknesses of principals; and (7) factors affecting the usage of technology.

Meaning of technology. The term *educational technology* is not to be confused with *instructional technology*, which describes the enhancement of the learning process and curriculum through the application of differing modes of technology. Richey (2008) contended the terminology of educational technology has several interchangeable wordings. These wordings include substitutions like “instructional” for “educational” and “media” for “technology.” She believed this is problematic and therefore stipulated, “Educational Technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Richey, 2008, p.1).

Globalization of technology. Technology and education have been inextricably connected for three decades. In the beginning, educational technology focused primarily on devices and applications, such as overhead projectors, television, and word processing (De Vaney, 1998; Hollenbeck, 1998; Reiser, 2001). The limited focus expanded as technology opened new avenues of communication. Once computers were able to communicate with one another, sharing information in a way that was never before possible became a standard. Educational technology today is focused on the access and manipulation of global data. New and existing knowledge is directly available as a result of the World Wide Web (Hew, 2004; Jochems, Koper, & Merrienboer, 2013; Yong, 1998).

Friedman (2005) suggested that globalization has resulted in educators being tasked to prepare technology-savvy students who thrive locally and compete globally. However, equity among student groups regarding access to a global education remains problematic (Kilpatrick &

McCarthy, 2015). Technology plays a vital role in global education. McCarthy (2011) stated technology is a major theme connected to global education. It is important for future K-12 leaders who have access to technology to appreciate the role of technology in the careful preparation of students. As “facts become so widely available and instantly accessible, each one becomes less valuable. What begins to matter more is the ability to place these facts in context and to deliver them with emotional impact” (Pink, 2005, p. 100). When information is readily available to students, educators can help students define who they are, find a place in the world, and succeed in a highly competitive and global culture (Friedman, 2005).

Today, business and education fields, as well as personal lives, are connected through the growth and possibilities of the Internet. Technology enables people in most countries to rely on devices to quickly process rote and mechanical tasks that were once time consuming. This has advanced with the rise of robots with artificial intelligence. Martin Ford, author of *Rise of Robots: Technology and the Threat of a Jobless Future* (2015), stated that the same artificial intelligence that helps computers win games, could create a disruptive force that leads to the unemployment in jobs such as paralegals, radiologists, and teachers. The artificial intelligence leading to possible mass-unemployment would truly be “disruptive technology.” While technology allows users to learn from a global array of information previously accessible only in books or newspapers, students should be taught to be aware of the implications for job prospects in the post-secondary world. Pink (2005) concluded that technology, both within and outside of education, is entering an era where the global context, soft skills, and transformational leadership are the investment, not the technology alone.

Types of technology. Technology not only refers to material objects used by people of all skills and trades, such as machines or devices, but also encompasses broader themes including

systems, methods of organization, and techniques. Some modern tools include, but are not limited to, personal computers, laptop computers, and scientific or graphing calculators, drones, and robots. Newer tools, such as smartphones, LCD projectors, SmartBoards, SmartPads, and ELMO's, are used to facilitate learning through the use of corresponding applications. All of the previous examples of devices were used by participants in the current study. However, educational technologies must interact concomitantly. The 2015 *Horizon Report* (Johnson et al.) highlighted themes of instructional technologies that schools should either currently be using or should adopt in the near and not-so-near future. For example, schools and classrooms should take full advantage of cloud computing as well as collaborative environments. In the horizon defined as two-to-three years away, the report cites 3D printing and adaptive learning technologies as necessary tools to fully engage and make globally competent the present generation of students. 3D printing allows students to explore and build objects of the world more authentically. Adaptive learning technologies help schools follow the progress of students' work in real-time. Simply, these devices and applications are capable of not only helping students learn real-world skills with 3D printing, but are capable of learning the way people learn. This allows for the personalization of instruction. These examples provide insight into how the current generation of students learn, interact, and engage in the learning process.

In the horizon defined as four-to-five years away, instructional technology needs should include wearables and badges. As previously defined, wearables can be worn by users, and badges are a form of reward and motivation. Still in the early stages of development for educational use, both technologies provide real-time data and interaction with networks of social-media type groups. These examples, not exhaustive in nature, provide insight into the

future development of instructional technologies, as well as the path leaders of instructional institutions should take to guide their schools.

Role shift of school principals. Overall school management was the primary role of principals until the early 1980s (Rousmaniere, 2013). As the accountability movement gained momentum, the role of the principal changed from school manager to school instructional leader. The implementation of state-mandated curriculum standards and the supervision of instruction became more prominent components of the principal's management role (Cheney & Davis, 2011). When multiple reform efforts from multiple directions began to impact education, the principal became the school reform leader. Despite this shift in role focus, principals retained the overall management role. Principals currently play multiple roles: school manager, instructional leader, and the leader of school reform. This increase in a principal's duties and responsibilities generates a need for assistance from various types of technologies, and school districts must provide the support necessary to integrate new technology.

During the latter part of the 20th century, as schools began to be accountable for the performance of students on national and state assessment tests, the duties and responsibilities of principals changed. Principals became more responsible for teaching and learning practices. In particular, they acquired the role of monitoring instruction along with the responsibility for helping teachers improve instructional methods. With this change in responsibilities, principals discovered the need to more effectively evaluate instruction and assist teachers as they worked to improve instructional techniques. The principal's duty to improve the school instructional program is mandated by legislation in most states (Cheney & Davis, 2011). In 2011, McMurrer, Dietz, and Renter found federal guidance required the removal of principals when the schools they managed were classified as low performing (students do not meet No Child Left Behind Act

achievement expectations) for a specified period of time. Federal funds were contingent upon the removal of principals in low-performing schools deemed eligible for school improvement funds. This removal of personnel is based upon a school's academic performance over a two-year period and whether the principal has been in the position for the same period of time or longer. School-level leadership is at the heart of all four options within the school improvement grant requirements (McMurrer, et al., 2011). Whether it is for school closure, school restart, or school transformation, the school principal must be removed if hired outside of the two-year window.

In 2011, Cheney and Davis emphasized that the duties and responsibilities of principals have increased in recent years. Presently, principals are responsible for the overall operation of a school. Some of their duties and responsibilities are delineated in state statutes. States and school districts have established expectations for principals through evaluation criteria (Cheney & Davis, 2011). Many states, as a result of a federal initiative, have introduced new evaluation systems for school principals. These systems include components for student learning, and how cohorts of students are growing academically, while matriculating through a respective programmatic level.

In 2015, the National Policy Board for Educational Administration released its revised professional standards for educational leaders. These standards were formerly known as the Interstate School Leaders Licensure Consortium (ISLLC) standards. The current standards promoted by the National Policy Board for Educational Administration has broad support from member organizations, such as the American Association of School Administrators, the Council of Chief State School Officers, the National Association of Elementary School Principals, and the National Association of Secondary School Principals, to name a few. There are 10

professional standards for educational leaders outlined. The previous ISLLC standards were comprised of six. The 2015 standards are as follows:

1. Mission, Vision, and Core Values.
2. Ethics and Professional Norms.
3. Equity and Cultural Responsiveness.
4. Curriculum, Instruction, and Assessment.
5. Community of Care and Support for Students.
6. Professional Capacity of School Personnel.
7. Professional Community for Teachers and Staff.
8. Meaningful Engagement of Families and Community
9. Operations and Management.
10. School Improvement.

Standard 4, Curriculum, Instruction, and Assessment is the only standard in which technology is specifically referenced. Component “e” states that effective leaders promote the effective use of technology in the service of teaching and learning. However, much like the ELLC standards, technology is needed to effectively accomplish many of the other standards and sub-standards.

The former ISLLC standards became the foundation for a licensure assessment developed by the Educational Testing Service (ETS). The ETS website (March, 2016) stipulated that the *School Leaders Licensure Assessment* (SLLA) is still using ISLLC standards as a basis for the assessment. A number of states used the SLLA in conjunction with other criteria to license principals. Ultimately, the role of the principal is to provide leadership to a complex organization of people engaged in the process of educating K-12 children. Thus, technology

competence and leadership skills in technology are not specifically required for certification, but do aid in the ability to become certified.

As society continues to change and technological advances continue to add to the availability of innovative tools for teaching and leading, the role of the principal must evolve. Changes, such as the permission of parents to use school vouchers to select schools for their children, the establishment of charter schools, and the advancement of technology applications have the potential to alter the school experience in fundamental ways. As changes occur, the role of the principal evolves, specifically determining technological needs within the learning environment. The changing role of school principals in an evolving society is the focus of current research efforts. Researchers have identified the principal as the key to successfully transitioning an ordinary school into an institution that adequately prepares students for the 21st century (Jenlink, 2000; Wong, 2010).

Technology requirements for principal certification. Licensure requirements vary from state to state, but the requirements generally include some experience as a classroom teacher, graduation from a state accredited principal preparation or administrative program, and a passing score on a nationally validated licensing exam. Qualifications have been the subject of considerable debate as pressure has increased to make principals, teachers, and school systems more accountable for student achievement. Alternative licensure of school principals has become one way for schools and districts to address the shortage of qualified applicants for their vacant principal positions.

Davis and Darling-Hammond (2012) wrote in their short case study that one innovative principal preparation program infused practical knowledge such as law, budget, supervision, and technology. The program placed more emphasis on pedagogical matters like individual

discovery, data-based decision-making, reflective inquiry, and a highly structured set of field-based practical experiences that were guided by state and school system standards.

Identified technological strengths and weaknesses of principals. Over fifteen years ago, Celata (1998) reported that principals identified their technological strengths to be (in order of importance): (1) printing, (2) retrieving information from a student database, (3) word processing, (4) using a modem, (5) using electronic mail, (6) accessing information on CD-ROM, (7) conducting an Internet search, and (8) creating a master schedule using a computer program. The study revealed weaknesses in five categories: (a) using a digital camera, (b) using a program for budgeting and cost projections, (c) creating and presenting an electronic slide show, (d) using a spreadsheet to manipulate information, and (e) creating a database. Most of the identified technologies have been replaced with upgraded versions or are no longer relevant in 2016. Other handheld devices, for example, are replacing the digital camera.

A Theory Explaining the Use of Technology by School Principals

Technology use by school principals has undoubtedly increased in the last decade; however, specific factors that contribute to the usage of technology are relatively unexplored. Figure 1 (below) is a diagram of the interconnectedness of four factors that contribute to the use of technology by public school principals. The figure is a conceptualization of the idea that the use of technology by public school principals is related to four variables: (1) knowledge of technology; (2) attitude toward technology; (3) professional development and training; and (4) organizational support for technology.

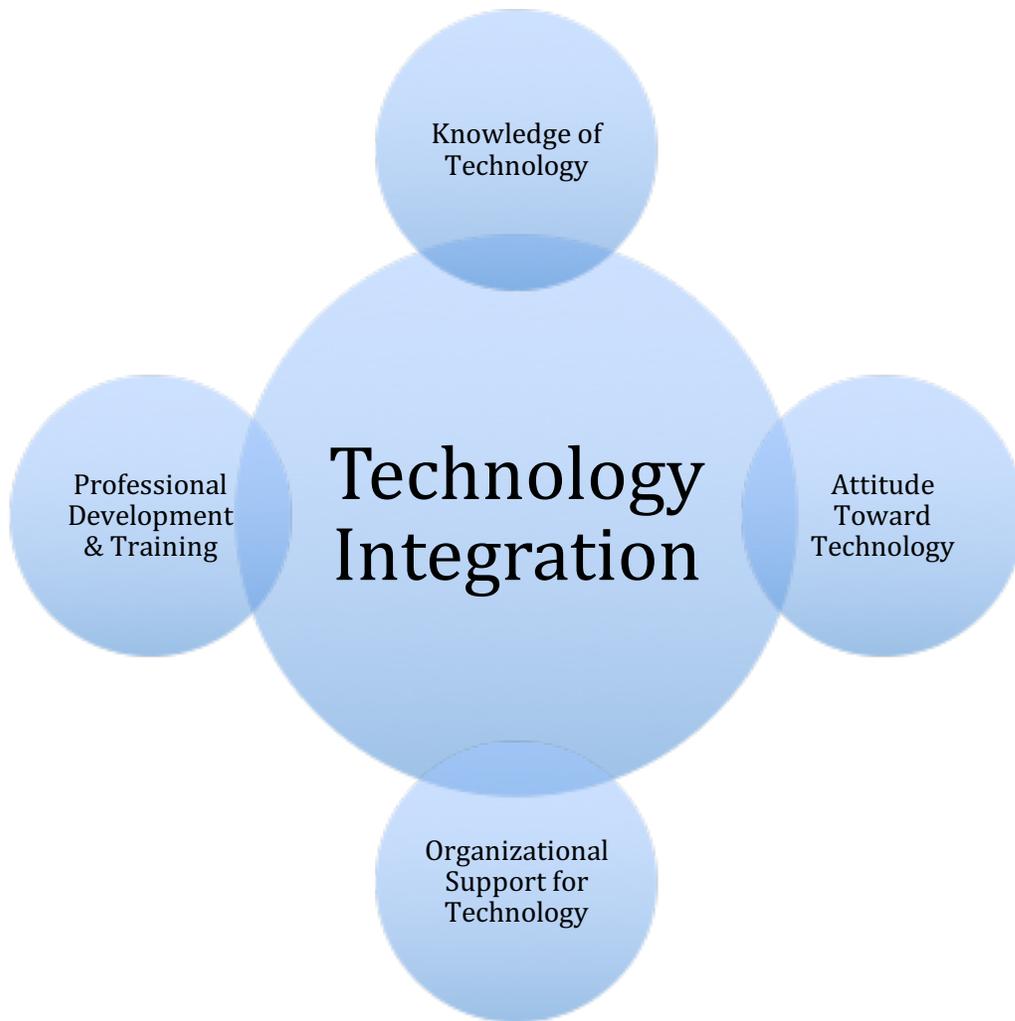


Figure 1. Moles's theory of technology use by public school principals.

The following literature review relates to the use of technology by school principals and the variables associated with that use. The focus of the examined literature is on the relationships between the variables identified in the diagram (knowledge of technology, attitude toward technology, organizational support for technology, and professional development and training) and the use of technology by school principals. After reviewing available literature on the relationships in the theory, an instrument was developed to collect data that could potentially verify the asserted relationships.

Knowledge of educational technology. Knowledge of technology and the use of technology are directly related. Studies have shown the more knowledge a person has concerning a component of technology, the greater the usage of that respective technology (Atkins & Vasu, 2000; Hughes & Zachariah, 2001). Ertmer and Ottenbreit-Leftwich (2010) concluded that knowledge, confidence, beliefs, and culture intersect with usage. The factors of Ertmer et al., 2010 reinforced the The International Society for Technology in Education's (2002) fundamental technology skills as benchmarks for educational leaders to evaluate their technological competency. The standards were updated in 2009 (The International Society for Technology in Education, 2009). The Society posited that part of the solution to technological competency was to provide comment on the state of educational technology and to highlight the areas that should be developed. The goal of the project was to create a standardized set of expectations for educational leaders and a list of skills they should possess. The standards comprise five key areas:

1. Visionary leadership.
2. Digital age learning culture.
3. Excellence in professional practice.
4. Systemic improvement.
5. Digital citizenship (The International Society for Technology in Education, 2009).

The standards provide clear parameters to analyze or measure school administrators' knowledge, as well as recommendations that should be implemented to guarantee technology is incorporated into the K-12 educational system nationwide. The Society posited that specific information would provide guidance to educational leaders to augment efforts to attain basic technological skills. The Society cited knowledge and understanding of technology as the most important

factor in determining whether or not the integration of education and technology would be successful in the classroom (The International Society for Technology in Education, 2009).

Furthermore, the more time teachers spend training with a device or application, the more knowledgeable they become with that device and application. As Stevens (2014) concluded, time is still the greatest factor in achieving a comfortable knowledge of technology for both teachers and school principals. Stevens (2014) continued to stipulate that the amount of time spent training does not necessarily save time with technology integration; however, the knowledge and comfort gained from the training may save time with the integration of technology. Stevens believed further research is needed in this area.

Attitude toward technology. The integration of technology into curricula started on a small scale (Pink, 2005). It was used in special circumstances and usually consisted of videos and music players. Advanced technological skills were not widespread, and technology was an isolated, unusual event. When computers with word processing were introduced to U.S. offices in the 1970s as an aid for secretaries, engineers and other professionals were not included in the distribution of devices. The computer was considered a secretarial tool. However, engineers soon hovered over the shoulders of secretaries wishing they had a computer of their own (Pink, 2005). This illustration shows the evolving nature of technology and how the leaders in their respective industries were placed in situations where their knowledge of such devices and applications was forced to expand.

A number of factors have led to the need for technology leaders to have ingenuity, soft skills, and right-brained thinking to succeed. The Internet-connected computer provides individuals not only with local access to a vast store of information, but also with the ability to succeed and compete globally. Globalization of the Internet has changed the manner in which

the world does business, educates, and communicates (Pink, 2005). Pink commented, “The capabilities we once disdained or thought frivolous --the ‘right brain’ qualities of inventiveness, empathy, joyfulness, and meaning -- increasingly will determine who flourishes” (p. 3).

One’s attitude toward technology can either hinder or help in terms of technology usage. A favorable attitude toward technology contributes to computer adoption by principals (Afshari, Baker, and Livan, 2010), and that same favorable attitude toward educational technology can lead to further improvements and sustained technology integration for a given school. Technology can be frustrating to school personnel for several reasons. Those frustrations can include, but are not limited to, speed of the Internet, broken devices, preparation time, and operator error. Each of these frustrations places a negative connotation upon the use of technology; therefore, diminishing its role in the classroom and school. Once this negative attitude has surfaced, training and professional development sessions are not enough to change the negative perception and attitude to a more positive one (Niles, 2006).

Computers can have a positive impact on the productivity of principals as managers, as well as instructional leaders. Simple processes, such as word processing, can help principals improve their attitude and respective usage of technology. The ability to save, delete, correct, and print timely correspondence is an advantage (Lim, Zhao, Tondeur, Chai, & Tsai, 2013). Word processing or desktop publishing can improve the appearance of correspondence with artistic designs or graphics. Principals can use technology for many administrative functions. Weekly memos to staff members, schedule changes, lesson plans, status reports, budget allocations or requests, or meeting minutes can be handled by email (Starr, 2001). School news can be broadcast throughout a school over a school television cable system. The frequency of written communication with parents and staff through blogging and tweeting can lead to a more

advanced and current reality. The design of a school webpage can provide a description of a school, its vision and mission, school highlights, upcoming events, and a place where participating parents can monitor student progress and academic achievement (Starr, 2001). The *Horizon Report* (2015) outlined the possible integration of technological advances that could be sustained into schools and the accompanying attitudes associated within each stage of integration.

Organizational support for technology. Technology integration begins when school districts build or enhance the technology infrastructure within schools. District-wide efforts to integrate technology include: implementing favorable local educational policies; making available the latest technologies; funding devices, trainings, and conference travel; and providing technical support. Infrastructure enables the integration of technology into the curriculum and has the capability of easily providing information to parents, teachers, or the public. Project RED (2010) emphasized the importance of integrating technology into every class period and core curriculum, utilizing technology for weekly formative assessments, and participating in daily online collaboration. As indicated by NCLB (2002), state and local educational agencies should provide professional development, so members of the professional community can effectively integrate technology into their jobs and the curriculum.

Policies are another way in which organizations can support the use of technology. As previously reported in this study, *The Horizon Report* (2015) noted the need for policy change as it relates to personalized learning as a difficult challenge. As increased concerns over privacy meet with the need for personalizing the learning experience for each student, policy changes can be difficult. Policy related to technology implementation requires goals that are clearly defined and connect with student learning initiatives (Fullan, 2001). Often however, no specific goals

are defined in educational technology policies, aside from goals that address the amount of hardware a school should have, or what their connectivity rates should be based upon the number of devices they use (Lim, et al., 2013).

Professional development and training. One of the most important aspects of any technology initiative is professional development (Whitehead, Jensen, & Boschee, 2013). Plans for professional development should be detailed long before the actual implementation of technology. Principals must decide who will lead the professional development opportunities, and it may be the school principal. In *Preparing Teachers and Developing School Leaders for the 21st Century*, Schleicher (2012) wrote that effective leadership preparation trains and develops school principals to use “progressive methods” that address larger roles and responsibilities of leaders and the purposes of school, and they use technologies to achieve those outcomes. One notable practice from the Schleicher (2012) study involved in-service training. Schleicher (2012) wrote that in-service training was designed to address specific needs which included new initiatives.

Using technology should not be confused with taking a technology-driven approach. Implementers of a technology-driven approach can fail to take the student into account and can assume students and teachers will adapt to the requirements of the new technology. The use of new technologies should be adapted by the leader to fit the needs of his students and teachers. Creating and adopting a comprehensive technology plan should include professional development for the principal, as well as others impacted by the technology.

Computer competence requires perseverance, time to practice, quality staff development, and equipment. In the early days of computerization in schools, Tiede (1992), in a study of 36 elementary principals in northeastern Illinois, found that most principals received training

through self-teaching and that time to practice had a major effect on the proficiency levels of administrators. Principals were nearly twice as likely to spend their time practicing technological skills independently as they were to spend their time attending a workshop for the sole purpose of learning computer proficiency (Tiede, 1992). However, in a more recent study, Schrum et al. (2011) provided evidence that more professional development is key to successful technology integration by principals. Schrum et al. (2011) thought that this change was related to the advanced sophistication of devices and applications.

