Fall 12-2016

Teacher and Administrator Perceptions of One-to-One Technology Device Implementation

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by

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December 2016

A Dissertation submitted to the Education Faculty of Lindenwood University in partial fulfillment of the requirements for the degree of

Doctor of Education

School of Education

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Technology Device Implementation

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This Dissertation has been approved as partial fulfillment

of the requirements for the degree of

Doctor of Education

at Lindenwood University by the School of Education

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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work at Lindenwood University and that I have not submitted it for any other college or university course or degree.

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Acknowledgements

I would like to thank my committee members Dr. Sherry DeVore, Dr. Rhonda Bishop, and Dr. Craig Carson for all their help throughout the completion of this work. I am appreciative of the Lindenwood University staff for providing quality instruction and dialogue about leadership and student learning. A special thank you goes to Dr. DeVore and Dr. Bishop for their time and efforts in editing this work and providing constructive feedback that led to the completion of this dissertation.

I would also like to thank the teachers, principals, and superintendents from area school districts who gave of their time and participated in the study. Their efforts and feedback will provide wisdom and allow others a deeper understanding. In addition, a thank you is extended to my colleagues at work for their unwavering support with a humble and grateful thank you to Dr. Kent Medlin for his leadership, wisdom, and friendship.

Finally, I humbly recognize the value of my foundational components, faith and family. To my parents, Charles and Leota Pratt, for providing a Christian home, guidance, and never-ending support. To my wife Sandra, for words of encouragement and motivation when times were difficult and for her undying love and patience as I navigated this journey of growth. Lastly, to the Heavenly Father, through whom all things are possible.

Abstract

The influence of technology on society shows little sign of diminishing (Puybaraud, 2012). Increased capabilities and the affordability of technology devices have brought a resurgence of one-to-one device implementation in schools (Dawson, 2016). This qualitative study was designed to elicit the perceptions of administrators and teachers on one-to-one device implementation. Marc Prensky's (2001) premise that students are digital natives embedded in media and digital device-rich environments provided the conceptual framework for this study. Furthermore, Prensky (2001) proposed modern students learn, conceptualize, and respond differently than previous generations. The participants in this study represented six southwest Missouri school districts with student populations of 300-2,500 in grades 6-12 which underwent one-to-one device implementation within the last five years. Data were gathered from responses of eight teachers, 11 principals, and five superintendents. Perceptions of principals and teachers in school districts implementing one-to-one devices were gathered during the first phase of data collection. These data were transcribed and analyzed for key words and phrases, as well as common themes. Then, during the second phase of data collection, an electronic questionnaire instrument was used to gain feedback of participating superintendents. The following findings emerged from this study: appropriate time, importance of key personnel, shifts in teaching, and shifts in learning through the one-to-one implementation process.

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Chapter One: Introduction

Substantial growth in technology and mobile computing has become prolific in the past two decades (Puybaraud, 2012). The infrastructure of the Internet has increased the speed and volume of data transmission to the business sector and into the American household (Seavy, 2014). Civic leaders who desire their communities to be competitive in attracting and retaining commercial businesses know high-speed Internet connectivity is a key factor in success (Fishell, 2014). In 2011, GigU, a consortium of companies and universities seeking to increase high-speed web availability to cities and communities, joined with web giant Google to produce a handful of gigabit fiber networks for selected municipalities (Scola, 2014). The resulting firestorm of requests across the country to be next in line for citywide Google fiber networks demonstrates business and public demands for greater speeds and bandwidth (Scola, 2014).

The evolving availability of Internet access has required the business sector to rethink the structure and philosophy of both the workplace and the employee. In research conducted by Koch et al. (2014), mobile technologies such as Information Technology (IT) consumerization and Bring Your Own Device (BYOD) were described as growing trends in the business workplace (Elmore, 2013). The mobility of employees and flexible workspaces have transformed the business office environment by reducing individual work areas and creating large collaborative spaces (Kristen, 2013). The days of the stereotypical business office filled with rows of cubicles, dangling wire connections, and employees fixed to their desks are gone (Kristen, 2013). Technology and mobile access have moved from luxury items only afforded to high-ranking corporate administrators to a necessary backbone to startup company success (Kristen, 2013). A greater percentage

of emerging companies rely on mobile devices such as phones, tablets, and Internet service to allow work from home, coffee shops, and libraries (Adams-Ockrassa, 2014).

The methods through which students and families connect with the Internet have expanded in terms of consumer choice and level of sophistication (Healy, 2013). The Internet for the public consumer, which began as copper phone lines and dial-up modems, has evolved to fiber optic cable and wireless 4G mobile frequencies dispersed over the airways (Sims, 2014). The percentage of students aged 12-18 accessing the Internet has risen from 75% in 2000 to 95% in 2014, while the percentage of adults of all ages accessing the Internet has risen from 76% in 2000 to 90% in 2014 (Fox & Rainie, 2014a, p. 1).

Mobile computing in the form of cell phones, tablets, and handheld devices continues to alter the way society functions, all while providing advancements in the mobile Internet market which allow consumers to communicate through multiple methods (KPMG: International Cooperative, 2012). Only 53% of adults owned a cell phone in 2000; in contrast, 90% of adults aged 18-50 owned cell phones in 2014, and 53% of the population used smartphones with Internet capability (Fox & Rainie, 2014a, p. 1). Both Android and Apple-based mobile devices provide video calling, speech-to-text recognition, and improved keyboard functions for written language (Grossman, 2014).

In a CNN report (O'Toole, 2014, p. 1), mobile devices accounted for 55% of Internet usage in the United States, surpassing personal computers at 45%. Although mobile devices have grown exponentially in the percentage of Internet usage by consumers, school districts struggle to keep pace with society's technology usage within

educational settings (Jukes, 2006, 2012; Prensky, 2001, 2010). During the early years of Internet computing, school classrooms were often a student's first introduction to computer usage (Fox & Rainie, 2014a). In contrast, the students of today enter kindergarten with technology device experience (Pinker, 2015). Upper-grade students return home in the afternoon to vastly superior technology equipment compared to the devices offered in the school setting (Pinker, 2015).

Understanding student learning in a media-rich world is a focus of urban, suburban, and rural school districts (Jukes, 2012). Dr. Marie Wright of Broward County Schools (as cited in Yi, 2013) stated, "Students are becoming much more disengaged… They are consuming knowledge outside of the school day very differently than they are in the school and we're not leveraging that in our classrooms because we don't have the devices" (p. 5).

Increased growth patterns of web connection speeds and the expansion of mobility to the business and public sectors will determine the future of student learning in coming years (Quillen, 2012). Fox and Rainie (2014a) found student interest in Internet and mobile technology continues to increase, with teenagers displaying high demand for new technologies. As technology device costs continue to drop and the possibility for widespread one-student-with-one-device schools, education leaders are poised to leverage computing mobility and connectivity for extended learning opportunities (Blackboard, 2012).

Background of the Study

Students who attend American schools today are natives to a digital world (Prensky, 2001). Unlike their parental family members, these children were born into a

world of digital media and live a hybrid life of online and offline (Anderson, 2012). Digital Natives have an inherent understanding of digital technologies, and devices have been integrated in their lives since early childhood (Jukes, 2006).

The 7-24 age group is a tech-savvy group and wish to blaze the trail of technological progress; they have a desire to be connected when they wish, from anywhere (Puybaraud, 2012). According to Jukes (2006), Digital Natives are today's instant messenger generation who have grown up in a digital landscape. The constant exposure to digital media has changed the way Digital Natives process, interact, and use information (Prensky, 2001). As a result, Digital Natives communicate in fundamentally different ways than previous generations (Jukes, 2006).

The amount of time Digital Natives spend online is significant in comparison to the older Digital Immigrant generations (Pew Internet, 2014). The rates of teen media use through TV, cell phones, computers, video games, audio, print, and movies have increased one hour and 17 minutes over teen media usage five years ago (Hysing et al., 2014). Additionally, the diversity in types of connections to the web creates a challenge in accurately gauging the amount of time teens are online (Hysing et al., 2014).

McAfee (2012), an Internet security group, found teenagers spend a considerable amount of time online, more than parents and adults realize. On average, teens spend more than five hours per day online with both wireless and wired access (McAfee, 2012). In 2012, research by Concerto Marketing supported the high connectivity of teens, reporting 79% of digital teens own their own computer, 51% own their own smartphone, and 24% own a personal tablet (Black, 2012, p. 1). According to Black (2012), youth are generally connected but selectively engaged. Puybaraud (2012) suggested Digital

Natives spend between two and six hours of their day online, and because of this massive investment of time, using digital media has resulted in teens becoming masters of navigating and filtering the flood of information they receive.

The youth of today are early and avid adopters of new technology not because they have an innate knowledge of technology, but because they lack fear of technology (Fowler, 2014). Fowler (2014) asserted teens are the most creative users of technology, often throwing away instruction manuals. Experimentation is just as important as instructions, and young people do not despair if instant competence is, or is not, gained (Puybaraud, 2012). The love of technology by teens is demonstrated through consumer purchases. Harris and Abrams (2014) found teens view owning an outdated phone as a larger problem than wearing last year's clothing styles. According to Harris and Abrams (2014), "Having a cool phone to show you're plugged in is a huge part of people's style, a huge part of life these days" (p. 5).

During an interview session, Prensky (as cited in Joy, 2012) defined Digital Natives as "those born into an innate new culture while Digital Immigrants are old-world settlers, who have lived in the analog age and immigrated into the digital world" (p. 1). In contrast, a majority of the adult population are Digital Immigrants (Prensky, 2001). Born prior to the digital age, baby boomers and subsequent generations have witnessed the transfer of media from wavelength frequencies to streams of digital information transferred by laser light (Jukes, 2012).

Digital Immigrants are accustomed to the analog world and are forced to immigrate to the new era of digital media (Jukes, 2006; Prensky, 2001, 2010). Digital Immigrants struggle to feel comfortable with technologies (Jukes, 2006, 2012; Prensky,

2001, 2010). While Digital Immigrants may learn to adapt by using email, mobile phones, and social media, they continue to feel out-of-place with devices and the web (Plante, 2012). Children and young adults live in context as Digital Natives, while older generations equate the changing context as a struggle (Prensky, as cited in Joy, 2012).

The weaving of Digital Natives and Digital Immigrants together to provide a meaningful education will require intentional thought and collaboration (Jukes, 2012). Global businessman Rupert Murdoch stated, "We need to realize that the next generation of people have a different set of expectations about information including when and how they will get it, where they will get it from, and who they will get it from" (The Guardian, 2005, para. 7). Classroom instruction, according to Prensky (2010), is most often led by Digital Immigrants who are struggling to be relevant to the Digital Native population.

Conceptual Framework

Increasing numbers of young people are deeply and permanently entrenched in the use of technology for everyday life (Jukes, 2012; Prensky, 2010; Puybaraud, 2012). The modern classroom is filled with a generation of youth connected to their peers and the world in ways no generation has ever been before (Prensky, 2010). Today's digital youth are uncommitted to organized politics, linked by social media, burdened by debt, distrustful of people, and optimistic about the future, while being the most racially diverse generation (Pew Internet, 2014). Furthermore, in these dimensions, Digital Natives are different from today's older generations (Pew Internet, 2014).

The conceptual framework appropriate to address the needs of Digital Natives and the environments Digital Natives inhabit was presented by Prensky (2001). When addressing different types of digital learners, Prensky (2001) proposed Digital Natives

learn, conceptualize, and respond differently than previous generations. Prensky (2001) purported Digital Natives' brains are physically different and therefore process information in different ways than previous generations. Additionally, learning is often provided in learning environments which do not align with how Digital Native students process (Jukes, 2006, 2012; Prensky, 2010).