Gray and Streshly (2008) reported that technology has created an opportunity for K-12 leaders to empower those around them. Project RED (2013) found that professional learning for both school principals and teachers was an essential element in the improvement of a school or district. Professional development is necessary for sustaining the use of technology in schools. Educational leaders who are deficient in basic technology skills are barriers to future technology integration within school districts (Pink, 2005). However, these individuals can provide resourceful leadership by becoming responsive to basic technology skills and by forming a vision that can be implemented in their respective schools (Corey & Wilson, 2006). Such leaders must model professional, as well as educational, growth by participating in various professional learning activities, so teachers and support staff can overcome fear, apathy, or resistance when asked to adopt and integrate technology into the curriculum (Paben, 2002).

Agnew (2011) stated that anxiety can be a factor inhibiting the advancement of technology integration. Agnew's finding (2011), is in agreement with Paben (2002). Fears, especially social, must be overcome; therefore, additional training and support are necessary. Agnew (2011) reported 95% of respondents had participated in some type of technology training. The data revealed that of those 95%, a strong technologically advanced principals were able to

embed and enhance technology implementation into their respective schools across West Virginia (Agnew, 2011). Educational leaders should be part of the solution, not the problem in regards to technology integration (Corey & Wilson, 2006). Project RED (2010) listed the staff development training of principals with their teachers as a key implementation factor of technology use in schools.

Technology training. A quality professional development plan should focus in part on the technology needs of principals. A consistent and sustained plan for principals increases overall awareness and user capabilities. Training in educational technology includes (a) in-service programs or workshops, (b) college courses, (c) self-teaching methods, and (d) conferences (Celata, 1998). These methods still hold true today. Mentoring programs and professional networks can also be used to develop school principals in the area of technology use (Schleicher, 2012). The development of specific and well-researched competencies helps the educational leader to sustain technology leadership, assist with technology integration, include technology literacy, and enhance student learning in the classroom.

Felton (2006) found that elementary principals used a computer on a daily basis for a variety of administrative and instructional tasks. The more proficient users had more favorable attitudes toward the use of computers, used the Internet more frequently and for more tasks, and believed that computers made a difference in the time spent on tasks and the quality of work. Formal training was related to four types of proficiency. A socio-demographic profile of “high tech” principals was not found by Felton (2006); however, “high tech” principals (personal digital assistant users) reported high levels of Internet use, high levels of all four types of proficiency, and a favorable attitude toward computers (Felton, 2006).

Graduate school preparation of K-12 leaders. Graduate schools of education can play a core role in preparing future K-12 leaders to succeed by exposing students to the wide range of technology devices and applications currently available (Hess, 2007). Graduate schools should train leaders to first predict and then to integrate the rapid changes occurring in educational technology today. Gray and Streshly (2008) stated that graduate schools are negligent if they fail to train leaders to implement technology in every aspect of the educational institution.

There may be a general lack of attentiveness by graduate schools of education toward educational leadership research and overall preparation in general (Levine, 2005). The lack of attention in developing effective technology leaders creates the potential for considerable problems in the future. The educators' basic technological competencies do not compete with the students' technological competencies and exposures. Administrators must learn independently, have a dedication to the changes in educational technology, and promote their staff members' implementation through professional development, modeling, and goal setting (Schrum et al., 2011). This fact is further evidenced by the research of Scott McLeod and Jayson Richardson (2011). McLeod and Richardson (2011) stated that about two percent of American Educational Research Association presentations in 2011 had a focus on technology leadership. Two other organizations had similar statistics. Only three percent of presentations conducted by the University Council for Educational Administration focused on technology leadership, and nearly seven and a half percent of similar presentations pertained to technology leadership for the National Council of Professors of Educational Administration (McLeod & Richardson, 2011). Furthermore, of the twenty-five most often cited journals in the field of educational administration, only forty-three journal articles focused on technology leadership (McLeod & Richardson, 2011). Specifically, the forty-three articles focused on integration, policy, and

professional development. One can surmise that only the educational leaders in K-12 education and post-secondary education programs who are technologically proficient are comfortable with tech-savvy students and the devices they use.

Stevenson Jr. and Shetly (2015) explored three partnerships between school leadership programs and large urban centers. The study compared these partnership programs with the five elements of Whitaker, King, and Vogel's (2004) best practices for the implementation of such partnerships. Stevenson and Shetly (2015) found that the three partnerships have implemented three of the five best practices by Whitaker et al. (2004). The three best practices were in the areas of curriculum, collaboration, and support of participants through advising. Technology can have an impact on the areas of curriculum and collaboration. Project RED (2013) stated, as part of its leadership recommendations, that higher education should be incentivized to incorporate change leadership and Information and Communications Technologies (ICTs) leadership in the curriculum of principal preparation programs.

Educational technology training and use of technology. Armistead (1989) and Celata (1998) concluded that a majority of secondary principals in Virginia received the majority of training in computer use through in-service programs provided by a given school district. Celata (1998) reported approximately two-thirds of secondary principals (67.3%) in Virginia received training through in-service programs. Ten years earlier, just over 51% of the secondary principals in Virginia received training through in-service programs (Armistead, 1989). Another notable difference between these findings is the year in which the studies were conducted. It is possible that because Celata's study was conducted nearly 10 years after Armistead's, principals had moved toward independent practice in the intervening years, or they may have used other resources, such as newly hired teachers or administrative staff members more familiar with

technology competencies to learn what they needed to know. Mcleod and Richardson further evidenced this trend in 2011. More training is provided to principals when they are in the principalship, than in preparation programs. The findings of Armistead and Celata researched in 1989 and in 1998 respectively, remains true today as evidenced by Hess and Kelly in 2005 and McCleod and Richardson in 2011.

Demographics. Demographic backgrounds can affect technology usage. For example, baby boomers are not as likely to have received the relevant professional development in technology during college or high school, whereas those graduating within the last ten years are likely to have had some technology training. The following outlines what WikiBooks (2010) and the Pew Research Center (2014) report as the demographic breakdown of tech users in the United States.

WikiBooks' *Who's Online in the U.S.* (2010) examined the age, ethnicity, income, and educational attainment of those persons accessing the Internet in February and March of 2007. The survey found that 71% of adults in America used the Internet, equally dispersed between male and female users. Eighty-seven percent of Americans, ages 18-25, used the Internet. That number consistently dropped as the age ranges increased. Eighty-three percent of 30-49 year olds accessed the Internet, in comparison to 65% of 50-64 year olds. As predicted in the pattern, only 32% of those ages 65 and older used the Internet.

A larger number of non-Hispanic whites used the Internet than any other ethnic group in the United States (WikiBooks, 2010). During the WikiBooks's (2010) survey period, 73% of whites accessed the Internet, along with 62% of Blacks, and 78% of English speaking Hispanics. Interestingly, a larger portion of urban and suburban populations used the Internet than did their

rural counterparts. Seventy-three percent of all urban and suburban residents used the Internet compared to only 60% of the total rural population within the United States.

The latest Pew Research (2014) on Internet user demographics suggested a slight change from the WikiBooks's research of 2010. Pew estimated that as of January 2014, 84% of American adults accessed the Internet. Ninety-seven percent of all 18-29 year-olds accessed the Internet. Conversely, only 57% of adults' age 65 and older used the Internet in some capacity. In addition, the Pew Research reinforced the theory that a larger percentage of adults with higher household income levels and advanced educational degrees were accessing the Internet.

A person's income is a predictor of the frequency of Internet use (WikiBooks, 2010). Of those individuals earning less than \$30,000 a year, only 55% were Internet users, while 69% of those making between \$30,000 and \$49,999 used the Internet. Eighty-two percent of individuals earning between \$50,000 and \$74,999 accessed the Internet, and 93% of folks earning more than \$75,000 were Internet users. Related research (Pew Research, 2014) regarding income levels and educational attainment support the above statistics. The higher the level of education, the more likely a person is to use the Internet (Pew Research, 2014). Only 40% of high school dropouts accessed the Internet, while 91% of those completing college did. Although Internet access is not a sole predictor of technology usage, it is a barometer for how tech savvy an individual group may be when examining technology usage.

Definition of Terms

The following terms are conceptually and operationally defined for this study:

Table 1

Conceptual and Operational Definitions for Concepts in The Moles's Theory of School Principals' Technology Usage

Concept	Constitutive definition (conceptual definition)	Operational definition
Technology use	The incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools.	All items listed on the Interview Protocol for School Principals.
Knowledge of technology	A familiarity with educational technology that can include information, descriptions, facts, or skills acquired through experience or education.	Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 on the Interview Protocol for School Principals.
Attitude toward technology	A hypothetical construct that represents an individual's degree of liking or disliking something. Attitudes are generally positive, negative, or neutral about a person, place, thing, or event.	Items 10, 11, 12, and 13 on the Interview Protocol for School Principals.
Professional development and training	Professional development encompasses all types of facilitated learning opportunities in the area of technology, ranging from college degrees to formal coursework, conferences, and informal learning opportunities situated in practice.	Items 14, 15, 16, and 17 on the Interview Protocol for School Principals.
Organizational support for technology	The technological support provided to school principals by a school district	Items 18, 19, 20, 21, and 22 on the Interview Protocol for School Principals.
Demographics	Characteristics of a population. Demographics used within this study are gender, race, age, educational years of experience, administrative years of experience, and education level.	Items 23, 24, 25, 26, and 27 on the Interview Protocol for School Principals.

Chapter Summary

Chapter 1 was a combination of the problem and a review of the literature on principals and the use of technology. The chapter established the research questions, described the researcher's theory, and reported on demographic data. The chapter concluded with definitions of key terms. Chapter 2 is a description of the researcher's methodology for the study.

Chapter 2

Methods

The purposes of this study were to examine the use of technology by school principals and identify variables associated with that use. This report has the following organization: (a) the overall design of the study; (b) settings and participants; (c) data collection procedures, including the assessment of the reliability and validity of the interview protocol; (d) data management procedures; and (e) data analysis procedures. The chapter ends with a summary.

The Overall Design of the Study

This was a qualitative study with in-depth interviews of 12 participants. The participants were elementary, middle, and high school principals from across the United States. Interviews were conducted with the participants, and the data were analyzed using the constant-comparative method of Maykut and Morehouse (1994) to identify the technology principals use in their work and non-work lives and the variables associated with those uses. These variables were then used to revise a theory explaining principals' use of technology.

Settings and Participants

The multiple settings and participants included in this study are described in this section.

The Settings

The settings were 12 schools identified as Apple Distinguished Schools by Apple Inc. for the years 2013-2015. There were four exemplary schools selected at each level—elementary, middle, and high school. These schools were located in Maine, Massachusetts, Delaware, Ohio, Alabama, Louisiana, Kansas, Nebraska, Oregon, Washington, and California. Apple describes these schools as follows:

“The Apple Distinguished School or Program designation is reserved for schools and school districts that meet criteria for innovation, leadership, and educational excellence, and demonstrate Apple’s vision of exemplary learning environments” (ADS and ADP: Apple Distinguished School and Program Showcase, 2013-2015).

Selection of the Participants

Participants were purposefully selected for their schools’ exemplary use of technology with the following criteria:

1. The principals lead schools that had a reputation for high levels of technology infusion. The procedure for the selection of participants was:
 - a. Apple Inc. provided the researcher with a list of schools from each programmatic level (K-5, 6-8, 9-12) and from within four regions of the United States. Those regions were: Northeast, Southeast, Central, and West (Figure 2).
 - b. Apple Inc. then helped the researcher select principals by programmatic level and region from the list of Apple Distinguished Schools.
2. The principal agreed to participate in the study. An invitation to participate was sent via email to each of the principals identified by Apple Inc. (see Appendix I). If one of the invited principals refused to participate, another principal was selected by Apple Inc. from the list of Apple Distinguished Schools. This selection process continued until four principals at each programmatic level — elementary, middle, and high — agreed to participate.

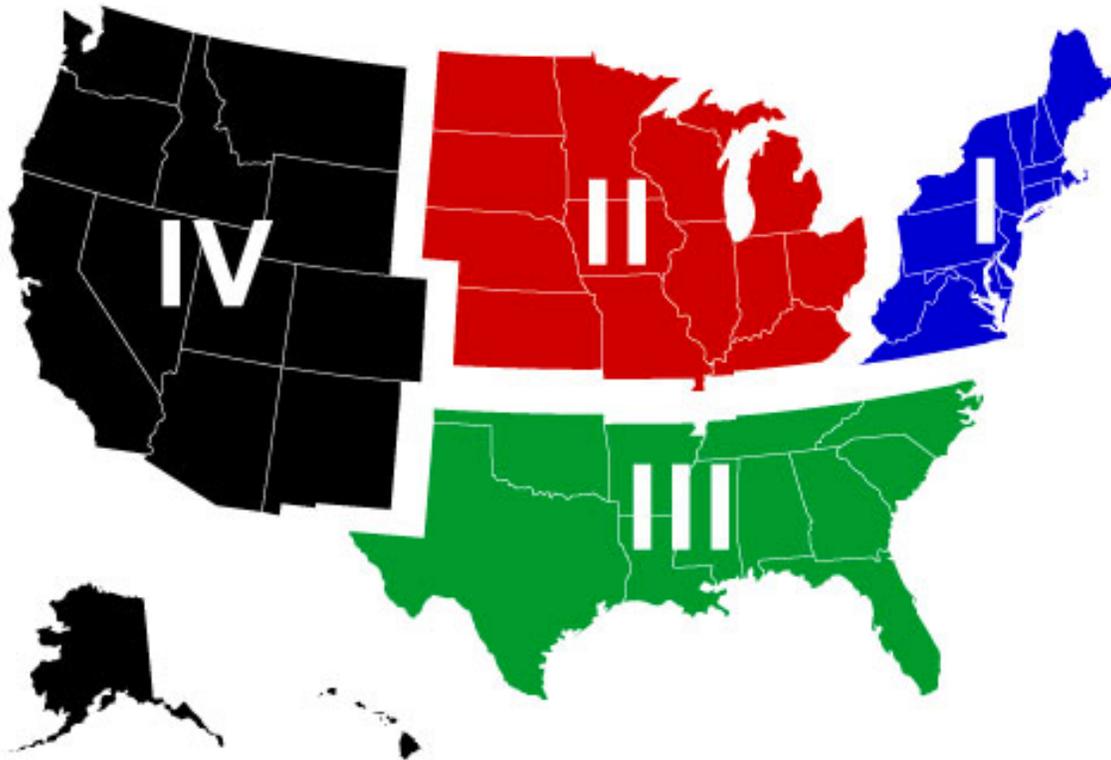


Figure 2. Geographic regions of the United States as defined by Apple Inc.

Demographic Characteristics of the Participants

The participating elementary, middle, and high school principals are described in this section.

The participating elementary principals were well established in their educational careers. The mean age of the elementary principals was 54.25 years. Although the mean years of teaching experience were 22.25, two of the female participants had nearly three decades of teaching experience. Only one of the participants had two months' administrative experience, while the other three participants had 10, 11, and 22 years of experience as school principals. All of the elementary principals held masters' degrees in educational leadership.

The middle school principals were younger than the elementary school principals. Their mean age was 43.5 years. The mean years of teaching experience was 21.25 years, and one of the

female participants had three decades of teaching experience. One of the participants had four years of administrative experience while the other three participants had 8, 12, and 18 years of experience as a school principal. These middle school principals held masters' degrees in educational leadership.

The high school principals were the youngest group with a mean age of 39.25 years. Their average years of administrative experience was 7.25 years, while their average years of teaching experience was 16.5 years. Two of the four high school participants held doctoral degrees, while the other two had masters' degrees. Three-fourths of the high school principals were males (see Table 2).

Table 2

Demographic Characteristics of the Participants

Participant code	Gender	Age	Years of teaching experience	Years of administrative experience	Highest educational achievement (degree)
Elem01	Female	59	29	22	Master's
Elem02	Male	49	18	10	Master's
Elem03	Female	41	17	2 months	Master's
Elem04	Female	68	25	11	Master's
Mid01	Male	51	30	18	Master's
Mid02	Female	47	27	8	Master's
Mid03	Male	41	17	12	Master's
Mid04	Male	35	11	4	Master's
HS01	Male	37	15	8	Doctorate
HS02	Male	38	14	7	Doctorate
HS03	Male	43	19	11	Master's
HS04	Female	39	18	3	Master's

Data Collection Procedure

The data collection procedure is described in this section. Data were collected with the interview protocol. The development, testing, and administration of the protocol is described.

Development of the interview protocol. The interview protocol was open-ended and semi-structured as defined by Merriam (1998). Items within the protocol were focused on answering the following research questions: (1) What technologies are school principals using? (2) Why are school principals using the identified technologies? (3) What are the relationships between each of the following potential explanatory variables and school principals' use of technology? The variables of interest were: (a) knowledge of educational technology, (b) attitude toward technology, (c) professional development and training, and (d) organizational support. Interviewees were provided the freedom to respond to interview questions at length; however, the researcher followed a pre-determined set of interview questions to maintain cohesiveness and structure.

Some of the questions posed in the interview protocol were modified from a questionnaire published by the University of Minnesota (2009) and the Project RED (2010) survey instrument. Each question taken from the questionnaires were changed to make it appropriate for an interview protocol and for school principals. The research questions, domains of interest, interview protocol questions, and probes are found in Table C1.

Content Validation of the Questionnaire

Once approval was received from the Institutional Review Board at Virginia Tech (see Appendix A), a panel was selected to review the interview items for content validation. That panel consisted of five former colleagues. All panel members held a doctorate degree and had served as school administrators. An email (see Appendix B), was sent to all panel members to obtain informed consent. Finally, the questionnaire was emailed (see Appendix C) to all panel members. The respondents were asked to review each question, statement, and probe associated in the protocol. As they analyzed each item, they associated that item with a domain, rated the

level of clarity of the item, and provided any additional feedback that might improve the item. Additional questions or probes that might be useful for the data collection process were requested. The panel members then emailed the researcher their responses, and necessary changes were made. A compilation of those responses is in Appendix D.

Testing the protocol. With support from my committee and permission from the Institutional Review Board at Virginia Tech (see Appendix E), the interview protocol was tested using Skype. Two test interviews were conducted with current school principals. These test interviews occurred in individual settings. An email was sent to each participant to gain informed consent (see Appendix F). The interview protocol (see Appendix G) was revised based upon the feedback received from the content validation.

Analyzing the test interview data. The test interviews were transcribed using a third-party transcription service. Once the transcripts were received, the researcher unitized and coded the test interview data using the constant-comparative method (Maykut & Morehouse, 1994). Test interview data were analyzed and revisions were made to the interview protocol. Revisions were made to the protocol to reflect feedback given during the test interviews. Those revisions included, reorganization of some questions, additional probes, and clarifying questions the respondents deemed unclear. This final reorganization helped the researcher conduct the official interviews more fluently.

Administering the interview protocol. Once final approval from the Institutional Review Board at Virginia Tech was granted for the revised protocol (see Appendix H), and an email was sent to each participant to gain informed consent (see Appendix I). The final questionnaire (see Appendix J) was administered through phone, Skype, or FaceTime. All interviews were conducted in a private and secure location. Each interview took 45-65 minutes

and began with an explanation of terms and the nature of the study. The interview process incorporated suggestions from the protocol test to ensure data were captured efficiently and accurately. Interviews were scheduled at times and modes most convenient for the respondent. Each interview was recorded with a desktop computer and backed-up with both a digital voice recorder and smartphone.

Data Management Procedure

Each interview was labeled with the principal's initials, the date of the interview, and then source code. The data were then transcribed by a third-party transcription service. Each line on the transcript was numbered. The researcher reviewed each transcription for accuracy and validity. All tapes were replayed and the transcripts were read simultaneously to check for accuracy. Data were stored on the researcher's password protected desktop and laptop, as well as two separate removable storage devices that were also password protected. The data were also stored in the cloud via Google Drive, which is password protected. Confidentiality was maintained throughout the study by using pseudonyms for each respondent and their respective schools and communities. Once the study was completed, data will be stored for three years on a password protected computer and in the cloud via password protected Google Drive.

Data Analysis Procedure

Data were analyzed after each interview. Data analysis was achieved using the constant-comparative method (Maykut & Morehouse, 1994). The constant-comparative method is an inductive grouping and coding system that compares a data set to another data set, thus allowing the researcher to consider the data before offering a hypothesis, minimizing the possibility of researcher bias (Merriam, 1998). After the transcripts were reviewed, coded, and then reviewed again (Stake, 1995), the researcher began "unitizing" (Maykut & Morehouse, 1994) the data.

The following abbreviated steps, adopted from the recommendations of Maykut and Morehouse (1994), were used in the analysis of data:

1. Once interviews were completed by the researcher, they were coded by source. “Elem” represented elementary school principals, “Mid” represented middle school principals, and “HS” represented high school principals. Participants were also given a number according to their geographic location. The number “01” represented the Northeast region. The number “02” represented the Southeast region. The number “03” represented the Central region. The number “04” represented the West region (Table 2, Figure 2).
2. Interviews were uploaded to a third-party transcription service’s website immediately after conducting and source coding the interview.
3. Once the researcher received the interview transcription from the transcription company, it was reviewed by the researcher and data analysis began.
4. A list of recurring patterns, concepts, and themes were made and noted on chart paper.
5. Data were unitized by reading through the transcripts, determining units of meaning, and labeling the unit of meaning with a word or phrase. Each unit was labeled with a word or phrase in Microsoft Word for separation from other units. When all of the data were unitized, units were separated by meaning. Each piece of data was printed, cut apart from other units, and posted under a theme.
6. Once the data were posted under a theme, data were reviewed, and overlapping ideas were combined. Subthemes were also created from this review.

7. Units that did not fit into any themes were placed into a miscellaneous category. Miscellaneous units were then reviewed for possible theme placements or new themes. Propositional statements were reviewed for stand-alone statements and for statements that could be connected to other statements with similar meaning.
8. Raw data matrices were prepared to organize and display the data.
9. The final step was the integration of data from the propositional statements with supporting units of meaning to provide a detailed description of the participants' responses with supporting examples, comments, and direct quotations.
10. The researcher kept a log of ideas, probes, and thoughts regarding the process throughout the study.

Chapter Summary

Chapter 2 is a description of the methods used to complete this study. The purpose of the proposed study was to examine the use of technology by principals, why they are using the technologies, and the variables associated with that use. The selection of the setting and participants, data collection procedures, data management procedures, and data analysis procedures are described. Twelve principals of Apple Distinguished Schools from four regions of the United States were interviewed in this study.

Chapter 3

Results

The following themes related to the use of technology by elementary, middle, and high school principals were found in the interview data: (a) access to technology by principals and others in their schools, (b) technology preferences of school principals, (c) dispositions of school principals toward the use of technology, (d) principals' purposes in using technology, (e) support for the use of technology by school principals, (f) district policies regarding the use of technology in schools, (g) respondents' knowledge of current technology and future trends, and (h) percentage of a principal's day spent using technology. These themes and related subthemes are reported in Table 3.

Table 3

Themes and Subthemes Related to the Use of Technology by School Principals and Their Schools

Theme	Subthemes
Access to technology by principals and others in their schools	<ul style="list-style-type: none"> • Principal access to devices • Principal access to learning platforms • Teacher access to technology • Student access to technology
Technology preferences of school principals	<ul style="list-style-type: none"> • Devices • Applications
Dispositions of school principals toward the use of technology	<ul style="list-style-type: none"> • Favorable dispositions • Mixed dispositions • Unfavorable dispositions
Principals' purposes in using technology	<ul style="list-style-type: none"> • Collaborate and communicate with other stakeholders • Access and apply management tools • Access and use personal and work-related information
Support for the use of technology by school principals	<ul style="list-style-type: none"> • District support provided to the principal <ul style="list-style-type: none"> ○ Hiring technical support personnel ○ Training and professional development provided to the principal

	<ul style="list-style-type: none"> • Grants from private companies
District policies regarding the use of technology in schools	<ul style="list-style-type: none"> • Acceptable use policies • Restrictive policies • Facilitative policies
Principals' knowledge of current technology and future trends	<ul style="list-style-type: none"> • The principal's knowledge of current technology • The principal's awareness of future technology trends
Percentage of a principal's day spent using technology	<ul style="list-style-type: none"> • The principals' time spent using technology in their work lives • The principals' time spent using technology in their non-work lives

Access to Technology by Principals and Others in Their Schools

All principals discussed the availability of technology. Access to technology was reported in two forms: access to devices and access to learning platforms.

Principal access to devices. The respondents had access to personal or officially funded smartphones, tablet computers, desktops, and other multimedia devices such as Apple TV's.

Principal Elem01 described her access at the time of her interview:

Well, right now, I am sitting at my desk and I have my iPad, my laptop, and my iPhone, so devices, I think I'm covered on that.... I have an Apple TV sitting ...on my table, and...my projector that's in my closet for when I need it. (Elem01, L442-444)

Mid04 listed the devices provided to him by the district. He stated, "I'm given a desktop computer, a laptop computer, and an iPad.... The district provides me with a stipend for my cellphone" (L373-374). HS03 similarly stated, "I have an Apple MacBook, and I have an iPad.... I have an iPhone5s" (L379-385).

Six participants (Elem02, Elem03, Mid03, Mid 04, HS01, HS04) noted access to technology was widespread. An indicator of this accessibility was their diversified preferences regarding the use of brands, applications, and devices. Principal Mid03 shared the various devices and applications he was currently using:

I have chosen to use a Google phone. I don't have an iPhone. I used [an] android phone. The reason I do that is I still want to be able to have knowledge on other products. I have the iPad, so I get the Apple part of it, but I also want to know and be able to experience and have some competence using other technologies. So at home, I have a...laptop. The nice thing about it is, so I have a...laptop at home and MacBook in my office, an iPad in my hands at my disposal..., and an android phone. No matter where I'm at, most of the things that I use are to be used on any of those devices. To me, that's the great thing about Google. I'm not a salesman for Google by any means, but I sure feel like that technology alone has allowed me to do whatever I want, wherever I go. (L494-504)

Principal access to learning platforms. The implementation of learning platforms was popular in the schools. A learning platform is an integrated set of interactive online services for information, tools, and resources to support and enhance educational delivery and management (Hill, 2012). Learning platforms may be operating systems in which educational cloud-based applications are able to run on a single platform (Hill, 2012). Learning platforms provide online services to principals, teachers, and students alike. All participants mentioned using a learning platform of some type. Specific examples provided by principals were Schoology (Mid02, HS01), It's Learning! (Mid01), Blackboard (HS02), and Moodle (Elem02, Mid01). Elem02 said:

Then...we use Google Docs, e-mail....Moodle.... Then, we also use...some of our Reading and Math websites, such as Dibbles for example, to progress monitor, which helps us look at our system-wide growth for reading, for example. So, we'll use that regularly for uploading data. (L354-358)

All participants reported using various social media, which they considered a learning platform. Principal HS02 said, "Getting that kind of information [technology-focused publications] is usually through Twitter" (L210). He further elaborated:

If I see a tweet from Digital Promise or TED Weekly or something like that, that deals with technology, that is how I really [receive my information].... I don't necessarily subscribe to it [technology-based publications] because I feel like I can get all the information on each through those [social media outlets], you know, just a brief summary. Then, if I liked what that brief summary said, then I'll click on the article and read it. Like today, I'd probably tweet about 10 ways principals can use Twitter, and so, that came from...something somebody else had tweeted, and I clicked on the article and read it and that's kind of how I got the information. (L210-217)

All participants claimed the mainstreaming of technology in society made sharing information more possible. Principal HS04 shared, "Facebook and Twitter and Instagram" were frequently used in her school and were the mediums for "sharing what we're learning here" (L209-211). She further reported the use of such media "on a consistent basis during the school day, and we embrace that, and we actually use that as a portfolio of sorts to capture our learning" (L211-212).

Sharing information among school personnel has resulted in the acceptance and adoption of non-traditional learning platforms in public high schools, as reported by HS02. He shared that his high school has been fortunate to use Blackboard for learning management, although it [his high school] does not utilize collaborative technology as much as higher education. HS02 said, “Our colleges use Blackboard as well, so that’s kind of an easy transition for a lot of our students” (L198-199). He said, “Like my fourth-grade daughter, she uses Blackboard, so she is ready. Other colleges use Blackboard.... It helps with our development as well” (L199-201).

Teacher access to technology. During the interviews, all principals discussed their teachers’ access to technology in their respective schools, which included the use of devices and applications. All principals reported teachers having an iPad, MacBook or both. Elem03 stated, “We...got our Apple computers.... All the teachers got MacBooks [at our school]” (L201). As Elem04 described, providing teachers with devices could enhance the learning environment. She said, “We’re doing a lot of Skyping right now. We have one teacher that’s Skyped with a night zookeeper at the London Zoo, which is absolutely fantastic” (L287-288). Elem01 described access in her school stating, “We’re one-to-one with iPads and laptops and Kindles, and we use the SAMR¹ [Substitution, Augmentation, Modification, Redefinition] model for a transformational approach to technology use in our day-to-day lives and educating students at the elementary level” (L44-46).

Mid01 commented on the learning management system the teachers in his school were using in conjunction with the iPad. He stated, “We started seeing these... powerful lessons. We

¹ SAMR is a model designed to help educators infuse technology into teaching and learning. It shows a progression that adopters of educational technology often follow as they progress through teaching and learning with technology.

use ‘It’s Learning!’ as our learning management system.... All of a sudden our eighth grade teachers are building unbelievably powerful lessons, getting away from that teacher upfront lecturing” (Mid01, L90-93). Elem02 spoke in depth about his teachers’ access to devices. He said:

As far as devices, all the teachers have access to a smartboard.... We have in-focus projectors and document cameras in every single room as well as our library. Every teacher has been issued an iPad for their use, and they use those [for] instruction as well as personally as they like. Every teacher has been issued a laptop by the district as well. (L360-364)

None of the respondents directly mentioned access to the Internet in relation to teacher access; however, web-based applications requiring Internet access were cited. Elem02 stated, “The district...uses computer-based assessment for our benchmark testing in both math and reading. But, again, those are web [cloud]-based” (L359-360). Mid02 provided additional examples of cloud-based applications:

We have iCal [cloud-based calendar sharing] that we...[use] to coordinate calendars and things like that.... We use Scantron performance as far as some of our testing and benchmarking that we do here. We have a program called Edusoft that we try to use for our unit and chapter-based tests that help[s] us compile data. We have a learning management system in place called Schoology, which is kind of like a teacher-based website but a little bit more along the lines...of Facebook in its setup, but you can put all your classroom resources on it. (L425-432)

Principals reported teachers used technology for communication purposes. HS04 reported, “To collaborate and communicate with staff..., we use Slack” (L276-277). Slack allowed teachers to create discussion threads with each other. HS04 continued, “I’m looking at our Slack channels right now and there’s probably 30 in here.... They’re just a variety of different happenings going on in our school” (L284-286). Elem04 stated her teachers use an application known as Shutterfly. She stated, “Some of them [teachers] have their individual classroom sites like through Shutterfly and so they were able to post...information to our families” (Elem03, L128-130).

Student access to technology. Both devices and applications must be present in the school to encourage the use of technology. All principals in this study had high levels of technology infused into their schools for student use. Tablets, such as Kindles or iPads, were cited most by principals. Mid04 said, “We have...iPads to all of our students, but we have a small number of actual desktops and laptops” (L84-85). HS04 mentioned needing laptops with high memories and capacities for student use. She specified, “We’d like to have some really powerful laptops to be able to run some programs that a few of our students are using to edit videos” (HS04, L263-265). Mid04 believed styluses were necessary to implement computer-assisted assessments. He said:

We find that some students preferred using the keyboards that are attached to the iPads, and some kids preferred just typing right onto the screen. Styluses are necessary for math tests. You really need to have the styluses if you’re doing math on the iPad because of having to plot and things like that.... You need a finer point to touch the screen to make sure you're plotting in the correct spot on the graph, so that's something to consider as well. (Mid04, L41-46)

One elementary principal (Elem04) shared her school's success with students with different learning needs by using specific applications:

They're either considerably learning disabled or they might be mildly mentally retarded or they may just have physical disabilities that really impact their learning. I know there's one little girl that was mainstreamed into a fourth-grade class last year. And they had to do...reports using iMovie and Keynote, and these reports were on flight and she had done one [report] that...you could not [tell she had a disability] looking at that [report].... If this little child hadn't had this [application], to me [looking at this report], there's no way I would have said, "Oh yeah, this kid's STC [special education]."

(Elem04, L162-168)

Two principals (Elem04, Mid03) acknowledged a lack of Internet access for students at home was not a concern. As Elem04 stated, "Even if the kids don't have Internet at home, ...they can still manage their downloaded applications" (L410-463). Mid03 added to this point by saying:

They [the high school] have implemented online textbooks, so our students here each have a laptop that they have assigned to them. And on that laptop, no matter whether they have the ability to connect to the Internet or not, they have access to that textbook, along with the assigned work that is part of that curriculum. My experience then is it allows students to be learning 24/7. (L35-42)

Technology Preferences of School Principals

The technology preferences of the school principals were categorized according to various devices and applications. Their preferences were based on making their lives simpler.

Mid04 specifically mentioned, “In my life, generally, I use what works and what I feel I need...to make life easier” (L113-114). This was the general sentiment of HS04 as well. HS04 shared:

I sit next to educators who still have their pencil and paper calendars, and they conscientiously make that decision not to be aware because they want to live in...what they perceive to be a simpler world. And to a certain degree, I can relate [to] and understand that, because if you don't allow yourself just to fully know and access what's out there, you don't really clutter your mind with that. (L110-113)

Devices. All principals are users of mobile telecommunication devices, such as smartphones, tablets, and personal computers. All 12 participants stated the smartphone was the device they used the most. For example, Elem01 shared she has an iPhone. She described the device as “my school phone” (L304). Elem01 said:

So now I have an iPhone, and I have to say, I don't know how I did it before. So yeah, I use it all the time. I have different apps. My Twitter account's on there. My Kindle is on there. My professional reading list is on there. My audio books are on there. My emails, both professional and personal. I'm just trying to think. All of my links are on there, as far as my professional links, those types of things. It's just, you name it, it's there. So yeah, I use it a lot. (L455-460)

Mid01 shared, “I have an iPhone myself, so I certainly use it a lot, from navigation aids to the Internet. I'm always looking for new things, personally” (L44-45). Eleven of the principals (Elem01, Elem02, Elem03, Elem04, Mid01, Mid02, Mid04, HS01, HS02, HS03, HS04) agreed their device preferences were those supported by the school or district and manufactured by

Apple². The only respondent who chose an android phone as his device of choice was Mid03. He said, “I have chosen to use a Google phone. I don’t have an iPhone.... The reason I do that is I still want to be able to have...experience and have some competencies using other technologies” (L494-497).

The tablet computer was second to the smartphone in popularity. Elem04 emphasized the availability of tablet computers, stating, “Well, everybody, every teacher, every principal has...an iPad Air. The kids...in my school, the third-through-fifth graders, have iPad Airs” (L481-492). Elem02 explained the principal’s account funded the tablets in his school, but the school initiated a separate fund to purchase computers with bigger screens. He reported, “We have personal cellphones.... Laptops, ...iPads, and a small stipend for a cellphone [are provided by the district as well]” (L351, L371).

Although all participants preferred using their smartphones, nine of the participants (Elem01, Elem02, Elem04, Mid02, Mid04, HS01, HS02, HS03, HS04) claimed they preferred using two or more forms of devices. For instance, Elem03 said, “In my work, I have an iPhone, an iPad, ... [a] laptop, and a desktop. [These] ... are all Mac products for work” (L285-286). She shared that she preferred using multiple devices rather than using one or two. Elem03 said:

It’s my school phone [iPhone], and I have my own personal iPhone, too.... My Macbook Air connects to the desktop, so the desktop isn’t a stand-alone computer, like I have to hook in my computer. So I guess I’m just using the screen of the desktop, and then an iPad. (L304-307)

HS04 spoke of the technologies she prefers at home. She stated, “I have a remote printer at home, and a laptop, and an iPad, and my phone. That’s about all I need at home” (HS04, L376-

² All 12 participants in this study are principals of schools identified as Apple Distinguished.

377). Mid01 also commented about having separate technologies at home. He stated, “I have my own iPad, my iPhone, [and] I have a scanner/printer at home that we use a lot” (Mid01, L287).

Applications. Most participants used social media applications, online cloud storage, and learning management systems. Social media-- such as Facebook, Twitter, and Instagram-- were used for personal and professional purposes. The participants did not prefer one social-media application over another; however, all specifically mentioned Facebook and Twitter. For instance, Mid02 clarified her school’s use of social media:

We can have a school-based Facebook account, which we do.... We can use it for announcement purposes, but we can't...., as teachers and administrators, go make friends with students and have... [a] relationship through social media that way. (L517-520)

Mid01 posited that he used social media often. He had a personal Facebook page, but not a Twitter account. He stated, “I don’t Twitter, I don’t Twitter myself” (Mid01, L308).

Cloud document storage applications were the preferred method for sharing working files with teachers. Ten of the participants (Elem01, Elem02, Elem03, Elem04, Mid03, Mid04, HS01, HS02, HS03, HS04) used Google Drive to communicate and share such documents as memoranda and notices. HS01 relayed, “I use Google Drive and Dropbox” (L381). Elem03 detailed his school’s Google preferences and use of Google applications:

Our district is big into Google Docs and Google, so we use a lot of that as our applications and collaboration to communicate with one another. Apps? Well, we’re just getting O-Test on the Go. It’s our evaluation system, so that was just installed into my computer yesterday, so I can go and evaluate teachers and I’ll be able to use...my phone to do that with walkthroughs and such, and then also my iPad. So, that’s an app that

we're using. I use [social media] to communicate with my families. I have a school Twitter feed and also a school Instagram account I'm playing with. (L286-292)

HS03 preferred Google Docs, because he believed everything in his work as a school principal was going digital. He believed Google was the application of choice. He stated, "My work as a school principal, I think everything is going to go digital, probably through Google Docs, relatively soon.... [Word] forms from the state department of education are converting over to Google Docs (HS03, L33-36).

Dispositions of School Principals Toward the Use of Technology

The dispositions of school principals toward the use of technology in their personal and professional lives were categorized as (a) favorable, (b) mixed, and (c) unfavorable.

Favorable dispositions of school principals. The majority of the participants viewed technology as a means to foster natural curiosity that could potentially improve a student's academic performance. For example, Elem01 recalled the moment she felt reenergized from owning an iPad with a management tool. She believed an iPad was "a game changer more than any other device" (Elem01, L234).

Most participants believed technology would direct the landscape of education over the next several years. Elem02 predicted classroom interaction and presentation materials would change as technology improved. He said, "The landscape of education is changing right in front of us right now. It's like we're on a moving carpet. Things are happening so rapidly" (L176-177). Elem01 spoke of how student access to devices and applications can help remove barriers and level the playing field. She stated:

I'm confident in the fact...if it's going to allow our students to progress and level the playing field and give students an opportunity, ...I'm going to try anything. Too often

students are limited or restricted by who's available at home to help them, or the teacher's knowledge.... No longer is that the case. There's no cap on what a student can access or learn if they have a desire and the tool in their hand to do it with...that's the part about this [that] is the most dynamic and the most exciting. (Elem01, L101-107)

One middle school participant reported technology as something that should be embraced. Mid02 recalled the first time she came to school and saw how all stakeholders of the school had grown to embrace the use of technology:

When I first came here, ... our school district ... was very proactive with technology. We've always tried to be on the forefront. And, when I came here, our technology director was very happy to announce that every classroom at that point in time had one computer.... (Mid02, L231-242)

High school participants who viewed technology favorably focused on the utilization of technology and its impact on the personal and professional lives of teachers and school principals. HS01 compared the use of conventional calendars to the electronic calendar currently used by many school principals. He shared, "How many times did people write things on calendars, and they left their calendar somewhere and they messed up the time that they were supposed to be at the appointment" (L124-126). He explained that with the presence of the electronic calendar, "I think the accuracy of things has increased dramatically in so many different areas of people's lives" (L127-128). HS01 added that technology increased the "level of sophistication with [teachers] being able to tailor things to individual students" (L83-84). He considered technology to be an influential tool for positive academic outcomes:

I think it increases the teacher's ability to differentiate assignments. I think it increases [an] administrator's ability to differentiate professional development for teachers. I think it allows students to move at a pace that is more conducive to their learning. Those are some of my initial thoughts. (HS01, L84-87)

The attitude of principals toward the use of technology seemed to emanate from their strong desire for simplicity and efficiency. Mid02 clarified the idea of "simplicity" by stating, "We coordinate calendars, and we email communications instead of having to call or run down the road" (L92-93). For these school principals, the use of technology made their roles and responsibilities easier and more manageable. HS04 shared:

To pursue the knowledge of what's available to you really takes quite an effort, to be able to educate yourself and know what's out there. But at the same time, you are able to accomplish so much more, and multi-task, and balance so many more projects than you ever thought that you could... [by using] programs that allow you to multi-task and communicate with many people that have many projects happening simultaneously.... (L116-119)

Budget efficiency was another favorable aspect of the principals' use of technology. Elem01 cited the previous challenge of regularly updating technology in her school. She said, "We have Apple TVs.... [We] have chosen not to do interactive projectors and whiteboards because that technology changes constantly, and it requires constant upgrades, and that's a financial burden to us" (Elem01, L70-72). The technologies she currently uses have more longevity and less overhead expenses.

Mixed dispositions of school principals. The participants who demonstrated mixed dispositions toward the application of technology believed the use of technology was exciting but challenging. When asked to rate his feelings concerning technology in his personal life, HS03 stated, “How about challenging” (L96). When asked how he felt regarding technology’s influence in his work, he shared:

I’m excited about it. I really am. I think education is going to look completely different in about five years with the implemented technology and what we can do at work and what we can do with our students and staff. (L100-102)

Mid04 reported similar feelings. He stated:

I think there are a lot of benefits, important tools that would be hard for us to live without, but at the same time, that comes with challenges and glitches and frustration. So it’s kind of a mixed bag, but I think the benefits outweigh the cost. (Mid04, L107-109)

HS02 stated his disposition towards technology required continual reassessment because of the rapid improvements and changes in device models. This was frustrating to him. He believed owning an iPad while also owning a MacBook Air was a duplication of functionality. He explained that he invested funds into devices because he valued their use for teachers and students; however, he struggled with their overlapping uses. He shared his perspective by stating:

I do not have an iPad.... I’ve toyed with getting an iPad. I have a MacBook Air that I use.... I do have an iPhone that the system provides for me.... That’s why I haven’t ventured to get an iPad.... I have the iPhone.... It’s pretty much the same device.... As far as what we have as a system and what I have for my different teachers and all, I’m not

sure if we are in need of anything that I would be, ”Hey, we should have this and we don’t.” (HS02, L54-59)

HS02 shared his mixed feelings regarding the possibility of providing teachers an application allowing them to monitor students’ device screens from their laptops. Although he believed this application could be useful, he worried it could cause teachers to become more stationary. He stated, “Do you give them that? They sit at their desk and can see 20 computer screens at once, or do you not give them that in hopes that they would be up and about” (HS02, L85-87).