Digital Natives are different in the physical structure of the brain and resulting methods of processing information because of an immersion into a digital world from birth (Jukes, 2012; Prensky, 2001, 2010). This is the primary basis for technology inclusion in student learning (Jukes, 2012; Prensky, 2001, 2010). Prior to the turn of the century, the scientific community held firm to the belief neurons, unlike other cells, could not reproduce after the first few years of life (Liou, 2010). The reciprocal advancement of psychology, neurology, and specifically brain imaging technology have exponentially magnified the understanding of the neurosciences of brain structure, processes, and learning (Sousa, 2011).

Modern medical investigative procedures have produced the concept of neuroplasticity, the ability of the brain to adapt to changing circumstances, stimuli and use throughout life, and relocation of functions when necessary (Aldrich, 2013). Neuroplasticity involves the brain creating new connections and discarding unimportant ones (Torper et al., 2013). Construction of new neurons is highly correlated with memory, mood, and learning (Jhaveri et al., 2015); however, the abilities of neuroplasticity are not without limits (Sousa, 2011). The highest rate of neurogenesis occurs prior to age 24 and decreases as the brain ages (Aldrich, 2013). Plasticity has served the human race well as it progressed from agrarianism to the Industrial Revolution

and now into the Information Age (Massey, 2013). In each era, the brain learned and adapted to new skills to meet the environment's ever-changing needs (Massey, 2013).

The learning processes for today's digital students contain social and cultural implications (Prensky, 2010). In sociocultural theory, mental functioning is related to cultural, institutional, and historical context (Scott & Palincsar, 2013). Vygotsky (1978) believed learning is a social process, and the learning process is mediated through social interactions using tools. Sociocultural theory tools fall into two distinct categories: physical tools and semiotic tools (Maher, 2012).

Physical tools, as described by Vygotsky (1978), include technology devices in modern media-rich environments replacing the earlier tools of pen and paper (Grushka, Donnelly, & Clement, 2014). Semiotic tools, such as language, are translated differently in the 21st century through digital texts, blogs, tweets, and website posts (Kern, 2015). By viewing the tools in sociocultural theory, ample evidence suggests traditional teacher-centered approaches are not as effective as they once were (Scott & Palincsar, 2013).

Classroom success exists with the highest probability when the learning challenge matches the skills and learning styles of the student, and when the exact location is the frontier between boredom and anxiety (Csikszentmihalyi, 1998). Effective practices must be targeted to the next-generation learner in an environment with matched challenges in order to avoid inducing student frustration from boredom or anxiety (Csikszentmihalyi, 1998). Therefore, the work of Prensky (2001), with additional support from Vygotsky's work in sociocultural theory, was considered an appropriate lens through which to view the development of embedding digital instructional environments into public schools.

Statement of the Problem

The proliferation of digital content and its accompanying technology tools have consumed a generation of youth through their formative years, resulting in a complex and different generation of learners (Jukes, 2006, 2012; Prensky, 2001, 2010). Jukes (2006) described this generation as "screenagers" who view, react, and adapt to the world in different ways than previous generations. Further accompanying the Digital Native and Digital Immigrant divide, Hinton, Fischer, and Glennon (2012) and Brinch and Galloway (2012) contradicted the longstanding notion individual abilities are fixed at birth; instead, abilities are plastic and malleable to adapt with changing stimuli (Doidge, 2016).

While educators are attempting to gain a better understanding of how the brain functions in learning process, the explosion of the digital environment onto the world marketplace has created a demand for new skills and different workplace thinking (Friedman, 2005). Efforts to prepare students for unknown jobs of the future have shifted focus to knowledge construction and critical thinking, communication, collaboration, and creativity skills (National Education Association, 2012). In a Gallup survey, 59% of 18- to 35-year-olds agreed or strongly agreed they developed most of the skills they use in their current jobs outside of school, while some respondents identified "the participation in a long term project that demanded extensive time" and "using new knowledge to develop solutions to real-world problems" as two school strategies with the strongest link to work quality (Gallup, Microsoft Partners in Learning, & the Pearson Foundation, 2013, p. 4).

The need for a high school diploma as a minimum standard is critical as jobs become more complex in a global society (Junior Achievement USA, 2011). Measuring

the benefits of education versus early job engagement, graduates are outperforming their peers with less education, while comparing today's graduates to previous generations with less formal education has never been greater (Pew Internet, 2014). When preparing students for jobs of the future, schools will be required to assist students in development of judgment, critical analysis, prioritizing, collaboration, and creative/innovative problem-solving skills (Willis, 2011).

School districts are making significant financial, personnel, and structural commitments on the promise technology, particularly one-to-one device implementation, will lead to higher levels of achievement (Sauers & McLeod, 2012). One-to-one laptop initiatives implemented throughout the United States continue to provide varied results in their effectiveness in improving the quality of public education (Smith, 2012). One of the most noted one-to-one initiatives with positive results is Mooresville Graded School District in North Carolina (Mellon, 2011). Within a four-year span, the district increased student academic proficiency by 13% and raised the graduation rate by 22 points (Mellon, 2011). Superintendent Mark Edwards attributed a majority of the improvements to the "digital conversion effort" (Mellon, 2011, p. 1). Despite significant investments and expectations of one-to-one device implementation, Bebell, Clarkson, and Burraston (2014) found it difficult to summarize the impacts of various one-to-one programs.

The increased commitment of funding for technology and one-to-one device implementation rests on various desired outcomes. Therefore, the intent of this study was to obtain administrator and teacher perceptions of one-to-one implementation and gain an increased understanding of the educational benefits and risks in implementing a one-to-one environment.

Purpose of the Study

The number of schools implementing one-to-one device technology continues to increase (Conlan, 2016). With the decreasing cost of the personal computer and a world-wide drive to build the $100 laptop for third-world countries, computer ownership and Internet connectivity have become a reality for most Americans (Krohn, 2014). Schools tend to lag behind the public sector in terms of technology purchases and implementation (Decarr, 2014). Although government and businesses are trying to secure technology for the classroom as quickly as possible, technology in most classrooms is lacking (Mouza, 2008). With technological advancements in equipment and decreasing costs, the dream of every student having a laptop device is on the horizon (Krohn, 2014).

As school districts examine and initiate one-to-one environments at the secondary level, questions surface about the effects on student attitudes toward learning. November Learning (2013) described students as motivated when presented with a technology device; however, the motivation only lasts if students become the master of their own learning. Conversely, Orlando (2011) found technology did not always generate perceived, hoped-for enthusiasm. Research has produced mixed results on student outcomes from one-to-one implementation (Goodwin, 2011).

The purpose of this study was to examine administrator and teacher perceptions of one-to-one technology device implementation in secondary schools. With increasing implementation of one-to-one devices in many public schools, the information gleaned from administrators and teachers about implementation could provide valuable data for future understanding.

Research questions. The following research questions guided this study:

1. What perceptions exist, both supportive and challenging, of building principals in regard to one-to-one technology device implementation at the secondary level?

2. What perceptions exist, both supportive and challenging, of teachers in regard to one-to-one technology device implementation at the secondary level?

3. After reviewing the data collected from building principals and teachers, what reflective perceptions do district superintendents have in regard to one-to-one technology device implementation at the secondary level?

Significance of the Study

The primary benefactors of this study include persons involved in strategic academic and financial decision making within educational institutions. The speed of technological advancement within society has outpaced the efforts of schools to adapt (Quillen, 2012). Teens are familiar with digital technologies (Jukes, 2012; Prensky, 2010) and spend considerably more time web-connected than their adult counterparts (McAfee, 2012; Pew Internet, 2014).

The educational community is transitioning to classrooms rich with technology devices, and as Bebell and O'Dwyer (2010) projected, "It seems highly likely that some form of one-to-one computing will be the norm for the majority of American classrooms at some point in the future" (p. 5). Educational stakeholders have determined integration of technology into classrooms is one of the highest priorities in an effort to prepare students for success in the 21st century global economy (Blackboard, 2012). Since this study revolved around the collection of perceptual data obtained from key stakeholders who were already involved in one-to-one device implementation, the results will allow

decision-makers to have a better understanding of how and when to implement future one-to-one technology initiatives in school districts.

Definitions and Key Terms

For the purpose of this study, the following terms are defined:

Bandwidth. Bandwidth is the maximum amount of data transfer sent over a specific connection in a given amount of time (Scola, 2014).

Bring your own device (BYOD). Bring your own device (BYOD) initiatives are schoolwide enterprises that allow students to bring their own technology products for learning (Ullman, 2011).

Digital divide. Digital divide is the term used to describe the disparities between the haves and have-nots in terms of technology (Richtel, 2012a).

Digital immigrant. A digital immigrant is an individual who during formative years learned analog technology and has adapted to technological changes to integrate into the digital world (Prensky, 2001).

Digital native. A digital native is an individual born after the widespread adoption of digital technology (Prensky, 2001).

Fiber optic network. A fiber optic data network transmits information through a series of light pulses along a glass or plastic wire or fiber (Fox & Rainie, 2014a).

Mobile learning. Mobile learning occurs while utilizing any mobile communication or cell phone device for educational purposes (Keskin & Metcalf, 2011).

Neurogenesis. Neurogenesis is the birth and proliferation of new neurons in the brain (Wainwright & Galea, 2013).

Neuroplasticity. Neuroplasticity is the ability of neurons and neural elements to adapt physically, chemically, and electrically in response to intrinsic and extrinsic signals (Wainwright & Galea, 2013).

One-to-one computing. One-to-one computing is a technology-rich educational reform where access to technology is not shared; however, all teachers and students have ubiquitous access to devices (Bebell & O'Dwyer, 2010).

Wireless network. A wireless network uses radio waves to connect devices such as laptops, tablets, and cell phones (Cisco, n.d.).

Limitations and Assumptions

The following limitations were identified in this study**:**

1. The sample size and scope of the study were limited to superintendents, principals, and teachers of eight southwest Missouri school districts with one-to-one device implementation at the secondary level. Because of this, the results may have reflected only a regional experience and may not be widely applicable.

2. The results of this study were limited to the participant responses of teachers and principals in grades 6-12.

3. Researcher bias may invade on any qualitative study; therefore, procedures were implemented to minimize bias and its impact on the study (Creswell, 2012, 2014).

4. The interview questions were created by the researcher with research bias controlled through triangulation of ongoing review of data and critiques by an educational researcher (Creswell, 2012, 2014; Merriam, 2009).

The following assumptions were accepted:

1. Public school superintendents, principals, and teachers answered the research questions honestly and fully to the best of their knowledge.

2. The interview and focus group questions were interpreted as the questions were intended.

3. The recorded responses were transcribed accurately by a transcriptionist without bias.

Summary

The increasing proliferation of devices and corresponding expansion of the Internet have dramatically altered the past two decades within the educational community (Jukes, 2006, 2012). Students born into a digital-rich world are Digital Natives (Jukes, 2006, 2012; Prensky, 2001, 2010). Digital Natives are connected to web-based devices at increasing rates (Anderson, 2012) and are producing and consuming information at unprecedented rates (McAfee, 2012).

Simultaneous to consumer advancements in society, researchers using newly developed digital imaging systems introduced new pathways in understanding brain adaptation and growth to external stimuli (Doidge, 2016). Researchers of brain plasticity, supported by Prensky (2001, 2010) and Jukes (2006, 2012), have revealed Digital Natives learn and process information differently than previous generations. The new revelations of brain functions and processes call for educators to synthesize new brain understanding with classroom strategies (Jukes, 2006, 2012; Prensky, 2001, 2010).

Digital students are more connected to their peers than previous generations (Pew Internet, 2014). In addition, Pew Internet (2014) found 85% of youth ages 12-33 are on Facebook with a median friend count of 250 (p. 3). Digital Natives view learning as a

social process (Vygotsky, 1978) facilitated through social interactions (Scott & Palincsar, 2013) using digital tools and language (Maher, 2012). Digital Natives are products of a different landscape than Digital Immigrants (Prensky, 2001). The proliferation of digital devices and technology and accompanying new understanding of brain adaptation to stimuli speak to educators of the importance of different digital learning environments within schools (Jukes, 2006).