Two participants (HS03, Mid03) expressed mixed views toward technology and the roles it played in their lives. HS03 stated technology made life both more complex and simpler, particularly during the transition phase. He described this as, “I think it makes it simpler, to be honest with you; but like I said, it could make... [life] more complex.... I feel like you never can get away from it sometimes” (L144-145). Mid03 reported being more efficient as a result of his technology use but has seen a change in addressing student behavior. He stated, “It allows me to be much more efficient. On the flipside, having more technology in the hands of students has also changed the dynamics for addressing student behavior.... I have to learn and develop ways of addressing digital citizenship” (Mid03, L110-114).

While budget efficiency was categorized as a favorable disposition for the participants, one principal noted the budget was the only factor holding him back from being one-to-one, which he desired to be. Mid01 stated, “Currently, we are one-to-one in eighth grade, and the plan was to go one-to-one in seventh grade next year, [but] a little bit of that is [dependent] upon budget trims” (L35-36). Mid01 desired to be one-to-one in all grade levels, but realized the budgetary constraints were tight.

Unfavorable dispositions of school principals. Although all of the participants expressed support towards the adoption of technology at their respective schools, they also expressed concern regarding comprehensive technology adoption by all school stakeholders and inappropriate social media use by students. Mid02 believed technology was biased towards individuals who were social media users. She said, “I’m not as confident, because I’m not a social media person” (Mid02, L87). Elem04 primarily focused on possible cybercrime risks for students. She shared:

There’s certainly...[a] risk for pedophiles...if they’re going on the Internet, which is why ... teaching digital citizenship is so crucial.... I had little girls a couple of years ago that opened up these accounts on these social networking sites for younger children called ‘Mallee’[ph]. And then what did they put on there? They put their picture. They put their name. They put their address. They put their telephone number. They put where they went to school, and...when I found out about it, I said, “You guys, this is so unbelievably dangerous.” (Elem04, L666-672)

HS03 expressed concern about the social media apps students had access to that could hide their actions. He posited:

I’m just concerned about the evolvement of social media and the hidden [apps], the apps where you can make comments that hide [from adults], that are anonymous...that could attack my daughter, or some of my students, or anything else like that. (HS03, L111-114)

Managing people that were not “on board” with the technology initiative was another concern. Elem01 stated, “Well, its [technology leadership] more complex in the sense that I constantly have to do battle with those that don’t get it [the reason for the technology initiative]”

(L176-177). HS02 furthered this disposition by referencing his advanced placement teachers. He shared, “With our teachers it’s a little different story.... Our advanced placement teachers receive training from instructors that are almost anti-technology.... These folks [advanced placement]...use pencil and paper and they just don’t believe in technology at all” (HS02, L183-187).

Principals’ Purposes in Using Technology

Principals used technology for three main reasons: (a) to collaborate and communicate with other stakeholders, (b) to access and apply management tools, and (c) to access and use personal and work-related information.

Collaborate and communicate with other stakeholders. The principals were optimistic concerning technology used to perform their leadership roles. Mid03 stated, “The other part for me as a principal is the networking piece. I really like the fact that I can FaceTime other principals out there” (L530-532). Elem03 emphasized the efficiency in communication gained with technology:

I think we’re more efficient. I can get feedback from my staff a lot quicker, too. Even on snow days like today, we’ve been emailing back and forth because we’ve had to change schedules and things like that. And even the one snow day we had was like a conference night, and we had donuts at school, so I was able to contact all of them [staff]. (L126-129)

Communication with various stakeholders is a critical responsibility of school principals. All participants in the study claimed they used technology to establish and maintain communication with students, teachers, parents, and other stakeholders. HS03 shared, “I think

just for means of communication with students or staff.... Even when you're out of the building, you feel like you still have [some] control of what's going on with the building" (L557-559).

HS02 adopted technology because he has a goal to "communicate extensively" (L49).

Technology "allows [him] to accomplish that goal of being a strong communicator" (L51).

Elem03 was an active Twitter and Instagram user. She said, "I use [technology] to communicate with my families; I have a school Twitter feed and also a school Instagram account I'm playing with" (Elem03, L293-294). She further stated:

I'm new to this decision [technology plan], and so I'm seeing how other principals use it and [how] my superintendent uses it to communicate with us.... All of the Google Docs and everything in keeping all that organized is still kind of new to me. (Elem03, L294-296)

A middle school principal (Mid03) shared that students favored school documents published through Google Drive and thought it was a convenient mechanism to catch the students' attention. Mid03 said:

But, they [students] do have to sign up and to show that they have in fact watched it [Google Video].... I felt like when we addressed those issues using that Monday Memo through Google Share, it has just been really, really nice for us.... The students have really responded well to that [Google Drive].... We surveyed our students twice throughout the year, and they have really felt like that was a favorable way to do it [provide a work-flow] and a good way to communicate the information we want to get out to them. (L161-167)

Access and apply management tools. The school principals involved in this study adopted certain technologies because of their desire to be efficient with their work. Nine (Elem01, Elem02, Elem03, Elem04, Mid01, Mid02, HS01, HS02, HS03) of the participants felt the need for effective and efficient management systems. HS01 shared:

Most of my things I would say are computer-based. Obviously, email. I use our learning management system--Schoology. We also have a statewide database for student registration, grades, attendance, and behavior. So, I use that database extensively.... We have a state testing database. I use a lot of the Department of Education databases that we have for different things. I use them pretty extensively. (L304-308)

Mid04 achieved a “higher level of efficiency” in his work using technology (L127). He added, “I think that without technology I would get less done. I would be less consistent in doing the things that I do. I would probably produce, at times, ... a lower quality of work and follow-through” (Mid04, L127-129).

Elem01 observed much faster communications because of her willingness to learn. She said, “It made communication so much faster, so much more efficient, and you’re just in touch with everything in a way that we never could have done before” (Elem01, L528-529).

Access and use personal and work-related information. All participants said that access to information was “one click” away from their digital technology. Everything they needed was published and shared via the Internet. For instance, Elem01 accessed digital books from the online public library in both her personal life as well as her work life. She stated, “We [the school] have let go of many books and paper products and materials. We [the school] are online with the Portland Public Library...for students to access books and materials (Elem01, L48-49). Elem01 shared, “In my personal life [I] use Kindle for books, downloading from the

public library.... It's just the ease of having that accessibility to those types of materials" (L57-58).

Similarly, Mid03 shared how the growth of web-based opportunities has given him continuous access to information. He said:

We're are no longer downloading as much software. We're no longer running as many programs. It's so much more web-based which in turn makes it accessible 24/7 to me wherever I'm at around the world, and that has really shown to me my improvement, the biggest change and growth for me. (Mid03, L26-30)

In addition, participants in this study claimed their use of technology was motivated by the accessibility of information even when they were at home. Elem04 said:

I mean, we're getting...Google Docs because... [of] the convenience of having something that you can access anywhere. I personally have Dropbox, which I have used for some work-related thing[s]. I use iCloud.... That's more for personal use though. (L524-L528)

HS02 shared that Twitter was an option for accessing information, particularly from his teachers. He thought a news subscription was no longer relevant to access information regarding current events. He justified not subscribing, "I don't necessarily subscribe to it [news publication], because I feel like I can get all the information on each [news publication] through...just a brief summary [on Twitter], then if I like...that brief summary..., then I'll click on the article and read it" (HS02, L214-215).

Support for the Use of Technology by School Principals

Two major themes of support were found in the data: district support and grant support. District support had two subthemes: hiring of technical support personnel and training and professional development provided to the principal.

District support provided to the principal. The level of district support received by the participants varied, as well as the mandates placed on them by their districts. A major source of district support was the purchase of devices and applications. For instance, one district required the use of the iPad in sixth grade, since they were purposely purchased for them by the district. Elem02 believed this mandate was a result of the students' previous technology usage while at his elementary school. He stated:

At this point, in our district it [use of district purchased iPads] has been optional. In fact...we had to apply to become a magnet school...a technology magnet school. So it's been more of us being the drivers or going to the district to ask for that [technology] rather than the district mandating; although, this year, in sixth grade, they have mandated iPad use in the middle schools. (Elem02, L252-257)

Elem02 also stated his district was supporting their technology integration through increased flexibility from district-wide procedures and policies. Because technology is moving at a fast pace, district procedures are evolving. He stated:

The district is looking at different things, like, they developed a team of teachers to push out some primary apps, because I think they realize they can't always be the expert...at the district office, so they'll need to bring in teachers to help them with that workload. (Elem02, L349-353)

Elem04 described how her superintendent allowed her to purchase devices without the recommendation of her IT [information technology] director. She stated:

I'm first told 'no' [by IT]...due to bandwidth concerns.... It just didn't make sense to me.... I wasn't even trying to access the Internet.... I went over the head of [the] IT [to]

the superintendent, and she was his [IT director's] boss.... She said, "He doesn't have the last word. I do. You can have it [devices]...." So we started buying the technology.

(Elem04, L115-125)

HS04 spoke of how her district allowed her to work without filters on the Internet. She stated, "In our district, we're the only school that has been allowed to turn off the search engine filter that blocks Facebook and Twitter and Instagram" (HS04, L222-223).

Hiring technical support personnel. Additional district support included the employment of technical staff in the schools to assist school principals with the implementation of daily technology integration. All 12 participants were asked to describe the level of technical support they received. All schools included in this study had at least one technical person responsible for the implementation, monitoring, and evaluation of technology support, facilities, and technology programs in the school (see Table 4). The hiring of such personnel depended on the allocation of financial resources from the district leaders. For instance, Principal HS02 described the personnel in charge of the installation and application of technologies:

I have... [a] part-time technology facilitator, and the other time she teaches.... I use her to help teachers integrate technology in the classroom. She can help them [teachers] with any Blackboard issues and Office learning issues. And, then, my media specialist really doesn't check out books and stuff. He's the guy that students go to if they're having computer issues, you know, like a black screen or whatever. He's also the one that could take away administrative rights and everything else. He sets up my Apple TV. (L243-249)

At the elementary level, Elem02 described his school district's assignment of technical staff as being responsible for the technical aspects of the program:

On all three levels, last year and years prior, we had a school-level person who was paid through a stipend to specifically help with technology needs. This year, we actually don't, so M... has been handling the majority of it and doing a fantastic job, I might add. And, then, we have support from the district level as well. They have a team that goes out and specifically supports the schools with technology and...integration of technology. And, then, above that, we have...a Director of Instructional Technology, I think his title is, with an assistant below that. And, so, the support is there from district level, and the district made the commitment to move into digital conversion two years ago. And, so, some funds are available and we are working that out as well. (L300-308)

At the middle school level, Mid04 described his district's response to the need for technical support with the integration of technology. He said:

Each school site has one more or less full-time technology specialist, so this is a classified employee. They're not exactly as highly trained or skilled as maybe the tech people at a district office or a large school district, but they're on-site, and they help with the computer labs, and they will help with the iPads and help with our tech elective. (L338-341)

Training and professional development provided to the principal. Ten (Elem01, Elem02, Elem03, Elem04, Mid02, Mid03, HS01, HS02, HS03, HS04) of the principals said they did not take technology-specific courses during their principal preparation programs. Of those ten, four (Elem03, Mid02, HS01, HS04) indicated technology components were built into other courses of study. Mid04, who had taken technology classes, was an exception. Mid04 said, "I had to, of course, take the technology class where I earned my teaching credential, as well as a technology class where I earned my administrative credential" (L164-165).

All of the principals shared that their districts provided professional development opportunities for both principals and teachers. HS02 stated that his district funded principals and teachers to attend a summer program on technology in Mooresville, NC:

Everybody goes through their [Mooresville Graded School District, North Carolina] summer program. I went through it in my first year, my first summer with my new teachers as well, and then..., the new teachers we've hired since, we always send them there. (L165-168)

Mid02 stated, "Our district offered a lot of technology in-services, and anytime we have a program that we have implemented school-wide or district-wide, we always have training on that" (L177-179). With knowledge gained from the professional development training, HS04 was able to transfer that knowledge to students and teachers.

Immersion was another source of training mentioned. The participants in this study claimed to be regular users of technology. They believed immersion in technological applications developed a user's competency. HS01 believed training provided by the district and the use of technology helped develop an individual's technological competence, but he thought these were more successful when combined with immersion. He explained this approach as "just living it, as well as some trial and error personally, as well as watching teachers try and fail and fix it" (HS01, L120).

Eight (Elem01, Elem02, Elem03, Elem04, Mid02, Mid03, HS02, HS03) of the school principals recognized the evolution of technology. They believed principals should evolve with the technological upgrades and changes. Elem02 posited:

The focus is to increase technological fluency...because if you're not fluent with technology, you're not going to be instructing well with it. And, you can't be fluent if you don't put in adequate training. It's one thing to have really cool devices sitting on your shelf. It's another thing to actually... [be] using them well and fluently, so we were putting a lot of emphasis on that. (L192-196)

In an attempt to gain fluency in technology, the participants recalled using a variety of learning models and experiences. All principals in this study claimed they were eager learners and learned a variety of applications and skills on their own. HS04 explained her acquisition of technological skills:

I sought them out. So, very early on in my [career]...there were some opportunities, some grant opportunities, to acquire some technology in my classroom... (This is going back 15, 17 years when I was a classroom teacher.)...and be able to equip my classroom with some desktop computers, and along with that came many hours of technology training. So, I applied for...those grants and received those grants, and that took me on a journey, a technology journey over several years. And, through that I was able to collaborate with some other classroom teachers, other educators, and that afforded me additional opportunities. (L139-148)

Elem01 sought more appropriate learning from other institutions. She stated, "The more I investigated, the more I got, 'Wow, and this is a game changer more than any other device'" (Elem01, L201). Elem01's self-learning motivated her to explore possible institutes where she could send her teachers to learn about the technology. She said, "We bring people in from all over the country, all over the world actually, to this institute [Leveraged Learning Institute] every year" (Elem01, L203).

Mid03 and HS02 shared their trial and error experiences while learning various technologies. Mid03 reported, “I think that has really been...a good lesson for me to learn on my own.... That’s how I just jumped in...just committed to it...decide[d] I was going to do it” (L195-198). HS02 recalled, “Oh, trial by fire, that’s for sure. I’ve always had an interest in technology, not as in depth with educational technology as I have been exposed to in the past two years as the principal here” (HS01, L152-154). HS04 emphasized this point. She stated, “Success of technology integration in the lives of a school leader requires additional learning on a continual basis. So, to...maintain a level of competence with the latest programs that are available just requires a consistent commitment to learn those programs” (HS04, L102-104).

Grants from private companies. Three of the participants (Elem03, Elem04, HS04) said their schools received grants to help fund the purchase of their devices and professional development. Elem03 stated the grant for her school was secured by the district leadership. She noted, “Dr. ... [Superintendent] was first going to bring Apple products into our district.... A grant [was used] to send a team of teachers...to Apple in California [Cupertino] to be trained for a week on Apple computers” (L100-102). Elem04 reported grants helped her purchase devices and provide needed professional development on the use of the devices. She stated:

That was the beginning of my really wanting to get it [technology] into the school.... I was fortunate enough because we had these big grants to be able at the beginning when we got it [devices] in the school to have Apple come in three times and give professional development which is expensive, but fabulous. (Elem04, L210-214)

HS04 recalled various grants she had received throughout her career. She believed the grants were the springboard to the technology integration at her school. HS04 stated:

There were some...grant opportunities to acquire some technology in my classroom.... Those grants took me on my journey, a technology journey, over several years.... Then [I] participated in another grant [for her current school], and so from there it kind of snowballed [technology in her school]. (L140-152)

Table 4

Descriptive Information on Personnel and Policies by Participant

Participant code	Provision of technical support personnel	Availability of policies concerning technology for--		
		Administrators	Teachers	Students
Elem01	Yes	No	No	No
Elem02	Yes	No	No	No
Elem03	Yes	No	No	No
Elem04	Yes	Yes	Yes	Yes
Mid01	Yes	No	No	No
Mid02	Yes	No	No	No
Mid03	Yes	Yes	Yes	Yes
Mid04	Yes	Yes	Yes	Yes
HS01	Yes	Yes	Yes	Yes
HS02	Yes	Yes	Yes	Yes
HS03	Yes	Yes	Yes	Yes
HS04	Yes	No	No	Yes

District Policies Regarding the Integration of Technology in Schools

District policies affect the way school principals and school personnel use technology. Three types of policies were identified in the data: (a) acceptable-use policies, (b) restrictive policies, and (c) facilitative policies. Table 4 lists the availability of technology-related policies for personnel and students by school principal.

Acceptable-use policies. All principals in this study shared their knowledge of acceptable-use policies for administrators, teachers, and students. HS01 said, “We have a district

acceptable-use policy that goes for administrators and teachers... [and an] iPad policy just for the students in our school” (L176, L181). HS03 emphasized that administrators in his district complied with the same acceptable-use policy as the one imposed on teachers. In other schools, the application of acceptable-use policies seemed to vary by position. Mid02 said:

It’s one acceptable-use policy; however, I think...everyone... [has] different rights, like administrator[s’ rights] to see our students’ [devices]. I guess it all depends on what program or what rights each individual has. In some programs, the administrator may have more rights than a teacher. (L257-259)

The school principals had varying levels of knowledge about acceptable-use policies for students and school personnel. Elem03 shared she was “not 100 percent sure” of the policies implemented regarding technology use; however, she said there was a “district use policy guideline that is kind of outdated now” (L201). She explained the policy involved the appropriate use of campus facilities, which included the use of laptops and desktops. Elem03 described the guideline as:

It discusses things about how to use the computer, what could happen if we used it inappropriately, but it was just...to cover everybody so we knew what we could and couldn’t do with our Macs, because... [they were] still school property. (L205-208)

HS02 shared the district policies he knew that guided the use of his school’s technology. He said:

I think that there’s probably written policies as far as how administrators should use them. I mean, it’s an expectation, but we are familiar with the curriculum that we use and

you know that we are diverse in our different approaches with technology. But, I don't know of any. (HS02, L228-238)

HS02 further explained, "One of our most specific [policies] is our student policy. We have what we call a Required-Use Policy that all our students sign and it is... basically, the in's and out's of digital citizenship" (L249-251).

Restrictive policies. Although five of the participants (Elem01, Elem02, Elem03, Mid02, HS04) stated they were not aware of written policies addressing all educational stakeholders, all 12 participants agreed that certain restrictions concerning the use of technology were implemented. Elem01 stated she desired more teacher autonomy in using technology, while imposing limited restrictions to discourage potential cyber criminals from hacking the school system. She said:

I would give teachers more autonomy. I would trust them more, and... I would encourage—not so much at my school, but in schools across the district—I would encourage people to look at the replacement, transformation, integration type thing and give teachers the freedom and flexibility, along with students, to not be as restrictive as they have been. I think we restrict things out of fear sometimes. Personally, I have to kind of grin behind my hand when I hear about, you know, a harmless hacker. You know a student who's broken into a system. (Elem01, L476-483)

Mid02 shared that her school restricted certain sites from students and teachers when using the Internet connections of the school. She stipulated that administrators had liberty to filter potentially inappropriate sites. She said, "We do have filters in place, trying to restrict

access to certain things. I think, for the most part, the way that we have divided the profiles...works for us” (Mid02, L294-296).

Elem02 stated his district’s policy on software was restricted to the use of applications that were reviewed and approved by a panel of experts on technology. He opposed this policy and believed the use of new applications reviewed by Apple-distinguished teachers should be allowed for student use. Elem02 believed the level of technological expertise among Apple-distinguished teachers was more advanced than the technological expertise of the district representatives. He said:

Their knowledge right now really is above maybe what the district’s knowledge is. So, they’re asking for apps that the district does not really understand or, you know, they’re trying to catch up and understand what these apps are so that they can approve them or not. (Elem02, L345-347)

Facilitative policies. One principal (Elem04) noted that she operated under a different set of technology policies than other schools in her district. Elem04 reported, “There—in my school, there’s different [rules] ... from school to school. In my school, I allowed them to have 2G-rated games or 2G-rated movies or 1G-rated game and 1G-rated movies, others did not” (L343-345).