In Chapter Two, a critical review of literature pertaining to the research questions utilized in the study is presented. The main topics explored are the evolution of society in the digital age, Prensky and Digital Natives, and changes in student learning. Subtopics reviewed include the personal computer, mobile computing, the rise of wireless access, cloud computing, neuroplasticity and Digital Natives, the learners, and the instructors.

Chapter Two: Review of Literature

Newborn children leaving the hospital are welcomed to an environment filled with digital media and technology (Jukes, 2006; Prensky, 2001; Tapscott, 1997). According to Statista (2015), the number of households in the United States with a television has reached 116 million, and 227 million families own a cell phone (p. 1). The social media connection of American youth to one another using technology devices is evident with youth ages 12-24 averaging 585 total contacts in their personal social media accounts (Statista, 2015, p. 1).

The exponential growth of technology to consumers has altered the lifestyle of children (Jukes, 2012). Prensky (2001, 2010) defined children born into a digital landscape as Digital Natives and adults prior to personal home computers, the Internet, and wireless access as Digital Immigrants. Jukes (2006, 2012) and Prensky (2001, 2010) reasoned Digital Natives learn to conceptualize and respond differently than previous generations.

The prevalence of technology in society parallels the usage of devices by youth in both school and non-school settings (Jukes, 2012; November Learning, 2013; Prensky, 2010). Young people are using new technologies to connect, share, and work with others, so it is only logical their school lives should reflect the level of technology outside of school (Muckersie, 2014). Classroom instruction is often led by Digital Immigrants who may struggle to be make learning relevant to the Digital Native population (Prensky, 2010).

Evolution of Society in the Digital Age

The use of computer devices prior to 1980 was reserved for government and large-scale businesses using mainframe computer technology (Gilling, 2015). Early computing devices were composed of vacuum tubes and were the size of an average room in the consumer home (Trueman, 2015). Additionally, early computers required multiple individuals to manage and significant coordination for successful operation (Overmars, 2012).

The placement of circuits on wafer board in the early 1960s led to microchip technology and the reduction in size of early computer structures (Trueman, 2015). Furthermore, the advancement of the microchip away from vacuum tubes and mechanical levers significantly reduced power consumption necessary for operation (Overmars, 2012; Stewart, 2015; Trueman, 2015). The microchip also demonstrated increased reliability, leading to business utilization (Trueman, 2015).

Enterprise-based technologies were site-based with transfer of data occurring through shipment of magnetic reels of information (Stewart, 2015). The advent of smaller microchip architecture provided the impetus for creation of simplified computer language, primarily supported by Microsoft and Apple, and small personal computing devices affordable for the home consumer (Stewart, 2015). In less than 20 years, computers moved from garage-sized devices only found in governmental and business application to the home market and into the hands of children (Jukes, 2012).

The personal computer. Prior to personal computers (PCs), children and teens were introduced to a new arcade product using video technology, which replaced the aging mechanical pinball machine with an electronic device (Overmars, 2012).

According to Overmars (2012), sales of arcade machines of Pac-Man, Space Invaders, and Asteroids reached 50,000 units respectively in 1979. Jukes (2006) and Prensky (2001) attributed the attraction of Digital Natives to video arcade gaming due to the use of color and electronic sounds. Overmars (2012) described teen gamers as wanting visual and auditory stimuli beyond the mechanical sounds of bells and dings found in analog arcade games. The new generation had access to color television at home and was looking for more in its gaming experience (Jukes, 2006; Overmars, 2012; Prensky, 2001, 2010).

Personal computers entered the American home in the 1980s with an individual cost of about $2,000 (Sandoval, 2008). The microprocessor revolution opened the door to many startup companies looking to deliver the personal computer to home markets (Palfrey & Gasser, 2010). Large corporations such as Zenith, IBM, and Texas Instruments were challenged by garage-based startups such as Altair, Apple, and Commodore (Ceruzzi, 2003). Entrepreneurial home-based computer companies such as Cromemco, Altair, and Sol-20 often sold home PCs as kits with a core unit and additional supporting components to allow consumers initial purchases and the ability to return for accessories (Ceruzzi, 2003).

The price point of personal computers limited consumer purchases to an estimated 621,000 home computers in the early 1980s (Blundell, 1983, p. 4). At the end of the 1980s, only 15% of American homes had computers (Gutman, 1987, p. 54). Additionally, early PCs were limited in software options, so sales were targeted toward small businesses and rudimentary games (Gutman, 1987).

Costs of home gaming systems such as Atari and Nintendo were significantly cheaper than early home PCs, capturing the attention of teens due to the graphical limitations of the PC monitor (Overmars, 2012). Additionally, early gaming systems were able to access lower-level microchip processors that provided enough capability for early arcade-style gaming but were unable to sustain needs within PC settings (Gutman, 1987). Early 1980s personal computers, which were the size of a small box and processed one million operations per second, could outperform their room-sized predecessors of the 1960s (Gilling, 2015).

Even though the personal computer experienced rapid growth in small business and consumer markets, data sharing from computer to computer remained cumbersome and often incompatible due to a wide variety of operating standards (Sandoval, 2008). The incompatibility among PCs resulted in consumer demand for the establishment of personal computer architecture standards (Sandoval, 2008). Microsoft and Apple operating systems led the way in creating data and operating standards which provided owners the ability to warehouse and share content (Sandoval, 2008). With business and home consumers having the ability to transfer information, the growth of household computer ownership rose from 15% to 51% between 1987-2000 (Newburger, 2001, p. 42) and rose to 84% in 2014 (Rainie & Cohn, 2014, p. 1). The 1980s was a time of growth in the personal computer industry as sales grew from 3.9 billion in 1981 to 37.1 billion in 1991 (Newburger, 2001, p. 48).

Large computer manufacturers experienced a price war in the 1980s as Intel Corporation, a major provider of microchip processors, elected to sell its 8086 microprocessors on the open market, causing a surge of personal computer clone devices

to challenge large manufactures such as International Business Machines, Hewlett Packard, and Compaq (Newburger, 2001). An example of PC clone manufacturer growth was computer maker Gateway Corporation, which generated $1.1 billion in sales in 1992, a 76% jump over 1991 (Rainie & Cohn, 2014, p. 1; Sandoval, 2008). While consumer desktop computers are in no danger of going away with the rise of mobile computing, personal computer ownership has decreased since 2012 (Fidler, 2015).

Mobile computing. Mobile computers such as smartphones and tablets are spreading faster than any other consumer technology in history (Regaldo, 2013). There is little debate concerning the impact of the personal computer on society and youth; however, nothing has changed the digital landscape more than the use of smartphone and tablet technology in recent years (Lenhart, 2015). Increased processing power, better battery life, improved networking capabilities, and larger screen sizes on mobile devices are driving the shift away from desktop devices to devices which are portable (Valcarcel, 2015). The public and corporate demand for increasing mobile access fuels continued research and development to improve the quality and functionality of mobile devices and the quality of wireless Internet access (Fidler, 2015; Valcarcel, 2015).

***Smartphone technology*.** The history of the smartphone is mired in controversy with multiple manufactures claiming to be the first smartphone manufacturer (Martin, 2014). Similar to the early beginnings of the PC, smartphone technology was only available in the enterprise and business sectors and was uncommon in the consumer market (Martin, 2014; Valcarcel, 2015). In January 2007, the smartphone market changed as the first Apple iPhone was released with a fury of excitement; appealing to youth were the vivid colors and images available on the screen (Martin, 2014).

Smartphone technology access coupled with bandwidth services have become the preference for children, youth, and adults (Valcarcel, 2015). The addition of liquid crystal display with touchscreen capability allows the device screen to function as a keyboard and high-quality video player (Fidler, 2015; Valcarcel, 2015). The enhancement of smartphone capabilities has led to high consumer demand and use (Valcarcel, 2015). Research groups, such as Pew Internet (2014) and Common Sense Media (2013), reported 87% of American homes have smartphones, with 73% of teens aged 12-18 having access (p. 1). Additionally, Common Sense Media (2013) found the percentage of children age eight and under with access to a mobile device jumped from 52% in 2011 to 75% in 2013 (p. 1).

The 10-year upward trend of purchases of smartphone devices has been reflected in an increased use of smartphones in teen and child markets (Pickerill, 2015). While traditional screen time for television, DVDs, video games, and computers is down 31 minutes per day in children aged 8-18, mobile device screen time is up 10 minutes per day (Common Sense Media, 2013, p. 1). In examining the number of minutes per day of use, television continues to reign supreme in children's media lives (Common Sense Media, 2013). While eight- to 18-year-olds watch television an average of two hours per day, television viewing using mobile devices is up six minutes per day (Common Sense Media, 2013, p. 1).

Smartphone technology continues to be refined to meet the ever-changing demands of consumers (Regaldo, 2013). Children, and especially teens, examine the newest-model smartphones looking for faster, more vivid access to apps that connect them to others and to the world. Valcarcel (2015) stated, "A person armed with a current

model smartphone is able to handle nearly all of their tasks at home, or at work, without needing additional technology" (p. 1).

Tablet technology. Portability in computing came to the forefront as business users called for computers to move with them (Nield, 2016). Early tablets such as the GRIDPad created in 1989 were revolutionary; the industry did not understand what consumers were seeking in a tablet format (Nield, 2016). In 2010, Apple introduced the iPad tablet to the marketplace. With a liquid crystal touchscreen, thousands of available apps, and lightweight portable design, the iPad tablet is the most recognized tablet on the market (Meeker, 2012). Since 2010, 200 million iPads have been sold; three times more growth than the iPhone (Meeker, 2012). Additional tablet models entered the marketplace with Android devices providing consumers additional choices and driving down prices for non-Apple products (International Data Corporation, 2015).

The tablet's physical structure and functionality for all age groups led to rapid consumer adoption (Lunden, 2014). The tablet market utilized a touch screen control interface, which provided younger generations the ability to navigate without fully developed fine motor skills (Rainie & Cohn, 2014). Wynne Tyree, president of Smarty Pants, a market research and strategic consulting firm, stated, "In just five years, the iPad has risen from ranking 109th to being kids' favorite brand" (Albanesius, 2015, para. 2).

Tablet devices have quickly become one of the preferred media choices for children and youth because of screen size, mobility, ability to stream content, and interactive capability (Kabali et al., 2015). Children use tablet devices to play games, watch videos, communicate, take pictures, and access applications (Radesky, Schumacher, & Zuckerman, 2015). The rapid adoption of tablet devices since 2010 has

changed the way technology influences family dynamics, child development, and literacy (Kabali et al., 2015).

In the past four years, the effect of tablets in education settings has been witnessed by an incredible surge in implementation (Daccord & Reich, 2015). With the introduction of mobile computer devices, schools across the United States and around the world have made major investments in tablet devices (Daccord & Reich, 2015; Rainie & Cohn, 2014). The educational tablet market desires greater content creation in media to showcase student understanding, collaborate with peers, and communicate with broad audiences (Daccord & Reich, 2015).

Connecting to the web. Computer-to-computer communication began in 1969, traveling a distance of 400 miles between UCLA and Stanford University and given an early name of ARPANET (Metz, 2012). The growth of the Internet was minimal through the early 1990s, as household and small business connections were either not available or extremely costly (Metz, 2012). Consumer connections soared by 500 million by the mid-1990s as email and web browsers brought communication and browsing capabilities (Burkeman, 2009).