Principals had differing views concerning permissible Internet sites for students and teachers when using school networks. The principals who allowed social media such as Facebook, Twitter, and YouTube emphasized an individual’s right to access information on these sites, as well as the individual’s personal control of the utilization of the sites. They appreciated the freedom from such facilitative policies that didn’t allow these freedoms for the rest of their

district. These principals felt they could turn student missteps into teachable moments. Elem04 believed children should learn from the consequences of choosing to participate in unacceptable Internet activities. She described this system:

There are schools that have...take[n] off the camera, take[n] off the App Store, take[n] off YouTube, take[n] off the Internet, and when they talked to me about it, I said, “Not in my school.” Because it’s too restrictive.... I don’t...think children learn from that. I think children learn from making...bad choices and getting corrected.... I think they learn from choosing not to make bad choices. You know, using their own self-control, not from having things imposed. But, we told them the rules. You know it’s not like it’s a free-for-all. Do whatever you want to. We tell them the rules, and then we leave it up to them to make the correct choice. (L369-372)

HS03 shared, “They’re [social media sites] permissible, but they are also aired with caution, and that was from the advice of some state attorneys in the state of Kansas on that” (L243-244). Mid04 opposed blocking YouTube, a site she considered informative, depending on the content selected. She said:

Our students don’t have open access to YouTube. It's blocked, so they can't go to YouTube where there are all sorts of great things...that they could be watching or searching for, but there... [are] so many bad things also. So, unfortunately, there's some give and take there.... You have the capacity to unlock that option when needed, but it does keep students from freely accessing all of the information and resources that are out there. (Mid04, L303-308)

Principals’ Knowledge of Current Technology and Future Trends

This theme focuses on the respondents' self-rated knowledge of current technology and their awareness of future trends in the field of technology. The section on principals' knowledge has their self-ratings in both their personal and work lives in relation to technological prowess. Evidence for why specific principals chose their ratings is presented. The section on the principal's awareness of future trends has the future technologies principals believe will affect their personal and work lives.

The principal's knowledge of current technology. Participants were asked about their level of knowledge concerning technology in their work lives and non-work lives. Respondents could rate themselves on a scale of one through four. One represented "little to no knowledge," two represented "some knowledge," three represented "much knowledge," and four represented "very much knowledge." Ten of the participants (Elem01, Elem02, Elem03, Elem04, Mid01, Mid02, Mid03, Mid04, HS02, HS04) rated their knowledge of technology in their personal lives as a "3" or having "much knowledge" while two of the high school participants (HS01, HS03) rated their knowledge as a "2" or having "some knowledge." Nine of the participants (Elem01, Elem02, Elem03, Elem04, Mid01, Mid02, Mid04, HS01, HS02) rated their knowledge of technology in their work lives as a "3"; whereas, Mid03 and HS04 rated their knowledge a "4". They were the only participants who rated themselves a "4" in either category. HS03 rated his knowledge a "2." Table 5 contains the principals' self-ratings of technological knowledge in their personal and work lives.

Table 5

Principals' Ratings of Their Knowledge of Technology in Their Work Lives and Non-Work Lives.

Participant code	Rating of knowledge in work life	Rating of knowledge in non-work life
Elem01	3	3

Elem02	3	3
Elem03	3	3
Elem04	3	3
Mid01	3	3
Mid02	3	3
Mid03	4	3
Mid04	3	3
HS01	3	2
HS02	3	3
HS03	2	2
HS04	4	3

The mean of the principals' ratings of technology knowledge in their work lives was 3.08 on the one-to-four scale. The mean of the principals' ratings of their knowledge of technology in their non-work lives was 2.83 on the scale of one through four. The grand mean, the combination of ratings for technology knowledge in both their personal lives and work lives, was 2.96 on the one-to-four scale.

Describing the rating of his knowledge of technology in his personal life, Elem02 said, "I realize that the more I learn about technology, the less I really know" (L59-60). He further shared the following concerning his knowledge of technology in his work life, "We use a particular software as a principal and so my knowledge of one particular thing might be at a 4; whereas, something else might be a 1.... I guess I would say a 3" (Elem02, L62-65). Mid01 explained that the rating of 3 meant technology "is pretty standard practice here" (L25). HS01, a doctoral-degree holder, rated himself a 3 because of his desire to learn more about the integration of technology in schools. He said, "Anything that's going to give me greater knowledge about individual kids so that our staff members can meet the needs of their students, I would welcome any of that technology" (HS01, L49-51).

The principal's awareness of future technology trends. All of the participants eagerly discussed their current uses of technology, but none had a solid awareness of future trends.

Mid01 summed it up:

I think for us, of where we are going, I don't necessarily see anything new in particular. I'm sure there's a few. I'm sure there's some applications that will probably be helpful. But, currently, we're one-to-one in eighth grade. And, our plan is to go one-to-one in grade seven next year.... (L33-36)

Elem01 stated, "I'm not sure what else is out there that I haven't accessed, so I think we are probably at the top end of accessing whatever is available at the moment" (L50-51).

The participants were curious about technology and searched social media for popular tools but were not able to cite specific examples of future trends. When asked about the possibility of future technologies, Elem03 said, "Oh gosh! Anything and everything! Emailing my staff and using social media to keep my community informed" (L39-40). Mid03 expressed his desire to uncover technology's potential for ease of use and accessibility. His answers to probes regarding future trends were associated with technology making his life easier. He explained:

No matter where I'm at...I have access to...all my contacts, all my messages, anything like that. I don't really have to carry around anything other than my smartphone.... I can go to a hotel over the weekend..., and if they have a computer in their lobby..., I can access all of my information because it's held in the cloud.... I can't say that there is anything that I don't have.... I have it all. (Mid03, L50-67)

Only two respondents specifically cited examples of possible future trends. Elem02 recalled reading an article in *Wired*, a technology-based publication. He stated,

We recently read an article in *Wired*. I think it was about what school is going to look like in 2020, I think. And, one of the things they talked about is we really don't need desks anymore with technology, and paper will basically go away, so pretty exciting.

(Elem02, L108-110)

HS03 reported a future trend in technology related to health care. He reported:

My daughter has type-one diabetes.... I think the technology there is going to, in my personal life, evolve to where we can keep...control of her blood sugar counts to be able to...keep an eye on her even when she's at a friend's house or school events or anything else like that. (HS03, L56-64)

Percentage of A Principal's Day Spent Using Technology

Participants were asked what percentage of the day they spent using technology in both their work lives and non-work lives. Table 6 contains the principals' percentages by work lives and non-work lives.

Table 6

Principals' Percentage of Time Spent Using Technology in Their Work Lives and Non-Work Lives

Participant code	Percentage of time in work life	Percentage of time in non-work life
Elem01	75	55
Elem02	50	25
Elem03	90	75
Elem04	75	75
Mid01	25	10

Mid02	50	10
Mid03	65	50
Mid04	25	5
HS01	70	5
HS02	50	25
HS03	70	40
HS04	80	80

The principals' time spent using technology in their work lives. During the interviews, participants were asked “What percentage of your day is spent directly using technology in doing your work?” Responses varied by participant. Mid01 and Mid04 reported a low percentage of 25. Mid01 elaborated on his chosen percentage, “I would say 25 percent.... Our evaluation system is tied to technology.... It’s more of a walkthrough-type system. We use Evernote for that...so that’s a part of technology I use a lot” (L403-405). A high percentage of 90 was recorded for Elem03. She stated:

Oh my goodness! Most of the day. All of our central office referrals are now on our computer here at school.... I have to send that stuff. I have to document it and then also submit it to whatever system we use, our power school system. I would say most of my day.... I would say at least 90 percent.” (Elem03, L380-384)

The principals' time spent using technology in their non-work lives. Participants were asked “What percentage of your day is spent directly using technology outside of work?” Responses again varied by participant. A low percentage of 5 was recoded for both Mid04 and HS01. Mid04 stated, “Pretty small, maybe five percent” (L431). A high percentage of 80 was provided by HS04. She stated, “That’s probably the same number [as her work life percentage]. Yeah, that would be my guess” (HS04, L414-416).

Chapter Summary

Chapter 3 included the results of this study presented through the words of the respondents. Eight themes emerged from the data analysis. Those themes were: (1) access to technology by principals and others in their schools; (2) technology preferences of school principals; (3) dispositions of school principals toward the use of technology; (4) principals' purposes in using technology; (5) support for the use of technology by school principals; (6) district policies regarding the use of technology in schools; (7) principals' knowledge of current technology and future trends; and (8) percentage of a principal's day spent using technology. A summary of findings is included in the following chapter, along with conclusions, discussion, recommendations, limitations, and reflections from the researcher.

Chapter 4

Summary, Conclusions, Discussion, Recommendations, Limitations, and Reflections

This chapter has six sections. The first is a summary of the study. The second section is the researcher's conclusions based upon the findings from the study. The third section is a discussion of the findings. The fourth has recommendations in two subsections: (1) recommendations for additional research and (2) recommendations for practice. The fifth section is a discussion of the study's limitations. The final section has the researcher's reflections.

Summary

The purpose of this study was to identify technologies school principals used, the reasons principals used the identified technologies, and the variables associated with their use. The research questions posed in chapter 1 of this study were only partially answered. They were:

1. What technologies are school principals using?
2. Why are school principals using the identified technologies?
3. What are the variables associated with that use?

Twelve principals from Apple Distinguished Schools across the United States were interviewed, and data were collected from those interviews. To begin the study, the researcher contacted an Apple employee who oversees the Apple Distinguished Schools program. She provided a list of schools that were currently labeled as Apple Distinguished Schools. She then helped identify elementary, middle, and high school principals from each of four geographic regions of the United States. The selected principals' schools had a reputation for having high levels of technology usage, and they consistently used the latest technologies. The researcher then sent an email to the purposefully selected prospective participants asking if they would

agree to participate in the study. Twelve interviews were conducted with the willing participants. The researcher purchased a company's services to transcribe interview data. The transcript data were then analyzed using the constant-comparative method (Maykut & Morehouse, 1994).

Interview questions were developed using the following domains: knowledge of technology, attitude toward technology, professional development and training, organizational support for technology, and demographics. The tentative conclusions were derived from the major findings of the study based on the participants' responses to interview questions. Eight variables associated with the use of technology by principals were found in the data.

Conclusions

The conclusions from this study were based on the data collected from the 12 interviews. The conclusions are tentative, because they are based on a small number of individuals identified through the Apple Distinguished School program. Just as technology has evolved since the beginning of this study, these conclusions are also subject to change as more information on principals' use of technology becomes available. Using this study's data, conclusions are grouped within eight thematic sections: (1) access to technology by principals and others in their schools, (2) technology preferences of school principals, (3) dispositions of school principals toward the use of technology, (4) principals' purposes in using technology, (5) support for the use of technology by school principals, (6) district policies regarding the integration of technology in schools, (7) respondents' knowledge of current technology and (8) future trends, and percentage of a principal's day spent using technology. These conclusions attempt to answer the researcher's questions to examine what technologies school principals are using, why they are using said technologies, and the variables associated with that use.

Access to technology by principals and others in their schools. Principals, teachers, and students had access to multiple devices and applications. The principals discussed this availability in four ways: their access to devices, their access to applications, teacher access to technology, and student access to technology. Access spoke directly to what technologies principals were using and why principals were using the identified technologies.

All principals had access to multiple devices. Devices used by all respondents included mobiles, such as smartphones and tablets. In addition, all principals used laptops. Few respondents referenced using a desktop computer. Mid03 stated, “I can’t say that there is anything that I don’t have. I have everything that I feel I need to do my job to the best of my ability...anywhere I’m at. I have it all” (L65-67).

All principals had access to a wide array of applications. Applications used by the respondents included the following: learning platforms, like Schoology; cloud-based services, such as Google Drive; communication tools, such as email, blogs, and Skype; learning management systems, such as Edusoft; web-based teacher evaluation forms; and social media. Social media, such as Twitter and Facebook, allowed principals to stay current on technology-related research and to communicate with stakeholders frequently. Principals noted using personal applications for ski reports, fitness tracking, and pleasure reading.

Teacher access to devices and applications was high. Principals spoke of teachers having both iPads and MacBooks. Principals also reported teachers having access to SmartBoards and projectors. One principal referenced teachers having access to Kindles. The applications reportedly used by teachers included the following: student progress monitoring tools, such as “It’s Learning!”; Apple productivity apps, such as Keynote and iMovie; cloud-based services, such as iCal, Google Drive, and Google Classroom. Teachers communicated

with colleagues, students, and parents through applications such as Slack, Shutterfly, email, Skype, and learning platforms such as Schoology and Edusoft.

Student access to devices and applications was high. Because the respondents were principals of Apple Distinguished Schools, the students' access to technology was abundant. Tablets were cited as the student device most used. Some principals referenced the students' use of laptops but not as frequently as tablets. Few respondents made direct references to PC's. Some respondents reported that home internet access for students was no longer an urgent need, since applications could be downloaded onto a student's device. Those applications included the use of online textbooks.

Technology preferences of school principals. Principals preferred technology that make their lives simpler. The devices and applications used were selected with the intent of making their lives simpler. There were similarities among preferred devices, but variations existed among preferred applications. The participants' preferences answered the researcher's question on what technologies these principals were using and why.

Preferred devices were similar among respondents. Principals within this study reported the benefit of using mobile devices, such as smartphones and tablets for communication purposes. The principals interviewed disclosed their dependency on telecommunication devices to sustain channels of communication like email, text, and social media. All principals listed the smartphone as their device of choice. The tablet computer was second to the smartphone in popularity. Several principals noted the desire to use more than one device. While the smartphone was the device they "could not live without," most referenced the need for other devices to do different aspects of their work, such as a printer.

Preferred applications varied by user. Respondents reported that working in the cloud made their lives simpler by giving them on-demand access to both work and personal documents. By using the cloud, principals were able to sync online calendars, collaborate on memos and other forms of written communication, and access student information systems. Google products such as Drive, Gmail, and Calendar were the most referenced cloud-based applications. Principals preferred other applications including learning platforms. They believed learning platforms were a tool to monitor classroom instruction through student progress monitoring.

Social media was used by all participants. The applications most commonly mentioned were Twitter and Facebook, but others such as Instagram were used by some. Social media apps were used to communicate and to stay current on technology-related trends. Participants used social media in their personal lives to share pictures with family and friends.

Dispositions of school principals toward the use of technology. The principals' dispositions toward technology varied. Three primary dispositions were noted: favorable, mixed, and unfavorable.

All principals shared favorable dispositions toward technology. The overwhelming majority of respondents' remarks were favorable toward the use of technology in both their personal and work lives. Participants believed they were more productive and better organized because of their use of technology. They felt they were better communicators and more responsive to the needs of their students, teachers, and parents. Respondents acknowledged the infusion of such technologies as wearables for outdoor activities and blood sugar regulation devices either currently improved or would improve their personal lives.

The principals with mixed dispositions discussed the challenges technology posed, as well as its potential. The word *challenging* was used by participants to describe their ambivalence about technology in their lives. Principals used the word when referring to their experiences with the implementation of large-scale technology projects within their schools. Additional challenges discussed by principals included professional development needs, the continual reassessment of technology, and the constant expectation of timely communication; however, these principals also noted the potential of technology. They believed education was going to evolve in the near future because of technology. Potential changes included the opportunity for more collaboration, as well as changes in device capabilities. Participants also had mixed views concerning the role technology played in their lives generally. They believed technology made their lives both simpler and more complex at the same time. Although it was easier to access emails and information from smartphones, principals felt more pressure was placed upon them to respond to those emails and information requests in a timely manner.

Unfavorable dispositions were limited to respondents who dealt with unwilling personnel and the use of social media by students. Staff who were late adopters of the technology initiative and student use of social media were the only topics on which principals had negative views. Principals discussed their frustrations with faculty members who did not embrace the technology initiative. Although this frustration was not directly related to the principal's use of technology, it was mentioned by respondents. Principals recognized this issue, but understood it was part of the change process. Some participants were not proponents of students using social media and believed students lacked the maturity to be cognizant of protecting their personal information. One principal provided a specific example of students in her school who mishandled personal information using social media, calling it "unbelievably

dangerous” (Elem04, L252). The principal explained that two girls had posted their pictures and personal information on a social media site for younger children.

Principals’ purposes in using technology. The principals’ primary purposes in using technology were to collaborate and communicate, access and apply management tools, and access personal and work-related information. This section provides additional answers to all three of the research questions: (1) what technologies are these principals using; (2) why principals were using the identified technologies; and (3) the variables associated with that use.

Collaboration and communication were critical components of principal usage.

Principals must communicate with a variety of stakeholders. With the assistance of technology, communication can take many forms. The principals discussed using email and social media apps like Twitter, Instagram, and Facebook for communication purposes. They noted the effect technology had on their productivity. Cloud-based services allowed participants to collaborate with all stakeholders in real-time from anywhere. Google Drive was used for document reviews and procedural updates.

Accessing and applying management tools helped principals feel more effective.

Management tools, such as learning platforms, student information systems, and the speed of communication were reported as ways principals felt more effective with their work. Learning platforms allowed principals to access student information through databases. Computer-based systems allowed greater access to data when needed. In addition, principals used technology to enhance their communication systems. They were able to be more responsive and more efficient with those responses because of the available data they had on their devices.

Personal and work usage overlapped. Principals reported using many of the devices and applications for both work and personal use. The device most commonly used at work and home

was the smartphone. Nine respondents noted using one phone, purchased by their school or district, for both work and personal business. Most participants used social media at their schools and in their personal lives. Typically, the use of social media was initiated in their personal lives and transcended into their work lives. The overlapping of technology at work and in their non-work lives allowed respondents to gain more knowledge about their applications and devices of choice which effectively gave them more confidence in using technology.

Support for the use of technology by school principals. Principals reported varying levels of district support and grant support for their use of technology. Types of district support included the purchase and use of devices, additional personnel, and professional development opportunities. Grants came from private companies. This section identifies additional variables impacting the selected principals' technology use.

District support varied in forms. While the level of district support for each principal varied, they all stated it existed in some form. All districts supported, through funding, the purchase of devices and applications. Districts also supported the use of technology through mandates. These mandates required students to use the district-purchased devices. Flexibility from policies and procedures was provided to schools by their respective districts. Examples of this flexibility were in the availability of funds for the purchase of devices and Internet filtering.

District personnel dedicated to technology integration was common. Participants reported that personnel were allocated by their districts to support the integration and maintenance of technology in their schools. For example, all principals reported having personnel solely dedicated to technology integration, technology support, or both. Their responses differed concerning the time the personnel were able to serve their respective schools.

Few reported having an individual solely dedicated to their schools to assist with technology-related areas.

Technology training in principal preparation programs was limited; however, professional development opportunities provided by the school district were abundant. Ten participants reported not taking technology-related courses during their principal preparation programs. Four respondents indicated technology skills were integrated into other courses of study. Professional development occurred regularly for teachers and principals. Most principals gained knowledge from technology-related publications on social media and trial-and-error methods. Immersing themselves into the technology after a professional development opportunity allowed for greater growth and valuable lessons to be learned.

Grants proved valuable for a few principals. Two respondents said their schools received funds from private companies to initiate their technology infusion. The grants helped pay for the devices as well as for professional development provided to both the principal and teachers.

District policies regarding the integration of technology in schools. All respondents reported having acceptable-use policies, but there were differences among the principals' knowledge and views of existing policies.

The respondents' knowledge about their acceptable-use policies varied greatly. All principals shared their knowledge of policies involving the use of technology by principals, teachers, and students. Some principals noted employee policies were part of the overarching acceptable-use policy. Others indicated that personnel guidelines for professionalism encompassed employee abuses of technology. All acceptable-use policies addressed the use of social media. None of the respondents discussed, in great detail, policies involving security.

Elem01 was one respondent who mentioned cyber criminals, but did so light heartedly in reference to a possible breach in security by a student who she referred to as a “harmless hacker” (L483).

The respondents’ views about acceptable-use policies varied greatly. Policies regarding certain uses of technology were deemed too restrictive. Participants shared different views on policies affecting the use of social-media sites. Some principals believed allowing students access to social-media sites could help teach digital citizenship. A majority of principals desired more teacher autonomy related to classroom use of applications. They believed some acceptable-use policies were outdated and did not reflect their school’s technology implementation.

All principals referenced policies they viewed as facilitative in their work. Facilitative policies were those in which the district granted flexibility to schools in using technology. All but one school allowed students to use social media when applicable to their work. Two schools believed they operated under a different set of policies than other schools in their district. In these schools, filtering restrictions were lifted and teachers had more autonomy to access previously restricted internet sites and applications.

Respondents’ were knowledgeable of current technology but less knowledgeable of future trends. Most participants believed they had much knowledge about current technology and its applications to their work and personal lives; however, they were much less knowledgeable about future technologies. When asked to note any technologies that may impact their work in the future, most respondents were unable to name one. Even when probed about their personal use of future devices, the participants were unable to translate the use of those devices to their work. For example, some principals referenced wearables used for fitness

tracking, such as the Apple Watch or GoPro; however, they were unable to envision ways those technologies could impact their work lives. The 2014 and 2015 editions of the *Horizon Report* (Johnson, Adams Becker, Estrada, & Freeman) noted wearables as a technology primed for adoption in four-to-five years. The principals were able to report on technologies they knew and used but struggled to identify future possibilities in the area of technology.

Percentage of a principal's day spent using technology, generally, was high. This theme identified how much of a principal's day was spent using technology in the work lives and non-work lives. The majority of participants spent most of the time in their work life and non-work life using technology. This theme helps to answer the question on the use of technology by school principals. Principals on average spent more time of their day doing work-related tasks with technology than in their non-work lives.

Discussion

The findings were derived from the data collected from 12 interviews regarding school principals and their use of technology. The researcher had experience with one-to-one technology implementations. This experience led him to additional studies (Anderson, 2015; Johnson et al., 2014; Johnson et al., 2015; Noblit & Pink, 2016) concerning technology implementation. The following areas are discussed in this section because of their relevance to the findings of the study: reevaluating how schools work, providing professional development and training, bringing your own device model compared to a one-to-one implementation, exploring the need for policy changes, and examining the need for school cultures to change.

Reevaluating how schools work. Participants of this study noted how technology has changed their work. Cloud computing, with applications such as Google Drive and iCloud, allowed principals to believe they were more efficient with their work. The majority of the

principals believed they effectively communicated with their stakeholders as a result of technology integration. Social media applications, such as Twitter, Facebook, and messaging services allowed principals to be more responsive to parents' requests and quickly disseminate information to respective stakeholders. These applications are not always perceived as welcome changes in the educational system (Project RED, 2010).

One participant posited how different he believed education would look in five years as a result of technology. Recent school improvement methods have challenged schools and classrooms to re-examine their functionality. This challenge has resulted in the need for increased leadership from the school principal, less teacher-led instruction, and more innovative learning approaches. As one middle school principal from this study stated, "We started seeing these... powerful lessons (Mid01, L90).

Principals in the current study discussed the use of teaching strategies that included the use of technological devices to encourage students, teachers, and principals to use a more integrated approach to content. Interdisciplinary units, while not a new phenomenon, are becoming more prominent in schools, such as the schools included in this study. Several principals within this study acknowledged teachers were able to teach content, like digital citizenship across the curriculum, because the content was on devices. One elementary principal noted that she felt digital citizenship lessons were crucial and encompassed all subject areas.

The principals believed learning in their schools was more student-centered and fluid with technology. For example, iMovie projects could include lessons from all four core subjects (Science, Math, Social Studies, and English) as evidenced in this study by one principal's statement on how a device and the iMovie application enhanced the learning of a student with a

disability. Although these types of projects have always been possible, the principals in this study said they were easier within their framework of technology integration.

Providing training and professional development. Prior researchers (Agnew, 2011; McLeod & Richardson, 2011; Paben, 2007; Project RED, 2010; Schrum et al., 2011; Thacker, 2007) have addressed how and why the ability to use technology could be categorized as a practical skill needed for principals within the 21st century. The current study targeted the specifics of training and professional development for that skill. Most participants indicated they were not trained appropriately to lead a large technology initiative. Tiede's (1992) research showcased how most principals' technology skills were self-taught and practiced on their own time. This study further supported that finding. Participants shared their self-learning of both devices and applications. The principals in this study stated professional development was abundant, but immersion into the technology after a training was most effective.

The need for technology-related training and professional development for principals was highlighted in the recently published *Professional Standards for Educational Leaders* (2015). These standards were published by the National Policy Board for Educational Administration and supported by the Council of Chief State School Officers. The 10 standards were:

1. Mission, vision, and core values.
2. Ethics and professional norms.
3. Equity and cultural responsiveness.
4. Curriculum, instruction, and assessment.
5. Community of care and support for students.
6. Professional capacity of school personnel.
7. Professional community for teachers and staff.

8. Meaningful engagement of families and community.
9. Operations and management.
10. School improvement.

Standard 4 is the only standard directly linked to technology use. The expectation of addressing the principal's own learning and effectiveness is embedded in Standard 6. This is important, especially as it relates to technology integration. The participants indicated their primary goal when selecting technologies for use was to make their lives simpler. While this is a useful goal to reduce stress, the principals did not understand or could not articulate educational trends in the world of technology that could potentially impact their work. Participants spoke knowledgeably about the technologies they were using and the technologies used throughout their schools by students and teachers. Many even indicated technology implementation was at its height within their schools. However, when asked about future technologies that could impact their work, the participants consistently failed to provide a concrete example.

Principals discussed devices for personal use, such as the Apple Watch, that were recently announced but not yet available for purchase. One principal noted an emerging technology in the field of medicine, specifically for his daughter who was diabetic. None of the participants indicated how the devices or any other emerging technologies could impact their work. They spoke only generally about how education may look differently in the years to come. Professional development and training on emerging technologies may be useful to assist principals to reevaluate how schools are to work in the future and potentially better serve the needs of their students. Emerging technologies could make their lives even simpler.

Bringing your own device compared to a one-to-one implementation. The current study's findings showed students in the participants' schools had high levels of access to both

devices and applications. All of the principals led schools that were recognized as Apple Distinguished. This does not necessarily mean they had a one-to-one ratio of devices to students. Several did, but others needed additional funds. None of the schools used a bring-your-own-device model.

“Bring your own device” refers to the practice of students bringing their own laptops, tablets, smartphones, or other mobile devices to the learning environment. Many students already enter classrooms with mobile devices. They can access the school’s network and use their devices for research, word processing, filmmaking, and other educationally useful activities. This model is a less expensive means to reach a one-to-one implementation. Since students bring their own devices from home, they have freedom to choose their devices; consequently, inconsistencies occur in the classroom when attempting to use the devices as teaching tools. This is a drawback to the bring-your-own-device model. Administrators can become frustrated with device management. Juggling multiple operating systems and locating applications for those operating systems can slow the learning process. Internet safety and filtering are additional concerns.

Student equity and access is a concern within the bring your own device model. The *Professional Standards for Educational Leaders* (National Policy Board for Educational Administration, 2015) promotes equity within student demographic groups. Technology could help create equity among students from different environments through access. By providing disadvantaged populations with access to devices and applications, the playing field is leveled for all students. One principal noted that there was no limit to what a student can access and learn if they have the proper tools and inclination. A principal provided another example of a student with special needs creating an iMovie project of the same quality as her peers.

Multiple definitions are used to describe a one-to-one technology implementation. The researcher chose the following definition from *The Glossary of Educational Reform* (2013), which stated, “The term one-to-one is applied to programs that provide all students in a school, district, or state with their own laptop, netbook, tablet computer, or other mobile computing device. One-to-one refers to one computer for every student.” Because the participants worked in Apple Distinguished Schools, every student, teacher, and principal had the same device. Principals reported that technology administrators were able to focus on assisting teachers with technology integration in their classrooms. One participant shared that his media specialist and technology teacher helped coordinate technology services to students and teachers.

The participants believed teaching and learning were enhanced by their technology initiatives; however, true one-to-one models are expensive. Not only can initial costs be prohibitive, but one must plan for the sustainability of the devices. There are some potential cost savings with free applications, curriculum, and the use of less paper. Project RED (2013) highlighted the financial impact of one-to-one learning. Greaves et al. (2013) stated that the true cost savings benefits only begin to be realized when students are in a complete one-to-one environment.

Refreshing or exchanging old devices for new ones after a certain period, can be expensive. Refreshing devices alone can cause districts and schools to reconsider a one-to-one option. Districts are often compelled to continue with a one-to-one implementation because of their initial investment in the project. This decision to continue with the one-to-one program may lead to budget cuts in other areas. Often, districts fail to consider sustainability and refresh rates; therefore, many one-to-one implementations phase out over 3-5 years as a result of a lack of funding. One participant believed his middle school should have been one-to-one before the

high school, because the technology he had integrated had led to the Apple Distinguished School recognition and improved learning outcomes for his students. However, budget constraints prevented the district from continuing with their plan to provide additional devices to his middle grade students.

Exploring the need for policy changes. Policy development and awareness were additional themes that emerged from the literature review (*Horizon Report*, 2015; Project Red, 2010; U.S. Department of Education, 2009) and the results of the study. The current study identified the variable of policy development and awareness as influential factors in technology use in schools. These factors could influence the effectiveness and efficiency of a school's technology program.

Technology policies for personnel. Policies were loosely connected to how principals used technology in their schools. One participant (Mid02) stated she was unaware of any policies addressing the use of technology by personnel. Another (Elem01) reported her district didn't have a separate acceptable-use policy for personnel and students. Several others were not knowledgeable on such policies and simply referred to their staff code of conduct. They believed any inappropriate use of technology by personnel would fall under the policies guiding other areas of professionalism. Seven respondents (Elem02, Elem03, Elem04, Mid01, Mid03, HS03, HS04) stated there were no written policies guiding their school personnel's use of technology, but there were "unwritten" rules.

Acceptable-use policies addressing personnel will be necessary as more technology and one-to-one implementations are integrated in schools. It is likely that policies are in effect for personnel in these schools. Some participants appeared to have a cavalier attitude toward technology policies. This attitude may be because the field of technology is changing so rapidly

and current policies are out of date. It is possible, as well, that none of the principals had experienced a serious security breach. Specificity regarding adult expectations for their use of technology will need to be a part of policies and training programs for teachers and principals.

Technology policies for students. All respondents reported having acceptable-use policies for students, and many believed these policies were restrictive in nature. This finding is consistent with previous findings and reflections concerning data security (Johnson et al., 2015) and learning analytics (Johnson et al.; McLeod, & Richardson, 2011).

The 2014 edition of the *Horizon Report* (Johnson et al.) illustrates both the concern and need for policy updates and legislation to protect student data and provide a mechanism for third-party educational software providers to leverage data in a meaningful way for student learning. This process of leveraging data to enhance student learning is often referred to as learning analytics. Data mining can be used to decipher trends in student behavior and create applications for personalized learning; however, it should not be allowed without parental awareness. Ninety-five percent of the districts surveyed within the *Horizon Report* (2015) stated they used cloud computing in schools; however, only twenty-five percent of those districts informed their parents of such practice. In addition, fewer than seven percent restricted the sale or marketing of student data by vendors. These lack of restrictions to forbid the sale of student data by third-party vendors is a serious concern. These statistics are alarming and highlight the need for policy updates and additional communication from schools to communities.

Policies regarding a student's use of technology and a school district's use of student data are described as difficult challenges by the 2014 *Horizon Report* (Johnson et al.). Principals were concerned about their students' use of social-media applications. One principal noted how dangerous it could be for students to place their personal information on social-media outlets.

Digital citizenship education was one method mentioned by principals that could help combat this concern.

The principals in this study stated favorable dispositions toward the accessibility of data, but did not specifically mention how readily available their student data were for the learning platforms they were using. One principal noted his student information system was an application on his smartphone; however, this is not the type of big data the 2014 *Horizon Report* (Johnson et al.) is referencing.

The 2014 *Horizon Report* (Johnson et al.) referred to big data relating in relationship to personalized learning. Personalized learning can be made easier using technology devices and applications; however, the devices and applications need access to student data to personalize the learning experience for the student. According to the 2014 *Horizon Report* (Johnson et al.), policies are not aligned to allow this level of data mining while also protecting student privacy. The 2014 edition of the *Horizon Report* stated twenty percent of districts surveyed lacked policies governing the use of online services. Broad federal laws, such as the *Family Educational Rights and Privacy Act* (2012), have not kept pace with the rapid development of technology. Principals in this study were not specific in discussing policies that governed their use of student data. They spoke broadly about acceptable-use policies, student disciplinary problems associated with inappropriate use, and the learning platforms their respective schools were using. Not only do state and local policies need updating to support students in both learning and matters of privacy, they also need to reflect an awareness of privacy and need for security by stakeholders and employees.

The need for school cultures to change. All participants in this study had favorable dispositions toward their own technology use, as well as the technology used in their schools.

Most participants used technology for the majority of their work and non-work lives. The exploration of themes, such as principal dispositions and knowledge of technology, aligned with previous research (Leftwich, 2010) revealing how knowledge, belief, and culture intersected with technology usage. One principal believed education would look completely different in the next five years as a result of technology. He believed this change would be a positive one.

Recent researchers (Hanushek, & Woessmann, 2015; Jorgenson, Ho, & Samuels, 2015), stated that schools can play a role in the growth of local and national economies. Flexibility is critical for this to occur. Schools must be able to adapt to the needs of a local or state economy. They must be able to train students to compete globally in their post-secondary world. Creativity and entrepreneurial thinking are keys to creating learning environments that spur this higher-order, deeper thinking. Technology and leadership have roles in this process, not by simply providing a student with a device, but by allowing a device to change a learning culture. Creating a culture of innovation may start with a device, but to sustain the culture, it must be imbedded in a teacher or principal's practice. Without leadership, the device will not have the intended impact (Project RED, 2010). Technology can be a catalyst for innovation, but learning and culture must evolve from the simple execution of device deployment.

Recommendations for Additional Research and Practice

The recommendations for additional research and practice are founded on the participants' responses and recent research from other sources.

Recommendations for additional research. Recommendations for further research include: (1) school culture and its impact upon technology use; (2) additional factors determining use; (3) security; and (4) effective and efficient management.

School culture and its impact upon technology use. In the current study, principals explained how district leadership and support from third-party organizations were influencing technology integration in schools. Future research has the opportunity to investigate policies and governmental initiatives that affect the use of technology by staff and students in educational institutions. Questions regarding how organizational culture and technology usage influence one another could be explored further. Dr. Mark Edwards, Superintendent of Schools for Mooresville Graded in Mooresville, North Carolina, is credited with the following statement, “When visitors come to view our technology initiative, they arrive talking about the devices. They leave talking about our culture” (Edwards, 2013). This statement provides anecdotal evidence that there is a relationship between technology usage and an organization’s climate and culture. Further research studying school cultures within schools of high technology usage, compared with the school cultures within schools that do not have high levels of technology usage could be useful. While there are many variables affecting the use of technology, a school’s culture could be one of those variables.

The current study’s participants spoke overwhelmingly in support of their technology initiatives. However, they shared that employees who were not on board with the technology plan were challenging. This can impact the school culture in a negative way. The expanding role of technology in education will impact personnel and students. Technology enables customization and innovation in teaching and assessment. However, it also causes principals and teachers to change how they lead and teach. Understanding the change process and continuing research on how change impacts a school’s culture could be of great importance to technology integration and other large-scale initiatives (Project RED, 2010).

Additional factors determining use. The question, “What drives your use of technology?” was not answered completely. Most participants claimed their technology usage heavily depended on the technologies needed and provided for them at work, but this was not the case for all participants. One participant deliberately used different technologies outside of work to be knowledgeable about various devices, operating systems, and applications.

Balance. The 2016 Higher Education edition of the *Horizon Report* (Johnson, Adams Becker, Cummins, Estrada, Freeman, & Hall), attempted to address the issue of balance. The section titled, “*Balancing our Connected and Unconnected Lives*” examined the abundance of devices and applications available to educational institutions, *primarily* students. Although this area of the report focused on the digital footprint for post-secondary students, it could easily be a lesson for school principals. Principals must lead by showing a balance between work life and non-work life and how that balance can be achieved. The landmark project “A Day Without Media,” led by the International Center for Media and the Public Agenda with the University of Maryland provided students with an opportunity to disconnect from technology to better understand how it impacted them. This type of activity could help principals, teachers, and students understand how a balanced approach to technology use is necessary and how that balance relates to the learning process (Johnson, et al., 2016).

One important question involves the relationship between personal uses and work uses of technology. Is a principal who uses certain technologies in his personal life more successful with the same devices or applications in his work life? Are principals more prone to sustain their technology usage at work when they are familiar with the device or application from personal use? Is the reverse true? Do principals find that the technology used at work influences the

types of technology used at home? Research on these questions could be important for schools and districts as they provide professional development for their staffs in the area of technology.

Security. Participants were noticeably silent when given the opportunity to discuss the area of security. All participants discussed technology that involved student information systems, progress monitoring, and other forms of student data, yet none of the participants expressed concerns of a possible security breach. One participant noted that he could access his student information system anywhere from his phone. He did not appear to worry about a security breach. Trainor (2015) describes the student data privacy issue in today's world as cloudy. However, he outlines federal legislation, such as the proposed changes to *Family Educational Rights and Privacy Act* as illustrating how the student data privacy issue may soon become clearer.

Effective and efficient management. Principals in this study felt they were more efficient in their jobs as a result of technology. Their purposes in using technology focused on being better communicators, allowing time for more collaboration, accessing management tools, and accessing information within their personal lives and work lives. Recent research by Stevens (2014) suggested time dedicated to training may not increase the efficiency of technology usage, but rather one's confidence using the technology; therefore, it may be relevant to evaluate whether data categorized as an efficient use of technology may simply be an increase in usage resulting from self-confidence. Stevens (2014) called for additional research in this area and questioned the interpretation of "technology efficiency," as not only stemming from professional development or technical infrastructure, but also personal confidence with technology. Professional development may increase use. Increased use may improve one's confidence in the use of technology. Increased confidence may lead to the exploration of new

and different technologies by school principals. This exploration may affect the knowledge principals have on future trends and how those trends may impact their field. By exploring multiple domains such as a principal's attitude towards technology, technological knowledge, professional development opportunities, and confidence with technology, patterns related to efficiency and effectiveness may be observed. Further research on technology usage as it relates to confidence may be useful.

Recommendations for practice. Based on the participants' responses and the researcher's understanding of technology usage, the following recommendations for practice have been made: (1) identify technological devices and applications using the researcher's revised questionnaire; (2) include time for immersion after a training or professional development opportunity; (3) update acceptable-use policies; and (4) carefully construct the goals and resources needed to successfully implement technology.

Identify technological devices using the researcher's revised questionnaire. Schools and districts could utilize the questions from this survey to prepare a major technology initiative. The questionnaire may help schools and districts determine goals for their technology initiative. Asking questions regarding policy updates, technology and internet access capabilities, the current knowledge base of potential users of devices and applications, as well as anticipated uses could prove valuable to schools and districts before investing significant public monies into a technology adoption. A possible list of questions and probes are listed in Table 7.

Table 7

Possible Questions for Schools and Districts to Consider When Exploring a Large-Scale Technology Initiative.

Question	Probes
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<p>1. What technologies do you use in your work?</p> <p>2. Why do you use those technologies?</p> <p>3. What percentage of your day is spent using technology while at work?</p> <p>4. What technologies do you use outside of work?</p> <p>5. Why do you use those technologies?</p> <p>6. What percentage of your day is spent using technology outside of work?</p> <p>7. What types of electronic media do you use?</p> <p>8. What technologies are you aware of but are not currently using?</p> <p>9. What technologies do you see coming along that may impact your work as school principal?</p>	<p>1a. What devices do you use at work?</p> <p>4a. What devices do you own?</p> <p>4b. How do you use your phone?</p> <p>7a. What types of social media do you subscribe to?</p> <p>8a. Which Cloud applications do you use?</p>
<p>10. How do you feel about the influence of technology in your life?</p> <p>11. How would you rate your attitude towards technology? Confident, challenging, apprehensive, or hindrance?</p> <p>12. How many technological devices do you own?</p> <p>13. Please list any applications and gear (devices, accessories, etc.) that you cannot live without.</p>	<p>10a. In your work life?</p> <p>10b. In your personal life?</p> <p>10c. In your students' lives?</p> <p>10d. In the lives of your faculty and staff?</p>
<p>14. How did you acquire your knowledge and skills in the use of technology?</p> <p>15. How many technology-related courses have you taken?</p> <p>16. What percentage of other courses taken during your professional</p>	<p>14a. What types of training or professional development have you received in the area of technology?</p> <p>15a. How have these affected your use of technology?</p> <p>16a. Do you subscribe to any technology focused publications? Any websites?</p>

<p>preparation embedded technology standards or best practices?</p> <p>17. How many hours of technology related professional development is needed?</p>	<p>16b. Do you participate in webinars on technology applications?</p> <p>16c. Describe the value of those in which you have participated.</p>
<p>18. What support is available to help you with technology?</p> <p>19. What types of technology competencies does your state or district impose upon principals or professional educators?</p> <p>20. Do you have personnel solely dedicated to technology integration in your district? School?</p> <p>21. Tell me about your district's policies on the use of technologies by administrators? Teachers? Students?</p> <p>22. Tell me about your school's procedures regarding the use of technologies by administrators? Teachers? Students?</p> <p>23. What type of infrastructure do you have?</p>	<p>20a. Are there technology integration specialists at your school?</p> <p>20b. Other support personnel?</p> <p>21a. Are there rules, regulations, or policies that facilitate the use of technology by administrators? Teachers? Students?</p> <p>22a. Are there any restrictions on the use of any technologies in your work? If so, what are these and why the restrictions? Are there ways of getting around these restrictions?</p> <p>22c. How are these restrictions changing?</p>

Include time for immersion after a training or professional development opportunity.

Professional development models are an important decision for those considering a large technology initiative. Clearly, identifying the needs of those involved in the project is critical if student outcomes are the ultimate goal. If the professionals responsible for leading the technology initiatives are not properly trained on how to use the devices, how the devices will impact learning, and how to implement the devices with fidelity; districts will not realize their established goals. School principal development in the area of technology usage is equally important to the training teachers receive. Project RED (2013) differentiated between training

and professional learning. Greaves et al. (2013) defined training as one-time or short-term activities designed to develop a specific technical skill. While training is important, it is not the same as professional learning. Professional learning is defined by Greaves et al. (2013) as ongoing, collaborative, job-embedded, and supported through a continual cycle of improvement. School principals must be a part of this cycle. The participants in this study discussed self-learning about the devices and applications they were using. Although this method is always useful, it should not be the standard mode of operation when attempting to accomplish the goals associated with the technology initiative.

Principals in this study discussed the lack of training on technology use in their principal preparation programs but that lack of training was offset by the abundance of professional development opportunities provided by their school districts. In either occurrence, they spoke of needing time to immerse themselves into the technology after the professional development was provided. For example, following professional development on devices and applications used to enhance communication among principals, teachers, and stakeholders, principals and teaching staff could use the identified technologies to communicate in new ways, which could benefit student learning.