The World Wide Web and its predecessor, the Internet, grew at incredible rates as an access point of information, images, and music (Burkeman, 2009). Furthermore, the development of Fiber Optic Service (FIOS) provided information around the globe traveling at the speed of light, and by early 2000, every continent on the globe was connected by FIOS cable, providing an unprecedented level of communication ability via phone and Internet (Burkeman, 2009). Services of FIOS continue to expand as fiber-based Internet comes to homes across the globe (Fidler, 2015).

As a new entity, the Internet was addressed by United States Congress in 1995 with legislation to regulate and safeguard material on the Internet (Dawson, 2013). With rapid expansion in multinational forms, speech and information access brought discussion of Internet control to the table (Dawson, 2013). The Communication Decency Act of 1996 (CDA) became the first legislative attempt to regulate both indecency and obscenity available on the Internet (Dawson, 2013).

The Internet, as an entity, is unique in its structure, is always on, and is growing in strength and size with each device connection (Burrus, 2014). The Internet consists of machine-to-machine connections creating networks of devices connected physically or virtually (Burrus, 2014; Fidler, 2015). The devices connecting to the Internet network continue to expand as household devices, transportation services, and country infrastructure systems provide utilities to everyday home users (Burrus, 2014).

The exponential growth of the Internet leans heavily on the creation of new technologies to provide greater capacity for the corporate business sector and for household consumers (Burrus, 2014; Fidler, 2015). Technology industry has placed significant funding toward research and development of new devices and tools, which could provide home users with bandwidth capabilities once only available at corporate business levels (Aron, 2015). Additionally, fiber optic consumer connection capabilities continue to move beyond the major metropolitan regions and provide high-data rates to areas once thought of as non-Internet accessible (Fidler, 2015).

Rise of wireless access. The ability of technology devices to be mobile began early in the computer revolution as the desktop machine was downsized into a mobile laptop device (Lomas, 2014). Wireless connectivity to the Internet began in the mid-

1980s and has significantly changed the way people use, create, and share online (Wood, 2014). By 2003, the average laptop connected to wireless could connect 10 times faster than the Internet-wired connections of the mid-1980s (The SUIT Staff, 2014).

The demand by consumers for wireless devices, primarily smartphones, continues to drive the wireless market to greater levels of connectivity (Schmidt & Cohen, 2014). Market research of wireless sales has revealed signs of an increasing trend of expansion in worldwide wireless access with $1.2 billion in sales in the first quarter of 2016 (Machowinski, 2016). One of the most important components is the wireless access point, which broadcasts the signal for devices to connect to the Internet (Machowinski, 2016). The number of access points shipped reached 4.7 million in the first quarter of 2016, further supporting an increased demand in wireless systems at work and in home consumer markets (Machowinski, 2016).

In addition, there is a significant focus on bringing wireless Internet access to remote regions throughout the world. Meena (2014) forecasted the number of global smartphones would reach 3.5 billion by 2019. Furthermore, Alba (2016) and Meena (2014) described three billion people, mostly in Africa and Asia, only have access to basic-feature mobile phone technology. With growing smartphone demand and expanding wireless access, the next 1.5 billion cellphone-market subscribers joining by 2019 will come from only 12 countries (Alba, 2016; Meena, 2014).

The driving demand for mobility in society is mirrored in educational settings. Students and staff each day are more dependent upon their mobile devices, which places demands on schools to have greater accessibility through wireless systems (Fulkert, 2015). The mobile device gold rush leans heavily on the ability of the selected device to

connect wirelessly to the web, to have sustained battery life, and consists of a portable form factor (Ackerman, 2013).

Cloud computing. The advances in the mobility of tablet and cellular phones brought demand for a new type of personal computer, a device that possessed quick startup times and quickly connected to the web (Enderle, 2016). As early at 2012, predictions from technology pundits described the demand for increased abilities of mobile devices to emulate desktop PC functions (Gartner, 2012). The consumer demand for ergonomic size and user-friendly functions pushed developers to move phone and tablet operations to occur elsewhere, or in the cloud (Griffith, 2016).

Cloud computing is described as a method of storing and accessing data and programs over the Internet instead of on the local computer's hard drive (Griffith, 2016). As increasingly greater speeds and volume of data transferred over the Internet became available to small businesses and homeowners, storing data in megaservers on the Internet rivaled the transfer speeds of home computers (Enderle, 2016). Therefore, very small devices connected to the Internet can access vast quantities of information and data, which is described as a go-and-retrieve concept (Feldman, 2013).

Programs in the cloud. As the complexity of mobile phones has increased, the two major phone manufacturing markets of Apple and Android created applications (apps) to be utilized on mobile devices (Macmillan, 2015). Through purchases of an Android phone or iPhone, consumers are provided the ability to purchase additional programs to customize and enhance the phone (Golson, 2016). Both Android and Apple app stores began as corporate-only ventures, but quickly the companies discovered the opportunity to create a market where the public could create applications to be purchased

(Golson, 2016). The incorporation of third-party apps developed for the Apple App Store and Google Play Store created a free market system for Apple and Google to compete against one another for consumer purchases (Golson, 2016). Since the first opening of the iTunes App Store in 2008, the market to create and promote apps has been quite lucrative, with 1,887 individual app developers making more than one million dollars per year (Macmillan, 2015, p. 1). As emerging markets in Brazil, India, Indonesia, Turkey and Mexico continue to expand, the current 300 million downloads from app stores pale in comparison to future demand (Woods, 2016).

The mobile device app continued to evolve into a more complex and demanding system, which required more power from mobile devices (Woods, 2016). In 2010, search engine giant and apps developer Google communicated the creation of a cloud-based operating system, which challenged current thinking of programs purchased and placed locally on each device (Raphael, 2015). The cloud-based operating system by Google was embedded into laptop devices named Chromebooks, with a price tag of $300 or less in 2012 (Rodriquez, 2013). The price point and durability of the Chromebook devices targeted the education market with sales of 1.3 million devices in 2012 and 1.7 million in 2013 (Rodriquez, 2013) and outsold Apple Mac devices in the first quarter of 2016 (Warren, 2016, p. 1).

The influence of cloud-based operations from Google's Chromebook resulted in other software producers re-examining the philosophy of placing software on each device and instead developing cloud-based systems (Crucial Cloud Hosting, 2014; Schaffhauser, 2015). Industry giant Microsoft lagged behind in cloud-based software and wanted to get Office365 suite software in the hands of students; the product was offered to education

systems at no cost (Crucial Cloud Hosting, 2014; Schaffhauser, 2015). Apple Computer created iCloud for storage and remote access purposes; however, Apple has not ventured into cloud-based software programming (Warren, 2016).

The desire to have a market share of educational cloud computing is reflective of the amount of monetary reward for providing educators and students with devices in the classroom (Schaffhauser, 2015). Devices and software materials, which are cloud-based in design, are estimated to become a $60 billion industry by 2018 (Kardaras, 2016). Additional forecasts are the cloud computing market will see a growth of 24.57% between 2016 and 2020 as education-based consumers increasingly invest in cloud-based learning platforms (Klostermann, 2016).

Prensky and Digital Natives

The technological advancements of the past 30 years have precipitated significant changes in human life (Ramey, 2012). The increases in connectivity and use of technology in the United States are staggering, as 279 of 322 million Americans are connected to the Internet daily (Internet Live Stats, 2016, p. 1). The astounding numbers of digital devices with web connectivity are not limited to adults; today's youth are deeply and permanently entrenched in the use of technology for everyday life (Pew Internet, 2014).

Birth of digital natives. With the arrival of the affordable personal computer to home consumers in the 1990s, current college students and young adults in the workforce have matured with rapid technology advances (Prensky, 2001, 2010). Furthermore, Prensky (2001, 2010) described three generations, born since the 1980s, as children born into an increasing technology and digital media-rich environment, equipped with Internet

browsing, social media, digital music, and gaming as integral parts of their lives. Additionally, Prensky (2010) noted, “It is now clear the result of their ubiquitous environment and the volume of their interaction with it, students today think and process information fundamentally different than their predecessors” (p. 1). Recognizing the change in youth, Tapscott (1997) described Digital Natives as “kids born and so bathed in bits that they think it’s all part of the natural landscape” (p. 2), and “for the first time in history, children are more comfortable, knowledgeable, and literate than their parents with an innovation central to society” (p. 2). Teachers entering their classrooms find students connected to their peers and the world in ways no generation has ever been before (Jukes, 2006; Prensky, 2001, 2010).

The Digital Native metaphor, created nearly 15 years ago, has received harsh criticism, as education pundits interpreted the Digital Native concept as students natively having knowledge of everything about technology, rather than referring to a comfort level with technology by virtue of having grown up with it (Prensky, 2012). Moreover, Digital Natives are viewed as a product of immersion in an environment of technology and media forcing the brain to adapt to new stimuli (Jukes, 2006, 2012; Prensky, 2001, 2010; Tapscott, 1997). Digital youth are defined by the ways they connect to the world, and their labor and language are structured by digital technologies (Jukes, 2006, 2012; Prensky, 2001, 2010).

Furthermore, Jukes, McCain, and Crockett (2010), in support of Prensky (2001, 2010), described Digital Natives as a generation who do not become comfortable with any one particular piece of technology; however, they welcome the coming change in all technology. The characteristics of Digital Natives were specified by DeLion (2015), who

purported Digital Natives may spend days and even months without coming face-to-face with another person, communicate through hands-on devices, and yet preserve the feeling of staying connected.

Additionally, the proliferation of images and color has a profound impact on the digital student. Today's youth see digital, full-color content as the normal way of learning about and interacting with their world (Xerox Corporation, 2012). The proliferation of images means visual literacy is now crucial for obtaining information, constructing knowledge, and building successful educational outcomes (Jukes, 2012). Color has a tremendous impact on student learning and engagement and is found to have value for understanding complex topics, maps, data charts, and other graphics (Jukes, 2012; Prensky, 2001, 2010; Tapscott, 1997; Xerox Corporation, 2012). Surveys of students in grades 3-12 indicated color copies would make school work more interesting and provide students with focus on what is important (Xerox Corporation, 2012).

Today's digital youth are uncommitted to organized politics, linked by social media, burdened by debt, distrustful of people, and optimistic about the future, all while being the most racially diverse generation (Pew Internet, 2014). Digital youth are complex individuals who participate with others in an equality-based system of sharing and co-existing online (Dawson, 2016). The Digital Native generation utilizes non-traditional mediums to engage in political and activist messaging (Dawson, 2016). Furthermore, two-thirds of 18- to 29-year-olds state social media is the most helpful means of learning new things about politics (Lang, 2016). In contrast, Lang (2016) found only 40% of Baby Boomers, who are described by Prensky (2001, 2010) as Digital

Immigrants, found social media helpful in learning new information in the 2016 United States Presidential election.

The symptoms of generational connection while simultaneously linked by technology are not limited to North America and Western European countries (Choi & Lee, 2015). The increased integration of technology in the lives of youth worldwide has resulted in young people instantaneously connected socially, educationally, and politically (Friedman, 2005). By analyzing youth in these dimensions, Digital Natives are different from today's older generations (Pew Internet, 2014).

Neuroplasticity and digital natives. When addressing different types of digital learners, Prensky's (2001) work indicated Digital Natives learn, conceptualize, and respond differently than previous generations. Prensky (2001) purported Digital Natives' brains are physically different and therefore process information in different ways than previous generations. According to Jukes (2006, 2012) and Prensky (2001, 2010), heavy media and digital environments have altered the Digital Native's brain wiring and processing.

The primary basis for including technology in student learning comes from the principle Digital Natives have different physical brain structures resulting in different methods of processing information due to immersion into a digital world from birth (Jukes, 2006, 2012; Prensky, 2001, 2010). Prior to the turn of the century, the scientific community held firm to the belief neurons, unlike other cells, could not reproduce after the first few years of life; therefore, the number of neurons, functions, and connections were final by school age (Liou, 2010). The reciprocal advancement of psychology, neurology, and specifically brain imaging technology has exponentially magnified the

understanding of the neurosciences of brain structure, processes, and student and adult learning (Sousa, 2011).

Modern medical investigative procedures have revealed the concept of neuroplasticity, the ability of the brain to adapt to changing circumstances, stimuli and use throughout life, and relocation of functions when necessary (Aldrich, 2013). Neuroplasticity involves the brain creating new connections and discarding unimportant ones (Torper et al., 2013). Early analysis of brain plasticity focused on the neurons of the brain, or the brain cells (Aldrich, 2013; Liou, 2010; Sousa, 2011). Additional investigation indicates brain plasticity involves myelin, the sheath surrounding neurons (Burrell, 2015).

In a television interview, Dr. Norman Doidge described how brain connections work and why understanding the limits of plasticity are still in the infancy stages:

> Scientists thought of the human brain as a complex machine with parts, a mechanistic model that never changed. It turns out that a metaphor was wrong, and that the human brain is animate and it is growing, it works by changing its structure and function as it goes along. (as cited in O'Brien, 2008, p. 3)

The foundations of a student's learning potential are built permanently into the brain from infancy throughout life, giving the mind the ability to continually adapt to new challenges (Wilson, Conyers, & Rose, 2015). Experience-dependent synaptogenesis explains how synapses are forged by learning experiences, therefore describing the brain as plastic, or changeable (Jhaveri et al., 2015). The changeable properties of the human brain have been demonstrated by brain scans showing changes as a result of intensive practice in violinists, cab drivers, and medical students (Wilson et al., 2015).

Construction of new neurons is highly correlated with memory, mood, and learning (Jhaveri et al., 2015); however, the abilities of neuroplasticity are not without limits (Sousa, 2011). The highest rate of neurogenesis occurs prior to age 24 and decreases as the brain ages (Aldrich, 2013). Additionally, stimulating the brain in various ways can boost myelin production; inversely, too little stimulation can result in reduction of the myelin insulation (Aldrich, 2013; Jhaveri et al., 2015). The emphasis of the brain as a malleable organ suggests the brain is a "use it or lose it" organ (Burrell, 2015).

When describing nature versus nurture, experiential and environmental factors contribute greatly to the development of intelligence (Aldrich, 2013; Jukes, 2006; Prensky, 2001, 2010; Sousa, 2011; Wilson et al., 2015). Focusing on expanding the plasticity and malleability of the brain is critical in the learning environment (Sousa, 2011; Wilson et al., 2015). Wilson et al. (2015) asserted classroom teachers should explicitly teach all students, kindergarten through high school, how to use cognitive assists so students can take charge of their own learning. Describing cognitive assists in the classroom, Wilson et al. (2015) asserted students should be provided with skills to think about their learning and to be aware of factors that affect their intellectual performance.

Neuroplasticity understanding is limited and in the infancy stages with researchers posing more questions than answers about brain adaptation and rewiring (Castro, 2011). The brain has the ability to reorganize itself to meet external stimuli, and a deeper understanding will improve learning and re-learning of both motor and sensory information (Banks, 2016).

Changes in Student Learning

Many schools and districts have undertaken technology initiatives with the intention of creating classrooms that are technology-rich, preparing students for 21st-century workplaces (Ally & Prieto-Blazquez, 2014). The move to increase student and teacher access to technology is often a goal of American public schools; however, education proponents call for a shift from obtaining and equipping schools with technology to a change in the way learning opportunities are provided for students (Bebell & O'Dwyer, 2010; Goodwin, 2011; Jukes, McClure, & MacLean, 2011; November Learning, 2013; Prensky, 2001, 2010, 2012).

The desire to fill every classroom with devices and to provide student and teacher access has not waned. Herold (2015) noted public schools provide an electronic device to one in five students and spend over four billion dollars per year on devices and another three billion dollars per year on digital content (Winske, 2015). Educational institutions, according to Winske (2015), are looking for versatility in devices, and these institutions do not foresee the spending trend in education to slow.

The learners. The students residing in classrooms are constantly connected and use the Internet as their media of choice (November Learning, 2013; Palfrey & Gasser, 2010). Prensky (2010, 2012) contended students learn socially, and their learning is not confined to specific places, times, or sets of teachers. Furthermore, Jukes et al. (2011) indicated the modern student views learning as not limited to human teachers, not driven by paper-based information, nor requiring voluminous content memorization.

Understanding of Digital Natives guides educators in bringing relevance into the classroom (November Learning, 2013; Palfrey & Gasser, 2010; Prensky, 2010; Sheskey,

2010; Wilmarth, 2010). For digital students, learning is not about the technology, it is about being learners who are mobile and at the center of learning, while technology allows them to learn in any context (Ally & Prieto-Blazquez, 2014). The learners, or Digital Natives, look to learn from multiple information sources and try to utilize resources in the form of technology to provide answers to inquiries (November Learning, 2013). Digital Natives are often described as students born with a markedly different approach to learning (Bebell & O'Dwyer, 2010; Joy, 2012; Jukes, 2006, 2012; November Learning, 2013; Palfrey & Gasser, 2010).

Students, as described by Prensky (2010, 2012) and Jukes (2012), exhibit different neural networks or pathways which bring new learning patterns (Doidge, 2016; Grushka et al., 2014; Massey, 2013). When analyzing the differences between pre-digital age students and digital-age students, a wide array of cultural and social implications emerge (Csikszentmihalyi, 1998; Kern, 2015; Vygotsky, 1978). In sociocultural theory, mental functioning is related to the cultural, institutional, and historical context in which students are immersed (Scott & Palincsar, 2013). Learning is a social process, and the learning process is mediated through social interactions (Vygotsky, 1978).

The social processes of learning are amplified as technology advances into the hands of children worldwide (Mitra, 2013; Zur & Zur, 2016). In examining social learning, Victor (2015) asserted students learn best together, through collaboration with peers, discussion with mentors, and by sharing knowledge and experiences with others. The brick-and-mortar schools prevalent today will need to modify as educational web sites continue to flourish in providing instruction and guidance of specific learning content (Jukes, 2012; Mitra, 2013; Prensky, 2010; Zur & Zur, 2016). Social networking

tools, such as Facebook, Twitter, and Instagram, keep young people connected to friends, colleagues, and often total strangers (Victor, 2015). Today's youth share a multitude of information about themselves and their activities and learn from what others share (Victor, 2015). Informal learning is an important part of human development, and with technology the potential for continual learning is magnified (Jukes, 2006, 2012; Prensky, 2001, 2010; Victor, 2015).

The implications of social learning are supported by Mitra's (2013) research of impoverished Tamil-speaking Indian children. Tamil-speaking children were provided a laptop with English language set as the default language (Mitra, 2013). Without support from outside sources, Tamil children, through social interaction, learned to navigate the device and demonstrated the ability to teach themselves basic levels of English (Mitra, 2013). In examining Mitra's work, Stinson (2015) described the children of Tamil as a self-organized learning group. Children, through peer social interaction, learned to use the device and within a few months asked for an improved version (Stinson, 2015).

Wan, Compeau, and Haggerty (2014) also found social learning strategies are important. Learners who interact with their peers and the instructor are able to receive feedback to guide their learning through social comparison and social assistance, resulting in better learning outcomes (Wan et al., 2014). Investigating learning through web-based connections, Moore (2012) described the social interaction of learners as "the interplay of teachers and learners in environments that have the special characteristic of their being spatially separate from one another" (p. 68). Additionally, Moore (2012) noted the social aspect of learning among students hinged on dialogue occurring

electronically. Moore (2012) described dialogue as "constructive" (p. 92), because it was built during exchanges among individuals participating in a course.

Furthermore, Kear, Chetwynd, Williams, and Donelan (2012) asserted, "There is some evidence to suggest that student-to-student interaction is more likely to take place when the tutor is not present, so this could be encouraged" (p. 961). Social presence will likely promote group cohesion and increase the likelihood students will become more engaged (Kear et al., 2012). In examining social learning theory (Bandura, 1976), learning occurs mandatorily via communication among individuals (Kear et al., 2012). While all communication is useful, peer-to-peer interaction has advantages through reference to the zone of proximal development (Vygotsky, 1978) in promoting shared learning experiences that do not "create a form of mastery that is contingent upon the perpetual presence of the teacher" (Kear et al., 2012, p. 961). The importance of social interactions in evident in digital learning (Mitra, 2013; Moore, 2012; Wan et al., 2014). Today's youth are using technology as tools to create learning in a different social process (Maher, 2012).

In contrast with teacher-centered approaches, the level of social interactions is diminished by structure, as students are delivered information by the classroom teacher (Ahmed, 2013). Understanding the social connection, some student-centered learning spaces are labeled as socio-technological classrooms to highlight the emphasis on student collaboration and educational technologies (Lasry, Charles, & Whittaker, 2014). Learner-centered spaces take on various meanings in today's technology-driven world (P21 Partnership for 21st Century Schools, 2016a). Learning spaces may be defined as virtual, online, and remote; in other words, the space does not have to be a place at all

(P21 Partnership for 21st Century Schools, 2016a). By viewing the tools in sociocultural theory and connecting the characteristics of digital era students, there is ample evidence indicating traditional teacher-centered approaches are not as effective as they once were (Scott & Palincsar, 2013).

The instructors. The arrival of the computer and Internet into the classroom has been disruptive to educational thinking, and the increase of technology will not work well in the current culture of industrialized classrooms (Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010). The emergence of the Internet in the 1990s to the ever-increasing ease of access to the web in the present have unmistakably usurped the teacher from the role as authority of subject content (Godsey, 2015). Furthermore, Godsey (2015) noted the invasion of technology has shifted the role of public school educators from "content expert" to "learning facilitator" (p. 1).

Prensky (2001, 2010) labeled teachers as Digital Immigrants, describing the gap between students and teachers as two nationalities meeting at the border speaking different languages. Teachers accustomed to a traditional landscape of classroom instruction often find difficulty in the transition to classroom environments with access to technology for every student (Godsey, 2015; Jukes, 2012; November Learning, 2013; Prensky, 2001, 2010). Teachers may enter classrooms ill-prepared for students who are highly invested in learning and socializing in a technology realm; often, the classroom is led by staff who are unable or unwilling to adapt to changing classroom dynamics (Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010).

Teacher-centered approach. The educational community, for the past 50 years, has based its pedagogical focus on teaching (Weimer, 2013a). When teachers

demonstrate characteristics such as organization, enthusiasm, clarity, and fairness, they create an environment where students learn more, as measured by higher grades (Weimer, 2013a). Furthermore, the term *teacher-centered* requires little definition and explanation, since it has been utilized since the beginnings of universal education in the United States. In teacher-centered approaches, the learner requires a person who can guide, advise, and help achieve the objectives of education (Nagaraju, Madhavaiah, & Peter, 2013).

Teacher-centered instructional styles are often defined as formal, controlled, and autocratic, which assume the learners are passive (Garrett, 2008). In classes considered teacher-centered, the teacher tends to be the most active person in the room, while students are the recipients of learning as demonstrated by listening, taking notes, giving brief answers, or completing assignments and tests (Sawant & Rizvi, 2015). Furthermore, in a teacher-centered classroom, instructional styles lend themselves to having the teacher stand in the front of the classroom while all students work on the same task (Garrett, 2008; Sawant & Rizvi, 2015). In classrooms focused on the teacher, the teacher may rely on extrinsic motivation to engage students and influence student behavior (Garrett, 2008).

Weimer (2013b) defined teacher-centered instruction as "focused on what the teacher knows, and teacher-centered approaches frequently provide universal transmission of information followed by student recitation and evaluation" (p. 65). In addition, in teacher-centered classrooms, the teacher controls the rigor and pacing of content and may select personal curricula which is familiar, or preferred (Sawant & Rizvi, 2015). Teacher-centered instruction is "often direct instruction or lecture-focused"

(p. 67); Sawant and Rizvi (2015) found teachers with greater than 10 years of classroom experience were "more likely prepared with teacher-centered models in pre-service programs" (p. 70). In observations of teacher-centered classrooms, Zophy (1991) found teachers want to show and demonstrate their understanding, and there is too much content to cover for learner-centered classroom structures.