Update acceptable-use policies. According to Project RED (2013), many districts across the United States renamed their acceptable-use policies as responsible-use policies. This name change is consistent with the need for policies to be revised to account for the rise in mobile devices. Some participants in this study presented a somewhat cavalier attitude toward their districts' acceptable-use policies. None of the participants referred to their policies as responsible-use policies. While all referenced the existence of acceptable-use policies for students, many were unaware of the existence of similar policies for personnel. Districts and

schools should outline at the forefront their expectations for the acceptable use of the devices and applications they provide their principals, teachers, and students. The balance between privacy and the use of devices and applications to guide personalized learning are difficult. Parents and advocacy groups are demanding tighter restrictions on who has access to student data.

Meanwhile, third-party vendors are creating applications for use on technological devices that could potentially improve student learning through individualized instruction and assessment. Addressing these issues is imperative to ensure the goals and resources needed to successfully implement the technology implementation are realized.

Carefully construct the goals and resources needed to successfully implement technology. Not all participants detailed how the technologies they used in their work or throughout their schools impacted student learning. Student learning should be the primary focus of any technology initiative. Even technology used to assist with the demands of the principalship, such as paperwork, travel for meetings, and teacher evaluations, should lead to increased outcomes for students. Although some of these uses may not directly impact student learning, they indirectly impact student learning by allowing principals more time to research progress monitoring tools, discover new trends and best practices through social media, or monitor student engagement in classrooms. Student learning should always be at the forefront of any technology initiative, whether it is directly impacted or indirectly impacted.

Within the study, the amount of support--i.e., personnel solely dedicated to technology integration--varied for each participant. Personnel needs should be considered as districts analyze their capacity for a technology adoption. Personnel costs could potentially derail the project. Academic and maintenance personnel are necessary for technology initiatives to be implemented with fidelity and to cause little disruption to the overall learning environment.

Districts and schools should carefully identify the necessary personnel needed to make the project successful but should plan for more.

Limitations of the Study

The sample population examined school principals who were predisposed to technology devices, like Apple, and were more inclined toward technology usage. A few of the principals commented that they were not device agnostic, but the majority of them were limited to Apple devices. Apple devices were utilized in most schools; however, Google cloud services and document sharing were applications used by most respondents. The lack of diversity with the device of choice could be a limitation, but this concentration of participants also allowed the researcher to provide specific suggestions and practical applications.

The open-ended questions created for this qualitative research study may have caused conversations to deviate from the topic. At the same time, beneficial information from the interviewees was gained. The sample size was appropriate for a qualitative research study, especially considering the in-depth nature of the data extracted from the interviews. However; a larger sample size may have revealed additional useful data.

Reflections

This section includes the reflections of the researcher. Thoughts were noted in a journal throughout the researcher's interviews and compilation of data. Reflections are presented on the future of technology and its impact on education, the principals' knowledge of technology trends in education, and a revised theory of the variables associated with principals' technology use. Overall reflections will also be provided.

The future of technology and its impact on education. The passenger side mirror on some automobiles reads as follows, "Objects in mirror are closer than they appear." This

familiar warning is applicable as we investigate the future world of technology. It could be argued that the trends reported in the *Horizon Reports* (2014, 2015) are much closer than they currently appear. As reported in the 2014 *Horizon Report* (Johnson et al.), privacy concerns are a difficult challenge; however, participants in this study made no mention of data security. The principals were concerned about students using social-media in inappropriate ways but were not concerned about carrying student information on their smartphones. The recent controversies over one presidential candidate's private email server and computer company's resistance to allow the federal government access to an accused terrorist's smartphone are evidence of this continual struggle for the balance of privacy and access to data. While more work is needed to improve personalized learning applications and to allow those applications access to student data, increased privacy concerns will continue to shape student data policies.

The principals' knowledge of technology trends in education. Most of the participants believed they were progressive in the area of technology. This is questionable. The participants may be more knowledgeable in certain aspects of technology usage compared with their colleagues in other public schools, but they are not aware of future trends. Some even believe they are at the peak of educational technology innovation. Previous research held educators responsible for teaching students to become technologically savvy and equipping them with the skills needed to be successful in today's global market (Friedmann, 2005). While these principals were knowledgeable about current technologies, they were unable in this setting to provide the researcher with concrete examples of how technologies might impact their work in the future.

A revised theory of the variables associated with principals' technology use. The researcher attempted to answer three questions: (1) What technologies are the principals using?

(2) Why are they using the identified technologies? (3) What are the variables associated with their technology use? The researcher identified four possible variables associated with principals' technology use: (1) knowledge of technology; (2) attitude toward technology; (3) professional development and training; and (4) organizational support for technology. The current study's results identified different variables associated with a principal's use of technology. The various themes derived broadened the original set of variables. A revised list of variables, based upon the data include; (1) a principal's access to technology, (2) technology preferences of school principals; (3) a principal's disposition toward technology in his work and non-work life, (4) a principal's purpose in using technology, (5) support through the availability of technology-related personnel and professional development with immersion, (6) acceptable-use policies, and (7) principals' knowledge of future trends in technology.

Chapter Summary

This study focused on the technology usage of principals in Apple Distinguished Schools, why they chose to use those technologies and the variables associated with that use. The researcher summarized the study, presented a summary of conclusions, and discussed findings based on the data that were collected from the study and from additional research. The researcher made recommendations for further research, as well as recommendations for practice, including potential guiding questions for districts and schools considering a comprehensive technology implementation. Finally, reflections on the study were provided by the researcher, including an appeal to examine the future world of technology and a revised theory explaining principals' use of technology.

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Virginia local School Directory.com

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Appendix A

Approval Letter from the Institutional Review Board of Virginia Tech for Content Validation



Office of Research Compliance
 Institutional Review Board
 North End Center, Suite 4120, Virginia Tech
 300 Turner Street NW
 Blacksburg, Virginia 24061
 540/231-4606 Fax 540/231-0959
 email irb@vt.edu
 website <http://www.irb.vt.edu>

MEMORANDUM

DATE: October 31, 2014
TO: David Parks, Kenneth Eugene Moles II
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: School Level Leaders and Their Use of Technology
IRB NUMBER: 14-649

Effective October 30, 2014, the Virginia Tech Institutional Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
 Protocol Approval Date: **October 30, 2014**
 Protocol Expiration Date: **October 29, 2015**
 Continuing Review Due Date*: **October 15, 2015**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Appendix B

Email to Participants for the Content Validation of the Technology Usage Interview Protocol

Dear (Add Name),

Thank you for agreeing by phone to receive this content-validation instrument. Your participation will be sincerely appreciated.

We are studying how school principals are adapting to technological change, and we would appreciate your assistance. Our findings could be useful in planning professional development for school principals, developing local policies, and adjusting the content of principal preparation programs.

We are asking for your assistance in conducting a content validation of an interview protocol on the use of technology by school principals. Your participation will take about 35 minutes and involves completion of a short questionnaire. If you agree to participate, please download and complete the attached questionnaire. The information you provide will be used to revise the interview protocol.

An informed consent document precedes the instrument. All information provided will be held in strict confidence. By completing the instrument, you are giving your informed consent to participate in the study.

If you have any questions, please contact either Dr. David Parks or myself at the contact information listed below. Your participation will be sincerely appreciated.

Gratefully,

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

INSTRUMENT FOR VALIDATING THE CONTENT OF AN INTERVIEW PROTOCOL ON
THE USE OF TECHNOLOGY BY SCHOOL PRINCIPALS

Informed Consent

Thank you for considering the completion of this brief content-validation instrument on the use of technology by school principals. Some information that may help you to decide on whether to complete the instrument follows:

1. The purpose of this instrument is to collect data on the relevance of the interview protocol questions and statements for collecting data on how school principals use technology and why they do so.
2. The questionnaire has been sent to five panelists who are familiar with the use of technology by school principals.
3. Risks of participation are minimal. Participation is voluntary. Responses will be confidential. No names of participants will be connected to any of the data.
4. There is no compensation for completing the instrument. The field of educational leadership may benefit from knowing how school principals use technology. No promise or guarantee of benefits has been made to encourage you to participate.
5. You may choose not to participate in the study by deleting the email message in which this questionnaire is referenced. If you choose to participate, you may choose not to respond to any of the questions or statements, just leave them blank.
6. If you choose to participate, your only responsibilities are to complete and submit your responses to the questions or statements.
7. By completing the instrument, you are giving your consent to participate in the study.

If you have questions about this research, you may contact:

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

If you have questions about the conduct of this research, or your rights as a participant, please contact:

David Moore, VT/IRB Chair
moored@vt.edu
540.231.4991

Appendix C

Content Validation Instrument

Directions for completing the instrument: Please **highlight** the number(s) of your response(s).

Please print the directions and domain definitions to use as a guide throughout the completion of the instrument. Each item requires a response for **Domain, Association, and Clarity**. Please **highlight** your responses and send the form back to Kenneth Moles (kennymoles@vt.edu) as an email attachment.

Domain(s):

Please read each item; decide on which domain(s) the item is associated; and **highlight** the number(s) those domain(s). Note that an item may have several related probes which may cover several domains. Mark all domains with which you think the item and related probes are associated.

1. *Knowledge of educational technology.* The level of familiarity of a school principal with educational technology that can include information, descriptions, facts, or skills.
2. *Attitude toward technology.* The feelings that school principals have toward technology. The leader's degree of liking or disliking for technology. The leader's attitude may be positive, negative, or neutral regarding technology.
3. *Professional development.* All types of learning opportunities in the area of technology, ranging from college degrees to formal coursework, conferences, and informal learning opportunities accessed by the school leader.
4. *Organizational support.* The technological support provided to school principals by a school district through infrastructure, policies, designated funding, and technical support.
5. *Use of technology.* The types of technology (devices, apps, software, programs) used by the school principals in his or her work or life in general, how this technology is used, and why it is used.

Association:

Decide how strongly the item is associated with the domain(s) you have selected and **highlight** the number: 1 = Very weak, 2 = Weak, 3 = Strong, or 4 = Very strong.

Clarity:

Read each item and decide how clear it is. Here I'm trying to address any ambiguity or confusion in the statements or questions. **Highlight** the clarity as: 1= Very unclear, delete or revise; 2 = Somewhat clear, revise; or 3 = Clear, leave as written.

Note. For any items you rate as 1 or 2 for clarity or association, please type your suggestions for improvement directly in the boxes with the items.

Note:

- Please remember to be thorough and take your time. The entire process should take no more than 35 minutes.
- Thank you for your generosity and help.

If you have any questions, please contact me at kennymoles@vt.edu or (304) 578-4164. Once you've responded to each item (and made suggested revisions), please return the instrument to me at the email listed above.

For any questions or statements you rate as 1 or 2 for clarity or association, please type your suggestions for improvement directly in the boxes of the items.

Table C1.

Content Validation Instrument

Questionnaire statements and probes	Source of Question	Domain	Association	Clarity
1. What technology (devices, apps, software, programs, social media) do you use in your work? Probe: How do you use this technology? Probe: Why do you use this technology? Probe: What devices do you own? Probe: How do you use your phone? Probe: What social media do you use in your work? Probe: What cloud applications do you use in your work? Probe: Any other technology? Any technology that we missed? Probe: If you could change how you use technology in your work, what would you do?	Modified from the survey instrument of Project RED (2010)	1 2 3 4 5	1 2 3 4	1 2 3
2. How do you feel about the influence of technology in your work? In your life, generally? Probe: How has your life at work changed since you began using the new technology? Your life in general? Probe: What do you see as the outcomes of your use of technology		1 2 3 4 5	1 2 3 4	1 2 3

<p>in your work? Is your life at work more complex? Simpler? Why?</p>	
<p>3. How did you acquire your knowledge and skills in the use of technology? Probe: Tell me about the training and professional development you have received or are receiving in the use of technology? Probe: How have these affected your use of technology? Probe: Do you subscribe to any technology-focused publications, websites, or other media? Which do you use regularly? Probe: Do you participate in webinars on technology or its applications? Which ones have you found useful? Why?</p>	<p>Modified from the survey instrument of Project RED (2010)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>4. Tell me about any technology-related courses that you took while preparing to be a school principal. Probe: How have these affected your use of technology?</p>	<p>Modified from a survey given by the University of Minnesota (2009)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>5. What technological competencies does your state or district impose upon school principals? Probe: How rigorous do you think these are? Probe: How well do you think you meet these competencies?</p>	<p>Modified from the survey instrument of Project RED (2010)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>6. What percentage of your day is spent directly using technology in doing your work?</p>	<p>Modified from the survey instrument of Project RED (2010)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>7. What technology are you aware of but are not currently using? Probe: In your work life?</p>	<p>Modified from a survey</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>

<p>Probe: In your personal life? Probe: How might you use this technology in your work? In your life generally?</p>	<p>given by the University of Minnesota (2009)</p>
<p>8. Tell me about your district's rules (as contrasted to policies) on the use of technology by administrators. Teachers. Students. Probe: What rules facilitate the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: What rules restrict the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: How do people get around these rules? Probe: How have these rules changed over the past few years? Probe: How do you think these rules will change in the near future (one-to-three years)?</p>	<p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>9. What percentage of your day is spent directly using technology outside of work? Probe: What social media do you use outside of work? Probe: What other applications do you use outside of your work?</p>	<p>Modified from the survey instrument of Project RED (2010)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>10. Which of the following words best describe your feelings about using technology? Confident, challenging, apprehensive, fearful</p>	<p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>11. What technology do you see coming along that may affect your work as a school principal? Probe: In your personal life? Probe: In your students' lives? Probe: In the lives of your faculty and staff? Probe: In the lives of your family members?</p>	<p>1 2 3 4 5 1 2 3 4 1 2 3</p>

<p>Probe: How do you think this technology will affect your work? Personal life?</p>	
<p>12. What technology (devices, apps, software, programs) do you use outside of your work? Probe: How do you use this technology? Probe: Why do you use this technology? Probe: What devices do you own for personal use, not related to work? Probe: How do you use your phone outside of your work? Probe: What social media do you subscribe to outside of your work? Probe: What cloud applications do you use outside of work? Probe: Any other technology?</p>	<p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>13. Please tell me about any applications and gear (devices, apps, software, accessories, etc.) that you cannot live without. Probe: Why are these so important to you?</p>	<p>Modified from a survey given by the University of Minnesota (2009)</p> <p>1 2 3 4 5 1 2 3 4 1 2 3</p>
<p>14. Tell me about your district's policies on the use of technology by administrators. Teachers. Students. Probe: What policies facilitate the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: What policies restrict the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: How do people get around these policies? Probe: How have these policies changed over the past few years? Probe: How do you think these policies will change in the near future (one-to-three years)?</p>	<p>1 2 3 4 5 1 2 3 4 1 2 3</p>

15. How would you rate your knowledge of technology (devices, apps, software, data bases) as it is applied to your work as a school principal? In your life generally?	1 2 3 4 5	1 2 3 4	1 2 3
16. How would you rate your knowledge of technology (devices, apps, software, data bases) as it is applied to your life generally?	1 2 3 4 5	1 2 3 4	1 2 3
17. What support is available to help you with technology in your work as a school principal? Probe: Do you have personnel solely dedicated to technology integration in your district or school? Probe: Are there technology integration specialists at your school? Probe: Other support personnel? Probe: What other support would you like to have available to you?	1 2 3 4 5	1 2 3 4	1 2 3
18. What do you view as the primary factors that determine what technology you use and how you use it in your work? In your life generally?	1 2 3 4 5	1 2 3 4	1 2 3

Please add any items that you think would be helpful in assessing the use of technology by school principals and in identifying variables that may affect the use of technology by school principals.

Please add any comments that you think may be helpful in improving the interview protocol.

Thank you for completing this instrument. Please return it as an email attachment to kenyholes@vt.edu.

Appendix D

Summary of Content Validation Responses

Table D1.

Responses from Participants in the Content Validation of the Interview Protocol

Questionnaire, statements and probes	N	Expected Domain ^a	Domain					Association with Domain					Clarity				Comments/ Additional Probes
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3	(M) _c	
1. What technology (devices, apps, software, programs, social media) do you use in your work? Probe: How do you use this technology? Probe: Why do you use this technology? Probe: What devices do you own? Probe: How do you use your cell phone? Probe: What social media do you use in your work? Probe: What cloud applications do you use in your work?	5	5	0	0	0	0	5	0	0	0	5	4	0	2	3	2.6	<p>Consider adding this Probe: What devices are provided for your use by the school or board of education?</p> <p>This question is not clear – why is vague.</p> <p>Are you interested in all of the factors such as district policy or personal motives?</p> <p>How about: list all of the ways you use your phone for school-related work</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes	
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c
<p>Probe: Any other technology? Any technology that we missed? Probe: If you could change how you use technology in your work, what would you do?</p>	5																
<p>2. How do you feel about the influence of technology in your work? In your life, generally? Probe: How has your life at work changed since you began using the new technology? Your life in general? Probe: What do you see as the outcomes of your use of technology in your work? Is your life at work more</p>	5	2	0	5	0	0	0	0	0	1	4	3.8	0	1	4	2.8	<p>Probe: Do you consider yourself an advocate of technology utilization in your work? In your life? Why?</p> <p>I feel like this one is a biased question, "advocate".</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3	
complex? Simpler? Why?	5															
3. How did you acquire your knowledge and skills in the use of technology? Probe: Tell me about the training and professional development you have received or are receiving in the use of technology? Probe: How have these affected your use of technology? Probe: Do you subscribe to any technology-focused publications, websites, or other media? Which do you use regularly? Probe: Do you	5	3	0	0	5	0	0	0	1	4	3.8	0	3	2	2.4	Suggestion: This is not a question & is worded awkwardly. Consider this wording: Describe any technology professional development or training experiences in which you have participated.

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes		
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c	
participate in webinars on technology or its applications? Which ones have you found useful? Why?	5																	
4. Tell me about any technology-related courses that you took while preparing to be a school principal. Probe: How have these affected your use of technology?	5	3	0	0	5	0	0	0	0	0	1	4	3.8	0	1	4	2.8	<p>Suggestion: For consistency I would suggest revising this one to a question such as: Did you participate in any technology-related courses during your preparation as a school leader? If yes, what were the courses?</p> <p>Suggestion: Rework for clarity: Probe: How did your participation in the course(s) affect your use of technology?</p> <p>May already be asked and</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes	
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c
	5																answered by question 3
5. What technological competencies does your state or district impose upon school leaders? Probe: How rigorous do you think these are? Probe: How well do you meet these competencies?	5	4	0	0	0	5	0	0	1	2	2	3.2	1	2	2	2.2	<p>Suggestion: This is unclear. Is the purpose of this question to ask if there are policies in place requiring school leaders to use technology? Do you mean “What technology policies (or perhaps expectations) does the state or county impose upon school leaders”? I am confused on this one.</p> <p>Impose is a loaded word – what about “expect from school leaders” or “stipulate for”</p> <p>This is tough, I want “impose” and</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity			Comments/ Additional Probes		
			1	2	3	4	5	1	2	3	4	(M) _b	1	2		3	(M) _c
	5																
																	“competencies”, none of their suggestions really get at what I want to come from this question.
6. What percentage of your day is spent using technology at work?	5	5	0	0	0	0	5	0	0	1	4	3.8	0	2	3	2.6	
7. What technology are you aware of but are not currently using? Probe: In your work life? Probe: In your personal life? Probe: How might you use this technology in your work? In your life generally?	5	1	3	0	0	0	2	0	1	2	2	3.2	1	1	3	2.4	Suggestion: Not sure what is meant here. Perhaps a better question would be: what technologies do you currently not have that would be useful at work? In life? Very broad – can you limit to “three technologies you are aware of but...” or maybe you care more about what they want to use but currently don’t? if so,

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity			Comments/ Additional Probes		
			1	2	3	4	5	1	2	3	4	(M) _b	1	2		3	(M) _c
	5																ask that specifically
8. Tell me about your district's rules (as contrasted to policies) regarding the use of technology by administrators. Teachers. Students. Probe: What rules facilitate the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: What rules restrict the use of technology by administrators? Teachers? Students?	5	4	0	0	0	5	0	0	0	5	4	0	2	3	2.6	<p>Suggestion: Again, for consistency I would suggest revising this one to a question such as: What rules does your district impose regarding the use of technology by administrators ?</p> <p>Start with “do people try to get around these rules? If so, in what ways</p>	

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3	
Probe: Why are these in place? Probe: How do might people work around these rules? Probe: How have these rules changed over the past few years? Probe: How do you think these rules will change in the near future (one-to-three years)?	5															
9. What percentage of your day is spent directly using technology outside of work? Probe: What social media do you use outside of work? Probe: What other applications do you use outside of your work?	5	5	0	0	0	0	5	0	0	0	5	4	0	1	4	2.8

Questionnaire, statements and probes	N	Expected Domain ^a	Domain					Association with Domain				Clarity				Comments/ Additional Probes		
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c	
10. Which of the following words best describe your feelings about using technology? Confident, challenging, apprehensive, fearful.	5	2	0	5	0	0	0	0	0	0	1	4	3.8	0	2	3	2.6	Add "somewhat confident"
11. What technologies do you foresee that may affect your work as a school principal? Probe: In your personal life? Probe: In your students' lives? Probe: In the lives of your faculty and staff? Probe: In the lives of your family members? Probe: How do you think this technology will affect your work? Personal life?	5	1	5	0	0	0	0	0	1	0	4	3.6	0	2	3	2.6	Lives in general or as related to work/school? A lot of this is conjecture.	