Furthermore, teacher-centered approaches in the classroom have been reported to provide increased control of content and of students in the classroom (Weimer, 2013a; Zophy, 1991). Since success is often measured with summative assessments or state or national achievement assessments (Sawant & Rizvi, 2015; Weimer, 2013b), within the traditional classroom, the teacher is in control of the standards to be covered, the depth of coverage, and the pacing of the lessons, despite varying individual needs of remediation and acceleration within the group (Godsey, 2015; November Learning, 2013; Scott & Palincsar, 2013).

The role of the student in teacher-centered classrooms is vastly different than in learner-centered environments. The findings from a meta-analysis of 142 studies of instruction in the United States indicated the traditional teacher-centered approach nullifies the role of the students in the classroom, thereby creating an inauthentic, subjective classroom climate (Camburn & Han, 2011). The architecture of the traditional classroom is implicitly based on a transmission model of learning; an expert transmits knowledge to attentive novices (Lasry, Charles, Whittaker, Dedic, & Rosefield, 2013). Furthermore, traditional classrooms are physically structured for teacher-centered approaches in the design of the room, the arrangement of furniture, and the placement of technology (Lasry et al., 2013).

Learner-centered approach. Two frames of reference for classroom instruction provide perspectives of student-teacher roles in learning. Student-centered or learner-centered teaching is defined as instruction focused on the learner (Garrett, 2008). In learner-centered approaches, a constructivist teacher is interested in helping the child engage problems and issues, search for solutions, try various explanations, and finally construct his or her own meaning (Garrett, 2008; Scott & Palincsar, 2013). Learner-centered teaching utilizes reflective thinking, inquiry, exploratory discussions, role-playing, projects, and simulations (Garrett, 2008).

Additionally, classrooms focused on the student are designed to increase learner outcomes and to promote student learning based on a number of factors affecting student achievement (Jukes, 2012; November Learning, 2013; Prensky, 2010). Student-centered teaching and learning focus on the needs, abilities, interests, and learning styles of students and have many implications for the design of curriculum, course content, and interactivity of courses (Coalition of Essential Schools, 2016). This pedagogy acknowledges the student voice as central to the learning experience of every learner and requires students to be active, responsible participants in their own learning (Coalition of Essential Schools, 2016; Garrett, 2008; November Learning, 2013).

Prensky (2012) described the importance of student inclusion in the design and goal setting of classroom instruction and the use of student feedback to collaboratively guide instructional needs (Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010). Further supporting student partnerships in an education format, Jukes (2012), November Learning (2013), and Richtel (2012a) described the need for collaboration

between learners and educators in selecting what to learn, when to learn, and where to learn.

The inclusion of the learner in the decision-making process to select materials and strategies for gaining understanding is described as learner autonomy (Benson, 2009). Learner autonomy is linked to Vygotsky's (1978) concept of self-regulation and Csikszentmihalyi's (1998) work on flow. Autonomous learners are provided some choices within the framework of the standards to be addressed (Vygotsky, 1978). When given choice, the students feel responsible for their own learning and the learning of those around them (Vygotsky, 1978). Additionally, Benson (2009) noted misconceptions of student autonomy remain in educational settings, including the belief autonomy is synonymous with self-instruction and that any intervention on the part of the teacher is detrimental to student voice in learning.

In examining student motivation and learning, Csikszentmihalyi (1998) described the delicate tightrope between the challenge of classroom instruction and the abilities of the student; with too little rigor the student does not reach potential, and with too much rigor, the student loses hope for success. Classroom success exists with the highest probability when the learning challenge matches the skills and learning styles of the student (Csikszentmihalyi, 1998). Furthermore, the proverbial sweet spot is the frontier between boredom and anxiety (Csikszentmihalyi, 1998). Effective practices must be targeted to the next-generation learner in an environment with matched challenges to avoid student frustration from boredom or anxiety (Csikszentmihalyi, 1998).

While students are digitally connected in ways no other generation has been, the bridge between a classroom learning model and the student learning style of the Digital

Native has been difficult to cross (Herold, 2015; Jukes, 2012; November Learning, 2013; Prensky, 2010). The traditional classroom hardly fits with the learning styles of the modern student (Jukes, 2006; Prensky, 2001, 2010; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2011).

Teacher professional development. Despite many of the positive effects of integrating technology in the classroom, many teachers are not using technology devices to their potential (UNESCO, 2011). Professional development is one means to change the self-efficacy of teachers and the level with which they integrate technology in the classroom (Lasry et al., 2013). Teacher self-efficacy has been defined as the extent to which a teacher is confident enough in his or her ability to promote student learning (Bandura, 1976). If teachers do not embrace technology and use it to assist in transforming their teaching practices, there will not be any significant effect on the classroom community or on student understanding (November Learning, 2013; Prensky, 2001, 2010; UNESCO, 2011).

Access to technology. Although knowledge of technology is necessary in the modern classroom, knowledge is not enough if teachers do not feel confident using technology to facilitate student learning (Ertmer & Ottenbreit-Leftwich, 2010). In examining barriers to technology adoption, Ertmer and Ottenbreit-Leftwich (2010) noted first-order and second-order barriers to teacher adoption of technology. First-order barriers were defined as the lack of technology equipment for teachers to integrate into daily lessons (Ertmer & Ottenbreit-Leftwich, 2010). Early accessibility to newly implemented devices is only the first step toward using the technology as an effective instructional and learning tool (Jukes et al., 2011; Palfrey & Gasser, 2010). Teacher fear

of something going wrong in the classroom when using technology plays a significant role in teacher adoption of technology in instructional settings (Kay, 2014).

Another barrier to digital integration may be teachers' technology skill levels. After assessing 384 secondary students and 367 teachers, Moradie-Rekabdarkolaei (2011) found "meaningful difference between the technology literacy of teachers and students" (p. 43), with students scoring higher than teachers on all areas of accessing, managing, integrating, evaluating, and creating information. Teachers involved in the study indicated they were reluctant to use technology in the classroom because they felt deficient in personal technology skills (Moradie-Rekabdarkolaei, 2011). Self-efficacy can affect learners' motivation, behavior, persistence, and effort (Tondeur et al., 2012). Many teachers do not integrate technology devices due to perceived skills, negative attitudes toward computing in the classroom, and high levels of anxiety about using computers with students (Rohaan, Taconis, & Jochems, 2012).

Furthermore, Kay (2014) noted many teachers experience a number of challenges when trying to use technology in their classrooms, including "the amount of time required to learn new software and insufficient access to software and hardware" (p. 142). In contrast, Hsu and Kuan (2013) found very few teachers wanted to learn more about how to use these forms of technology. Instead, the teachers' main desire was to learn how to effectively integrate technology into their classroom practice (Hsu & Kuan, 2013). According to research from the past 15 years, teachers have not been shown how to use technology properly (Godsey, 2015; Jukes, 2012; Prensky, 2001, 2010), and a fearful disposition within teachers exists of students having greater technology knowledge and skills than the teacher (Kay, 2014).

Time to incorporate new classroom learning strategies. The inclusion of technology tools in student learning is a risky venture for most teachers (Rebora, 2016). Professional learning often occurs outside of district-designed professional development programming, as teachers are far more likely to learn about new ed-tech tools from other teachers in their school than from any other source (Godsey, 2015; Kay, 2014; Rebora, 2016). In the results of a survey consisting of 700 classroom teachers, Rebora (2016) noted, "Teachers tend to put greater faith in other educators' statements about technology than they do in the opinions of administrators or outside experts" (p. 5). Furthermore, in examining professional development feedback, teachers gave the highest ratings when allowed "to participate in peer-to-peer idea sharing, collaborative planning time with colleagues and job-embedded coaching" (Rebora, 2016, p. 5).

Regarding frequency and the pacing of professional development, Jenkins (2012) noted "time as an additional factor" in teacher efficacy of technology in the classroom (p. 5). In analyzing teacher professional development time, Sinay, Presley, and Yashkina (2013) compared effective professional development to the business community:

> Like business leaders, teachers need the opportunity for brainstorming and collaborating with peers and goal setting with superiors. Ongoing professional development that supports the growth of a teacher helps to maximize the potential of each teacher and ultimately each student. (p. 60)

In examining integration of technology in the classroom, Smaldino, Lowther, Mims, and Russell (2014) noted teachers must undergo implementation stages and grow from novice learner to teacher facilitator of student technology use. Surveying the initial stages, teachers encourage teachers to "dabble in technology" (p. 5) and to randomly add

technology to existing curriculum in an experimental way (Smaldino et al., 2014). Teachers are provided time to explore practices that best meet their instructional needs (Sinay et al., 2013). Furthermore, teachers often discover how technology can support previously established teaching methods; however, teaching and learning have not changed due to the presence of technology (Jenkins, 2012; Smaldino et al., 2014). Furthermore, the power of transformative professional development occurs during the final stages as teachers use technology to enhance or elevate the lesson to extend student learning in new and innovative ways (Smaldino et al., 2014).

In the *National Education Technology Plan*, the United States Department of Education (USDOE) (2013) challenged the use of "episodic and ineffective" professional development practices (p. 34). Additional recommendations by the USDOE (2013) called for school leaders to create professional growth opportunities built on "collaborative, coherent, and continuous teacher growth systems" (p. 35). Professional development must be ongoing, as one-time sessions have been shown to have minimal effects (Center for Teaching Quality, 2014).

Summary

The advent of the personal computer and its counterpart the Internet has touched and changed nearly every aspect of society (Burkeman, 2009; Gilling, 2015; Jukes, 2012; Palfrey & Gasser, 2010; Prensky, 2001, 2010, 2012). The digital youth have adapted to the technological society and process learning in different ways (Joy, 2012). Jukes (2012), November Learning (2013), and Prensky (2012) described the need for education system reform to match the needs of today's youth.

To meet the needs of the digital student, school districts throughout the world are equipping classrooms with technology devices for every student (Jukes et al., 2011). The intent of one-to-one school environments is to increase student learning by providing instruction and opportunity using a keyboard or tablet (Bebell et al., 2014). The change in 21st-century student learning is not as easy as merely purchasing devices; for new learning practices to occur, significant changes in the ways schools function may be required (November Learning, 2013).

In Chapter Three, the methodology for this research is provided. Detailed descriptions of the survey instrument utilized, including its creation and the links between each specific question and the three respective research questions, are delineated. A general overview of the population of study and the sampling methods for determining participation in the study are also provided. In addition, the methodology utilized for data collection and analysis are detailed to provide the reader a clear understanding of the methods used to address the research questions in this study.

Chapter Three: Methodology

The accelerating proliferation of technology in the classroom has altered traditional learning models of student instruction (Ahmed, 2013; Ally & Prieto-Blazquez, 2014; Herold, 2015). To capture the attention of tech-savvy students and to prepare youth for a successful future, teachers must incorporate new strategies in lesson design by weaving classroom technology into student instruction (Secure Edge Networks, 2015). The implementation of one-to-one devices, once believed only available in wealthy school systems, is becoming an expectation of all schools (November Learning, 2013). Increasing device affordability is now met with a growing demand for a future workforce with technology skills embedded within academics (Herold, 2016). Therefore, additional research is necessary to provide a greater understanding of one-to-one device implementation.

To gain a richer understanding of the technology implementation process, school districts in southwest Missouri were asked to participate in a qualitative study to examine the perceptions of teachers and administrators of one-to-one device implementation at the secondary level. In order for a district to be considered as a participant in the study, the school district must have undergone one-to-one technology implementation in grades 6-12 within the past seven years. Multiple perspectives of the one-to-one technology implementation process were considered paramount to establish the veracity of the study.

Within this chapter, the specific methodology of the study is further delineated. Following a brief review of the research problem, the purpose of the study, the guiding research questions, and the research design are more thoroughly explained. The

population and sample, instrumentation, data collection, and data analysis are described in detail.

Problem and Purpose Overview

The length of time between technology development and embedded household use is rapidly decreasing (Manyika et al., 2013). In a matter of two decades, consumer technology in the household is now affordable and found in the hands of mobile device owners around the world (Fox & Rainie, 2014b; Kristen, 2013; O'Toole, 2014). In classroom and school settings, educators strive to provide an environment reflective of the environment outside school walls, while furnishing students with skills and knowledge to be successful within the technology and media-rich world (Troynikov, 2013). In reflecting real-world experiences, educational instructional practices with technology-embedded learning continue to lag behind consumer and enterprise trends (Troynikov, 2013). Therefore, the purpose of this study was to gather and examine attitudes and perspectives of teachers and administrators of secondary schools that underwent one-to-one technology device implementation.

Research questions. The methods of this study were designed to analyze the perceptions of teachers, principals, and superintendents regarding the implementation of one-to-one technology programs in secondary schools. The following research questions guided this study:

1. What perceptions exist, both supportive and challenging, of building principals in regard to one-to-one technology device implementation at the secondary level?

2. What perceptions exist, both supportive and challenging, of teachers in regard to one-to-one technology device implementation at the secondary level?

3. After reviewing the data collected from building principals and teachers, what reflective perceptions do district superintendents have in regard to one-to-one technology device implementation at the secondary level?

Research Design

For this study, perceptual information from educators well-established in one-to-one implementation in the secondary school setting was collected. Merriam (2009), as well as Trochim and Donnelly (2006), described qualitative research as collecting data not recorded in numerical form including interviews, observations, and written documents. Qualitative research is further supported by Patton (2001), who described qualitative data as research that "produces findings arrived at real-world settings where phenomenon of interest unfolds naturally" (p. 39). Bogdan and Biklen (2006), as cited in Fraenkel, Wallen, and Hyun (2012), noted qualitative researchers are not putting together a puzzle whose picture they already know; they are constructing a picture that takes shape as they collect and examine the parts.

Qualitative research was further defined by Fraenkel et al. (2012), who stated, "The natural setting is the direct source of data, and the researcher is the key instrument in qualitative research" (p. 426). The context of the study is important as "activities can best be understood in the actual settings in which they occur," and "human behavior is vastly influenced by particular setting" (Fraenkel et al., 2012, p. 427). Understanding how people interpret their experiences and the meaning they attribute to their personal situations is best described through qualitative research (Merriam, 2009).

In contrast, Creswell (2014) stated quantitative studies are the traditional mode of research, with highly systematic procedures and processes that may not allow the

necessary freedom for innovative and creative research. Creswell (2012) and Merriam (2009) described quantitative research as comprised of data which describe how much or how many and are often presented in numerical form; therefore, quantitative research is limited in the ability to analyze interview responses. This study was designed to obtain an understanding of teacher and administrator perceptions of one-to-one device implementation; a quantitative study structure would limit the depth and range of subject responses (Creswell, 2012). Furthermore, the research design is founded on personal interaction though interview and focus group settings, aligning more closely to qualitative design rather than quantitative structures (Merriam, 2009).

Qualitative research, as defined by Fraenkel et al. (2012), was appropriate for this study since it provided a more holistic view of what was happening in the situation; the researcher "investigates the quality of relationships, activities, situations, or materials" (p. 426). The data for this research included focus group transcripts, interview transcripts, personal comments, and "anything else that can convey the actual words or actions of people" (Fraenkel et al., 2012, p. 427). Since the purpose of this study was to gather administrator and teacher opinions and attitudes about one-to-one implementation, a qualitative research mechanism was deemed appropriate.

In Figure 1, a visual diagram of the research process is provided.

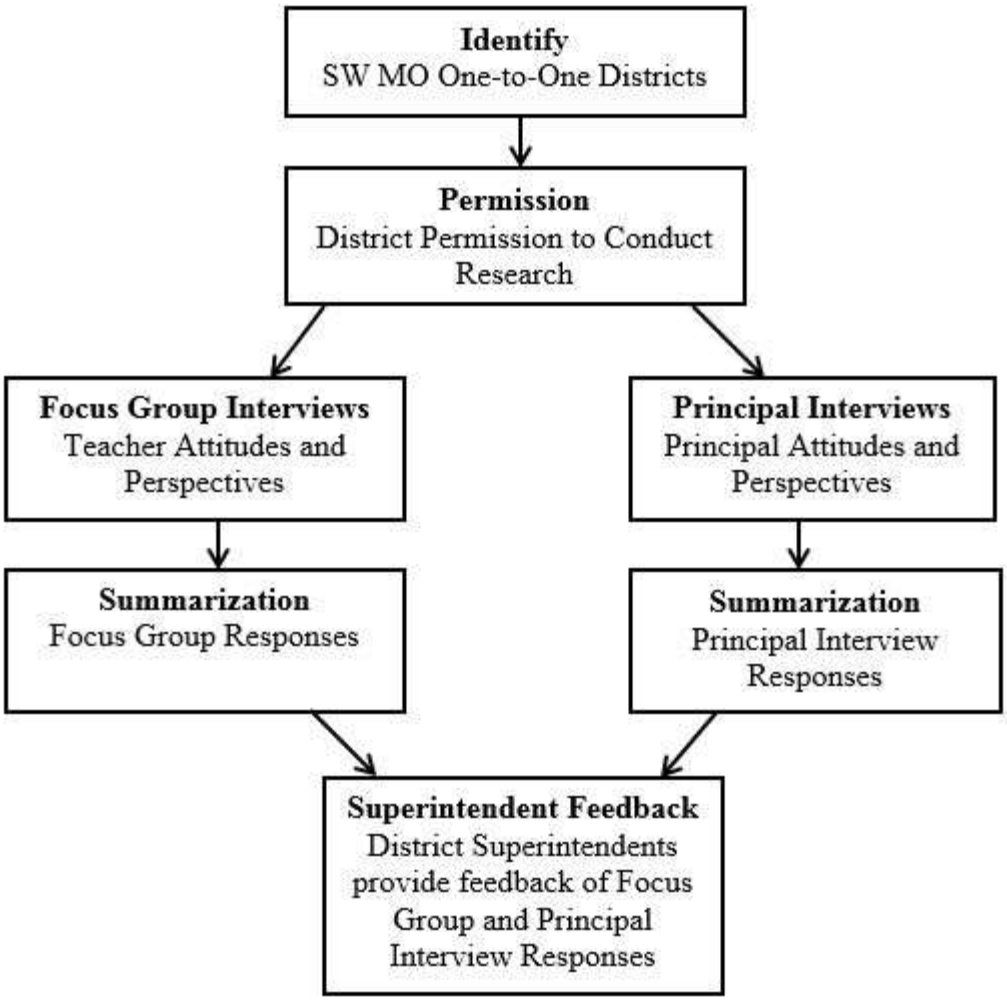

Figure 1. *Framework for the design of the study*

Population and Sample

Public school principals, teachers, and superintendents who were members of school districts in the southwest region of Missouri and who were associated and identified with the Missouri Association of School Administrators (MASA) comprised the population for this study. To further delineate participants for the study, a sample was selected from secondary-level principals, teachers, and superintendents who were

employed in districts where one-to-one technology initiatives had been implemented (Creswell, 2012).

The sample consisted of six school districts that had been involved with one-to-one technology implementation at the secondary level for two to seven years. School districts in the study consisted of student enrollment populations between 300 and 2,500 students in grades 6-12. School districts in various geographical settings of rural to urban environments were invited to participate.

A purposeful sample was created to represent the large individual populations in the study. Creswell (2012), as well as Kisely and Kendall (2011), described purposive sampling methodology as selecting individuals who are often information-rich and who can provide strong meaning to the phenomena observed. A focus group segment was created for the study in the form of a specific purposive sample which included two teachers from each selected district to represent teacher perspectives.

For the qualitative interview portion of the study, the lead building principals, who had been preselected from within the sample districts, were interviewed individually. The interview sample was a homogeneous sampling based on building grade-level configuration to provide an accurate representation of the secondary principal population (Yin, 2011). Two lead principals were selected from the following stratum: grades 6-8 with student populations of 100-400; grades 6-8 with student populations of 401-1,000; grades 9-12 with student populations of 100-700; and grades 9-12 with student populations of 701-2,000.

A third group of participants provided additional perceptions. The superintendent population was represented by a sample group of superintendents of the selected school

districts. A homogenous sample of superintendents established validity of the research using member-checking methodology (Creswell, 2014; Merriam, 2009).

Instrumentation

The instruments selected for this study consisted of interview questions and an electronic questionnaire. Teacher participant perceptions were gained through a focus group setting. Focus group questions (see Appendix A) were created by the researcher and were pilot-tested prior to utilization to increase validity (Yin, 2011). Interviews were used to gain the perceptions of lead principals of buildings that underwent one-to-one technology device implementation. Principal interviews were conducted in semi-structured face-to-face settings (Merriam, 2009). Principal interview questions (see Appendix B) were created by the researcher and were pilot-tested prior to utilization to increase validity.

To ascertain the perceptions of district superintendents, an electronic questionnaire was created by the researcher. Superintendent questions were pilot-tested to increase validity of responses (Creswell, 2014). Superintendents received an electronic document providing culminating responses of teachers and principals regarding one-to-one implementation. After analyzing the teacher and principal data, participating superintendents completed a questionnaire regarding one-to-one technology device implementation in their districts (Creswell, 2014). Superintendent feedback questions (see Appendix C) were created by the researcher and were pilot-tested prior to implementation to increase validity of responses.

Validity. Qualitative studies communicate validity through various terms such as goodness, trustworthiness, and confirmability (Creswell, 2012). Validity was further

supported by strategies of the researcher to reduce bias and to obtain trust of the participants (Gay, Mills, & Airasian, 2011). Trust of the researcher was critical to participants providing detailed and honest information to the researcher (Gay et al., 2011; Merriam, 2009).

Using Creswell's (2012) and Merriam's (2009) language of confirmability and credibility as validity cornerstones, measures were taken within the research structure. Focus group interview questions and administrator interview questions were generated by the researcher. Creswell (2012) noted the value of pilot testing in refining, developing, and clarifying questions and data collection plans. All interview questions and focus group questions were pilot-tested, and feedback data were evaluated to make modifications if necessary to the focus group and administrator interview protocols and questions (Creswell, 2012). Pilot testing questions provided the researcher feedback as to the understandability, the clarity of purpose, and sample focus group and interview dynamics (Creswell, 2012).

To diminish bias, focus group sessions and administrator interview sessions were audio recorded and maintained as confidential digital files and as confidential transcriptions (Creswell, 2014; Maxwell, 2013). A focus group facilitator was selected to lead the focus group sessions. Training was provided to the focus group facilitator to ensure focus group protocols were followed accurately (see Appendix D). Transcription of focus group and interview responses was completed by the researcher and an independent agent to increase accuracy in the meaning of participants' responses (Krueger & Casey, 2014). Upon completion of the transcripts, an informal member-checking process was utilized to increase validity. Lincoln and Guba (1991) described

the use of member checking in qualitative research as the "most crucial technique for establishing credibility" (p. 314).

Threats to validity. The process of validation occurs when evidence is analyzed and collected to support an inference for "appropriateness, correctness, meaningfulness, and usefulness" (Fraenkel et al., 2012, p. 111). Maxwell (2013) further described the validity threat as a way the researcher might be wrong due to an alternative explanation, interpretation, or conclusion. Furthermore, with qualitative design, the researcher must identify the specific threat in question and develop ways to attempt to rule out the validity threat (Maxwell, 2013). The influence of the interviewer to subject responses in both focus group and administrator interviews threatens validity.