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain					Clarity				Comments/ Additional Probes
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3	(M) _c	
12. What technology (e.g., devices, apps, software, programs) do you use outside of your work? Probe: How do you use this technology? Probe: Why do you use this technology? Probe: What devices do you own for personal use, not related to work? Probe: How do you use your cell phone outside of your work? Probe: What social media do you subscribe to outside of your work? Probe: What cloud applications do you use outside of work?	5	5	0	0	0	0	5	0	0	0	5	4	0	2	3	2.6	

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain			Clarity			Comments/ Additional Probes			
			1	2	3	4	5	1	2	3	4	(M) _b	1		2	3	(M) _c
Probe: Any other technology?	5																
13. Please tell me about any applications and gear (devices, apps, software, accessories, etc.) that you cannot live without. Probe: Why are these so important to you?	5	5	0	1	0	0	4	0	1	3	1	3	0	2	3	2.6	<p>Suggestion: Revise to a question for consistency: What technology (e.g., devices, apps, software) would be difficult for you to stop using?</p> <p>Did you switch from using the term “technology” to “applications and gear” for a reason? This could be a very long list. Can you ask about the top three? What if you get word, excel, and ppt as responses? Or phone, laptop, and Microsoft office? What will that tell you?</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain			Clarity			Comments/ Additional Probes			
			1	2	3	4	5	1	2	3	4	(M) _b	1		2	3	(M) _c
	5																
																	Consider splitting the probe.
14. Tell me about your district's policies on the use of technology by administrators. Teachers. Students. Probe: What policies facilitate the use of technology by administrators? Teachers? Students? Probe: Why are these in place? Probe: What policies restrict the use of technology by administrators? Teachers? Students? Probe: Why are these in place?	5	4	0	0	0	5	0	0	0	5	4	0	3	2	2.4		Suggestion: Revise to a question for consistency: What district technology policies are in place by administrators? Teachers? Students?

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes	
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c
<p>Probe: How might people work around these policies? Probe: How have these policies changed over the past few years? Probe: How do you think these policies will change in the near future (one-to-three years)?</p>	5																
<p>15. How would you rate your knowledge of technology (e.g., devices, apps, software, data bases) as it is applied to your work as a school principal? In your life generally?</p>	5	1	5	0	0	0	0	0	0	0	5	4	1	0	4	2.6	<p>Rate it based on what? A rating of 1-10 or some other type of rating? I used a 1-4 lickert scale, based upon what you have previously taught me about respondents defaulting to the middle, when there is a middle option. In your life generally? Should this be removed? It seems to be addressed in</p>

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes		
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c	
	5																the following question (#16).	
16. How would you rate your knowledge of technology (e.g., devices, apps, software, data bases) as it is applied to your life generally?	5	1	5	0	0	0	0	0	0	0	0	5	4	0	0	5	3	Are you going to give a scale and then ask them to explain why they rating themselves that way? For both items 15 and 16. Same as above, 1-4.
17. What support is available to assist you with technology in your work as a school principal? Probe: Do you have personnel solely dedicated to technology integration in your district or school? Probe: Are there technology	5	4	0	0	0	5	0	0	0	0	5	4	0	1	4	2.8	What do you mean by technology integration? That seems like a subset of technology use and different from technology support.	

Questionnaire, statements and probes	N	Expected Domain _a	Domain					Association with Domain				Clarity				Comments/ Additional Probes	
			1	2	3	4	5	1	2	3	4	(M) _b	1	2	3		(M) _c
integration specialists at your school? Probe: Other support personnel? Probe: What other support would you like to have available to you?	5																
18. What do you view as the primary factors that determine what technology you use and how you use it in your work? In your life generally?	5	5	1	2	0	0	2	0	0	1	4	3.8	0	0	5	5	How many do you want? If you give a number this helps bound the responses (e.g., three main factors) Good question but will span the 5 factors – it is really asking them to give you a holistic sense of technology in work and in life.

Appendix E

Approval Letter from the Institutional Review Board of Virginia Tech for Test Protocols



Office of Research Compliance
 Institutional Review Board
 North End Center, Suite 4120, Virginia Tech
 300 Turner Street NW
 Blacksburg, Virginia 24061
 540/231-4606 Fax 540/231-0959
 email irb@vt.edu
 website <http://www.irb.vt.edu>

MEMORANDUM

DATE: January 22, 2015
TO: David Parks, Kenneth Eugene Moles II
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: School Level Leaders and Their Use of Technology
IRB NUMBER: 14-649

Effective January 22, 2015, the Virginia Tech Institutional Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
 Protocol Approval Date: **October 30, 2014**
 Protocol Expiration Date: **October 29, 2015**
 Continuing Review Due Date*: **October 15, 2015**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Appendix F

Email to School Principals for Test Study Participation

Date:

Dear School Principal,

Technology usage in education has been and will continue to be a leading issue in today's schools. The world and the way people interact within it have changed significantly over the past several years. Technology and its use have contributed to this change.

We are studying how school principals are adapting to technological change, and we would appreciate your assistance. Our intent is to identify variables that affect technology usage of school principals. Our findings could be useful in planning professional development for principals and in adjusting the content of principal preparation programs.

An informed consent document precedes the instrument. All information provided will be held in strict confidence. By completing the instrument, you are giving your informed consent to participate in the study.

Your assistance would involve a 35-minute telephone interview at a time convenient for you. Schools and participants will not be identified in the report of the study. All information provided will be held in strict confidence. Please let us know if you are able to participate by replying to this email. Your participation will be greatly appreciated.

Gratefully,

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

INSTRUMENT FOR VALIDATING THE CONTENT OF AN INTERVIEW PROTOCOL ON
THE USE OF TECHNOLOGY BY SCHOOL PRINCIPALS

Informed Consent

Thank you for considering the completion of this brief content-validation instrument on the use of technology by school principals. Some information that may help you to decide on whether to complete the instrument follows:

1. The purpose of this instrument is to collect data on the relevance of the interview protocol questions and statements for collecting data on how school principals use technology and why they do so.
2. The questionnaire has been sent to five panelists who are familiar with the use of technology by school principals.
3. Risks of participation are minimal. Participation is voluntary. Responses will be confidential. No names of participants will be connected to any of the data.
4. There is no compensation for completing the instrument. The field of educational leadership may benefit from knowing how school principals use technology. No promise or guarantee of benefits has been made to encourage you to participate.
5. You may choose not to participate in the study by deleting the email message in which this questionnaire is referenced. If you choose to participate, you may choose not to respond to any of the questions or statements, just leave them blank.
6. If you choose to participate, your only responsibilities are to complete and submit your responses to the questions or statements.
7. By completing the instrument, you are giving your consent to participate in the study.

If you have questions about this research, you may contact:

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

If you have questions about the conduct of this research, or your rights as a participant, please contact:

David Moore, VT/IRB Chair
moored@vt.edu
540.231.4991

Appendix G

Test Protocol for Interview of School Principals

Introduction: Hello, my name is Kenny Moles, and I am a doctoral student at Virginia Tech. I would first like to thank you for participating in this interview. Before we begin, I will explain the purpose of my work and ask you for permission to use the information from our interview to assess the effectiveness of the questions in the protocol and my interview technique. This will take a few minutes. Please feel free to stop me at any point and ask any questions (review the attached informed consent document with the participant and ask for consent). Do you have any questions before we begin? You may refuse to answer any of the questions at any time and you may end the interview at any time.

Table G1.

Research Questions, Domains of Interest, Interview Protocol Questions, and Probes.

Domain	Question	Probes
Knowledge of educational technology Defined as: A familiarity with educational technology that can include information, descriptions, facts, or skills acquired through experience or education.	1. What technologies do you use in your work? 2. Why do you use those technologies? 3. What percentage of your day is spent using technology while at work? 4. What technologies do you use outside of work? 5. Why do you use those technologies? 6. What percentage of your day is spent using technology outside of work?	1a. What devices do you use at work? 4a. What devices do you own? 4b. How do you use your phone?

	<p>7. What types of electronic media do you use?</p> <p>8. What technologies are you aware of but are not currently using?</p> <p>9. What technologies do you see coming along that may impact your work as school principal?</p>	<p>7a. What types of social media do you subscribe to?</p> <p>8a. Which Cloud applications do you use?</p>
<p>Attitude toward technology</p> <p>Defined as: An individual's degree of liking or disliking for something. Attitudes are generally positive, negative, or neutral views about a person, place, thing, or event.</p>	<p>10. How do you feel about the influence of technology in your life?</p> <p>11. How would you rate your attitude technology? Confident, challenging, apprehensive, or hindrance?</p> <p>12. How many technological devices do you own?</p> <p>13. Please list for me any applications and gear (devices, accessories, etc.) that you cannot live without.</p>	<p>10a. In your work life?</p> <p>10b. In your personal life?</p> <p>10c. In your students' lives?</p> <p>10d. In the lives of your faculty and staff?</p>
<p>Professional development</p> <p>Defined as: All types of facilitated learning opportunities in the area of technology, ranging from college degrees to formal coursework, conferences, and informal learning opportunities situated in practice.</p>	<p>14. How did you acquire your knowledge and skills in the use of technology?</p> <p>15. How many technology related courses did you take in your principal preparation program?</p> <p>16. What percentage of other courses taken during your principal preparation embedded technology standards or best practices?</p> <p>17. How many hours of technology related professional development is</p>	<p>14a. What types of training or professional development have you received in the area of technology?</p> <p>15a. How have these affected your use of technology?</p> <p>16a. Do you subscribe to any technology focused publications? Any websites?</p> <p>16b. Do you participate in webinars on technology applications?</p> <p>16c. Describe the value of those in which you have participated.</p>

	<p>offered through your district? School?</p>	
<p>Organizational support</p> <p>Defined as: The technological support provided to school principals by a school district through infrastructure, policies, designated funding, and technical support.</p>	<p>18. What support is available to help you with technology?</p> <p>19. What types of technology competencies does your state or district impose upon school leaders or professional educators?</p> <p>20. Do you have personnel solely dedicated to technology integration in your district? School?</p> <p>21. Tell me about your district's policies on the use of technologies by administrators? Teachers? Students?</p> <p>22. Tell me about your school's procedures on the use of technologies by administrators? Teachers? Students?</p>	<p>20a. Are there technology integration specialists at your school? 20b. Other support personnel?</p> <p>21a. Are there rules, regulations, or policies that facilitate the use of technology by administrators? Teachers? Students?</p> <p>22a. Are there any restrictions on the use of any technologies in your work? If so, what are these and why the restrictions? Are there ways of getting around these restrictions? 22c. How are these restrictions changing?</p>
<p>Demographics</p>	<p>23. How many years of educational experience do you have?</p> <p>24. How many years of school administrative experience do you have?</p> <p>25. What is your gender?</p> <p>26. What is your age?</p> <p>27. What is the highest degree you have earned?</p>	

This concludes the question and answer portion of our call. Do you have any related points you would like to add at this time? Thanks for your time; I know how busy the principalship can be, so I do appreciate you spending some time with me today. Good luck during the rest of your school year.

Appendix H

Approval Letter from the Institutional Review Board of Virginia Tech for Interviews



Office of Research Compliance
 Institutional Review Board
 North End Center, Suite 4120, Virginia Tech
 300 Turner Street NW
 Blacksburg, Virginia 24061
 540/231-4606 Fax 540/231-0959
 email irb@vt.edu
 website <http://www.irb.vt.edu>

MEMORANDUM

DATE: February 11, 2015
TO: David Parks, Kenneth Eugene Moles II
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: School Level Leaders and Their Use of Technology
IRB NUMBER: 14-649

Effective February 10, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
 Protocol Approval Date: **October 30, 2014**
 Protocol Expiration Date: **October 29, 2015**
 Continuing Review Due Date*: **October 15, 2015**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Appendix I

Email to School Principals for Study Participation

Date:

(Add Name)

Dear (Name),

Thank you for considering participation in a study on how and why school principals use technology in their work.

Our intent is to identify variables that affect the use of technology by school principals. Our findings could be useful in planning professional development for school principals, developing local policies, and adjusting the content of leader preparation programs.

Your assistance involves a 45-minute telephone interview, which is scheduled for

(Add day, date, and time here.)

This interview will be audiotaped to ensure accuracy. Neither you nor your school will be identified in the report of the study. All information provided will be held in strict confidence. A consent form is attached. Please review it prior to the interview. If you have any questions, please contact either of us at the contact information below. Your participation and willingness to be audiotaped will be confirmed just prior to the phone interview. Your participation is greatly appreciated.

Gratefully,

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

A STUDY OF THE USE OF TECHNOLOGY BY SCHOOL PRINCIPALS

Informed Consent

Thank you for considering participating in an interview on the use of technology by school principals. Some information that may help you to decide on whether to participate follows:

1. The purpose of the study is to investigate how school principals use technology and why they do so.
2. The study will involve 12 school principals who have been identified for their exemplary use of technology in their work.
3. Risks of participation are minimal. Participation is voluntary. Responses will be confidential. No names of participants will be connected to any of the data.
4. There is no compensation for participating in the study. The field of educational leadership may benefit from knowing how school principals use technology. No promise or guarantee of benefits has been made to encourage you to participate.
5. You may choose not to participate in the study by deleting the email message in which this consent form is referenced. If you choose to participate, you may choose not to respond to any of the questions or statements on the protocol.
6. If you choose to participate, your only responsibility is to respond to questions in a phone interview of approximately 35 minutes. The phone interview will be audiotaped to ensure accuracy.
7. Your consent to participate in the study will be solicited at the beginning of the phone interview.

If you have questions about this research, you may contact:

Kenneth E. Moles, II
Ph.D. Candidate, Virginia Tech

Dr. David Parks
Professor Emeritus and Advisor, Virginia Tech

If you have questions about the conduct of this research, or your rights as a participant, contact:

David Moore, VT/IRB Chair
moored@vt.edu
540-231-4991

Appendix J

Interview of School Principals on the Use of Technology

Introduction: Hello, my name is Kenny Moles, and I am a doctoral student at Virginia Tech. I would first like to thank you for arranging time for our phone conversation. Before we begin, I want to remind you of the email you received expressing appreciation for considering participation. Within the body of that email, I outlined the purpose of this interview as identifying how and why school principals use technology in their work. The interview should take about 45 minutes. An Informed Consent Form was attached to the previous email, and I want to remind you of the major points on that form (Review the main points in the consent form). You may refuse to answer any of the questions at any time, and you may end the interview at any time. Do you have any questions about the informed consent or the study before we begin? Do you agree to participate (Yes or No)? May I audiotape our phone conversation (Yes or No)?

Note: From this point the interview will either begin or end, depending upon their answers to the above questions.

Table J1.

Interview Protocol Items and Probes

“I would like to start the interview by asking about your **knowledge of educational technology.**”

1. How would you rate your knowledge of technology (devices, apps, software, data bases) as it is applied to your personal life?
 Probe: Please use a scale of 1 through 4, with 1 representing little to no knowledge, 2 representing some knowledge, 3 representing much knowledge, or 4 representing very much knowledge.

2. How would you rate your knowledge of technology (devices, apps, software, data bases) as it is applied to your work as a school principal?
 Probe: Please use a scale of 1 through 4, with 1 representing little to no knowledge, 2 representing some knowledge, 3 representing much knowledge, or 4 representing very much knowledge.

3. What technology do you see coming along that may affect your work as a school principal?
 Probe: In your personal life?
 Probe: In your leisure activities?
 Probe: In your students' lives?
 Probe: In the lives of your faculty and staff?
 Probe: In the lives of your family members?
 Probe: How do you think these technologies will affect your work?
 Probe: Your personal life?
 Probe: In your leisure activities?

4. What technologies do you currently not have that would be most useful at work?
 Probe: In your personal life?
 Probe: In your leisure activities?
 Probe: How might you use this technology in your work?
 Probe: In your life generally?

“I would now like to ask you about your **feelings** toward technology and the impact it has on your life.”

5. Which of the following words best describe your feelings about using technology?
 Confident, somewhat confident, challenging, apprehensive, or fearful.

6. How do you feel about the influence of technology in your work?
 Probe: How do you **feel** about that?
 Probe: In your life, generally?
 Probe: How do you **feel** about that?
 Probe: How has your life at work changed since you began using the new technology?
 Probe: How do you **feel** about that?
 Probe: Your life in general?
 Probe: How do you **feel** about that?
 Probe: What do you see as the outcomes of your use of technology in your work?
 Probe: How do you **feel** about that?
 Probe: Is your life at work more complex or simpler? Why?
 Probe: How do you **feel** about that?

“Let's discuss **professional development** and training in the area of technology.”

7. How did you acquire your knowledge and skills in the use of technology?
 Probe: Describe any technology-related professional development or training experiences in which you have participated.
 Probe: How have these affected your use of technology?
 Probe: Do you subscribe to any technology-focused publications, websites, or other media? Probe: Which of these media do you use regularly?

<p>Probe: Do you participate in webinars on technology or its applications? Probe: Which ones have you found useful? Why?</p>
<p>8. Did you participate in any technology-related courses during your preparation to become a school leader? If yes, what were the courses? Probe: How did your participation in the course(s) affect your use of technology?</p>
<p>“Let’s move on to your school district’s technology support and policies.”</p>
<p>9. What technology competencies does your state or district impose upon school leaders? Probe: How rigorous do you think these are? Probe: How well do you think you meet these competencies? Please explain. Probe: How well do you meet the technology requirements of the principalship? Please explain.</p>
<p>10. What district technology policies are in place for administrators, if any? Probe: What policies facilitate the use of technology by administrators? Probe: Why are these in place? Probe: What policies restrict the use of technology by administrators? Probe: Why are these in place? Probe: How do people get around these policies? Probe: Have these policies changed over the past few years? If so, how? Probe: How do you think these policies will change in the near future (one-to-three years)?</p>
<p>11. What district technology policies are in place for teachers? Probe: What policies facilitate the use of technology by teachers? Probe: Why are these in place? Probe: What policies restrict the use of technology by teachers? Probe: Why are these in place? Probe: How do people get around these policies? Probe: How have these policies changed over the past few years? Probe: How do you think these policies will change in the near future (one-to-three years)?</p>
<p>12. What district technology policies are in place for students? Probe: What policies facilitate the use of technology by students? Probe: Why are these in place? Probe: What policies restrict the use of technology by students? Probe: Why are these in place? Probe: How do people get around these policies? Probe: How have these policies changed over the past few years? Probe: How do you think these policies will change in the near future (one-to-three years)?</p>
<p>13. What support is available to help you with technology in your work as a school principal? Probe: Do you have personnel solely dedicated to technology integration in your district or school? Probe: What are their positions? Probe: Other support personnel? Probe: How many students do you have enrolled?</p>

<p>Probe: How regularly do you have the support personnel in your building, both instructional and maintenance?</p> <p>Probe: What other support would you like to have available to you?</p>
<p>“Now let’s discuss your use of technology.”</p>
<p>14. What technology (devices, apps, software, programs, social media) do you use in your work?</p> <p>Probe: How do you use this technology?</p> <p>Probe: Why do you use this technology?</p> <p>Probe: What devices are provided for your use by the school system?</p> <p>Probe: Would you please list for me all the ways in which you use your cell phone for school-related work?</p> <p>Probe: What social media do you use in your work?</p> <p>Probe: What cloud applications do you use in your work?</p> <p>Probe: Any technology that we missed that you would like to highlight?</p> <p>Probe: If you could change how you use technology in your work, what would you do?</p>
<p>15. What technology (devices, apps, software, programs) do you use outside of your work?</p> <p>Probe: For each technology you listed, how do you use it?</p> <p>Probe: For each technology listed, why do you use it?</p> <p>Probe: What devices do you own for personal use, not related to work?</p> <p>Probe: How do you use your cell phone outside of your work?</p> <p>Probe: What social media do you subscribe to outside of your work?</p> <p>Probe: What cloud applications do you use outside of work?</p> <p>Probe: Any other technology?</p>
<p>16. What percentage of your day is spent directly using technology in doing your work?</p> <p>Probe: What is the primary technology that you use during this time?</p>
<p>17. What percentage of your day is spent directly using technology outside of work?</p> <p>Probe: What is the primary technology that you use during this time?</p>
<p>18. What technologies (e.g., devices, apps, software, gear) can you not live without?</p> <p>Probe: Why are these so important to you?</p>
<p>19. What do you view as the primary factors that determine what technology you use and how you use it in your work?</p>
<p>20. What do you view as the primary factors that determine what technology you use and how you use it in your personal life?</p> <p>Probe: In your leisure activities?</p>
<p>“Finally, and if you don’t mind, I have a few demographic questions I would like to ask.”</p>
<p>21. How many years of experience do you have in education, counting this year?</p>
<p>22. How many years of school administrative experience do you have, counting this year?</p>
<p>23. What is your age?</p>

24. What is your gender?
25. What is your highest earned degree?

This concludes the question and answer portion of our call. Do you have anything you would like to add at this time (provide wait time)?

Thanks for your time. I know how busy the principalship can be, so I do appreciate the time you spent with me today. Good luck during the rest of your school year.