Focus group and interview settings are susceptible to transference of beliefs as the interviewer has an influence on the interview environment, collection of interview data, and the analysis of interview responses (Maxwell, 2013). Krueger and Casey (2014) cited, "When asking questions, the session leader must be attentive to how they respond verbally and nonverbally to comments from participants" (p. 101). In an effort to control interviewer influence, focus group and interview sessions followed protocols to minimize the projection of researcher bias upon the interview responses.

Additional threats included instrument decay. Fraenkel et al. (2012) described instrument decay occurring when different interpretation of the results is permitted. To reduce threat to instrumentation, one other research expert coded the focus group and principal interview transcripts for reliability.

External validity, as described by Fraenkel et al. (2012), Merriam (2009), and Maxwell (2013), occurs when the results of one specific study can be generalized to

appropriate populations outside of the study. To ensure external validity, teachers and principals from school districts with a broad range of demographic data provided a basis for common themes of implementation of technology devices. The intent of researching this population was to explore teacher and principal perceptions in-depth and to elicit their experiences relating to one-to-one implementation.

Reliability. A review of both relevant literature and relevant protocols informed this study. Literature from both academic and non-academic sources focused on technology used in education and on one-to-one environments (Golafshani, 2003). Questions about setting and mode were also developed to provide a richer understanding of teacher and administrator perspectives of one-to-one implementation in public schools at the secondary level. According to Yin (2009), a definitive research protocol increases reliability. The researcher consulted literature on qualitative research and used the recommended protocols of focus group research and one-to-one interview research.

Researchers Olsen (2011), Schwandt (2001), and Merriam (2009) described reliability as the ability or the extent to which research findings can be replicated. While qualitative research seeks to describe and explain the world as those in the world experience it, within qualitative research, human experiences are rarely repeated with exacting results (Merriam, 2009). A healthy debate exists within the qualitative research community surrounding the importance of reliability in qualitative research, with most agreeing the repeatability of observations and consistent methods of data collection provide the foundation for a reliable study (Schwandt, 2001).

To gain the greatest accuracy of perspectives, the focus group teacher interviews and principal interviews consisted of common sets of questions delivered in a prescribed

order. A proctor was utilized to administer the teacher focus group interview session. Principal interviews were conducted by the researcher. Each interview consisted of common questions and followed a prescribed order (Merriam, 2009). The focus group responses and administrator interview responses were coded independently by the researcher and an outside agent to reduce bias (Creswell, 2012; Krueger & Casey, 2014; Merriam, 2009). Participating districts were represented by two secondary teachers during the focus groups interviews and by one secondary lead principal during face-to-face interviews (Creswell, 2014; Stewart & Shamsdasani, 2015).

Data Collection

To gain an understanding of teacher and principal perceptions of one-to-one device implementation, three foundational questions were identified addressing the three tiers of the public school organization: teachers, principals, and superintendents. A list was created of school districts within the Southwest MASA region which have undergone one-to-one device implementation within their secondary school buildings in grades 6-12.

Data were not collected or analyzed until after Lindenwood University IRB approval was obtained (see Appendix E). District superintendents who met the one-to-one technology implementation criteria were extended an invitation through electronic mail for school districts to participate in the study (see Appendix F). District superintendents were provided information about the study and a basis for the research. Upon completion of a 14-day district response window, a list of superintendents volunteering to participate was created. Districts responding to the invitation were assigned a number to be randomly drawn for participation. For the study, a target sample of four to six participating schools was initially identified. A total of six districts

responded to the district invitation to participate; therefore, all six were selected for the study (Creswell, 2009).

Teacher focus group interviews. Superintendents of school districts participating in the study were asked to select two secondary-grade level (6-12) core content teachers to participate in a teacher focus group interview. Krueger and Casey (2014) described focus groups as a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment. Once teachers were identified for a focus group session, an electronic mail communicated the expectations and information about the study. Additionally, teacher participants were provided contact information to allow scheduling of focus group interview dates and times. Lindenwood Informed Consent forms (see Appendix G) were collected at the start of the focus group session.

An administrator not associated with the selected districts facilitated the focus group sessions. The focus group sessions were video and audio recorded for accuracy of the data. Additionally, field notes were taken by the focus group administrator in the event of equipment malfunction. The data generated from focus group responses were transcribed and coded into emerging themes using open and axial coding techniques (Patton, 2001). Interviews were conducted to gain the perceptions of lead principals of buildings that underwent one-to-one technology device implementation. The researcher and an associate performed the coding of responses to provide greater reliability (Merriam, 2009).

Principal interviews. Superintendents of school districts participating in the study were asked to identify the lead principal of each building grades 6-12 that

underwent one-to-one device implementation. Once principals were identified for interview sessions, an electronic mail communicated information about the study and requested a phone number to schedule interview dates and times. Participants were asked to indicate a window of time to allow for completion of the interviews. A location was selected to obtain privacy and confidentiality. Lindenwood Informed Consent forms were collected at the start of each interview session.

Interview responses were transcribed by an independent transcriptionist not affiliated with the study. Data generated from principal interview responses were coded into emerging themes using open and axial coding techniques (Patton, 2001). Coding of responses were performed by the researcher and an associate to provide greater reliability in response meaning.

Superintendent reflections. Superintendents of participating school districts were asked to participate in the member-checking procedure of the study. Upon obtaining consent, an electronic response instrument was used to obtain feedback from the superintendent participants. Transcribed and coded themes from teachers and principals were summarized into narrative form and provided to the superintendent group. Creswell (2009) stressed member checking is best done with "polished" (p. 191) interpreted pieces such as themes and patterns emerging from the data.

A document was constructed indicating principal and teacher themes with an attached questionnaire instrument and was delivered to participating superintendents through electronic mail. The questionnaire instrument provided superintendents a) a narrative summary of culminating responses from the teacher and principal interviews, and b) five open-ended questions for superintendents to provide feedback upon analysis

of teacher and principal responses. Superintendents were provided a response window of two weeks to submit their perceptions. Superintendent responses were collected and analyzed to draw emerging attitudes and perceptions within the responses.

Data Analysis

The approach to data analysis for this study represented the approach commonly taken when conducting a qualitative study (Maxwell, 2013). Each focus group and interview session was reviewed through the transcription process. Two different systems of categorizing the information were used, an approach commonly referred to as coding (Fraenkel et al., 2012; Maxwell, 2013).

Open coding indicated distinct concepts, labels for chunks of data, and categories in the data, which form the foundational blocks of analysis (Patton, 2001). Axial coding confirmed the findings in open coding and helped identify relationships among distinct concepts and categories of data (Yin, 2009). Superintendent data collected through the member-checking process were analyzed and organized into themes and concepts. The analysis of collected data provided an opportunity to understand the process of one-to-one device implementation from three perspectives: the teachers, the principal, and the superintendent.

Ethical Considerations

Possible ethical considerations for this study included the personal integrity, sympathy, prejudices, and biases of the researcher (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014). These can enter the research, proving inaccurate findings and swaying questions for interviews and surveys (Sanjari et al., 2014). Further consideration for the participants in the study is supported by Merriam (2009), who

described the participant rights and privacy of utmost importance. A summary of procedural interventions was used to address participant rights as follows: research questions and goals were clearly articulated to study participants; subjects were informed of data collection tools and study design; and participants were able to access written reports and collected data upon request. Participants were identified by anonymous code, and confidentiality was maintained to protect the health and well-being of participants. Moreover, no one was harmed, and no personal information was released. The transcripts are secured in a locked cabinet and will remain secured for a period of three years and then destroyed.

This study included collection of data from human subjects; therefore, safety and ethical considerations were formally addressed. The IRB at the academic institution approved the study protocol prior to implementation. This study was designed and deployed to ensure the integrity of the study was maintained.

Summary

Within this chapter a description of the methodology of the study was presented. A brief review of the problem, research design, and purpose was provided. A qualitative research design was used to obtain the attitudes and perspectives of teachers, principals, and superintendents who recently underwent one-to-one technology device implementation (Creswell, 2014; Maxwell, 2013).

Sample groups selected for inclusion in this study consisted of teachers, principals, and superintendents of school districts in southwest Missouri which underwent one-to-one implementation. A qualitative instrumentation design consisted of

focus groups, interviews, and an electronic questionnaire constructed to ascertain perspectives of teachers, principals, and superintendent groups.

Participant responses were electronically recorded and transcribed. The focus group and administrator interviews elicited attitudes that allowed for themes and categories to emerge following open and axial coding of responses. The methodology, including research design, population and sample, instrumentation, data collection, and data analysis, were explained thoroughly in Chapter Three. In Chapter Four, the analysis of the focus group, interviews, and superintendent feedback responses are organized, analyzed, and synthesized.

Chapter Four: Analysis of Data

Web-based resources and classroom technology are being promoted as the most significant tools for transforming teaching and learning (Blackboard, 2012). Decreasing costs coupled with extensive classroom device options have allowed ubiquitous availability of technology for students and employees as a viable option for school districts (Clay, 2014). Therefore, the purpose of this study was to examine the perceptions of teachers and principals regarding one-to-one technology device implementation within their respective school districts and to provide a resource for other district leaders prior to implementation.

In this chapter, the data collected to answer the research questions are presented. First, the demographics of the participants are offered. Next, the data garnered from the participating groups—teachers, principals, and superintendents—are reviewed. Finally, themes are presented along with a summary of the chapter.

Demographics

Data for this study were collected through focus group interviews, individual interviews, and an electronic questionnaire. Utilizing a list of school districts from the southwest Missouri region of MASA, 34 school districts were identified as having one-to-one device environments in grades 6-8, 9-12, or 6-12. An invitation to participate was sent to the identified one-to-one school district superintendents. Districts agreeing to participate consisted of a combination of rural and urban schools with population ranges of 750-6,000 total students district-wide. A total of eight teacher perceptions were accumulated in a focus group setting, while building principal perceptions were gathered

during 11 individual interviews. A total of five superintendents provided perceptions through an electronic questionnaire process.

Data Analysis

In the following section, the results of the data collection are presented. First, principal interviews are discussed. Next, the teacher focus group results are presented. Finally, the superintendents' perceptions of information from principal interviews and the teacher focus groups are given.

Principal interview results. Building principals who participated in the study held varied building leadership responsibilities. Demographic information was garnered from Interview Question #1 and Interview Question #2. Building principal participants averaged 17.5 total years of educational experience, with an average of 9.5 years in administrative duties. Building-wide one-to-one implementation was considered recent in southwest Missouri, with building principals averaging four years of experience as a leader in a one-to-one environment.

Interview question #3. In one-to-one device implementation, what are the most successful components in preparing students for devices?

The building principals noted very little student preparation was needed as their buildings became one-to-one technology environments. A common thread in responses regarding successful student preparation centered around three themes: levels of student access to technology, previous learning experiences, and having student groups provide feedback on device and software selection.

Principals depicted their students as having high levels of access to mobile devices in the form of smartphones or tablets, regardless of socioeconomic status. Explaining socioeconomic status and devices, Principal P10 stated:

> We are 65% free and reduced [price meals], but what we found is most of our families have Internet access. It goes back to the level of poverty, and sometimes priorities are not what we [educators] would consider when people are short on money.

In reference to federal free and reduced meal price standards, participating school districts ranged from 41% to 87%. Principal P06 noted, "This is the world students live in. We are the ones making a big deal about the devices. Most of them [students] have a portable computer in their pocket every day." With high rates of technology ownership, primary preparation focused on providing students with expectations of intended use outside of school time.

Principals attributed success when students had previous technology access prior to one-to-one implementation. Computer carts and computer lab opportunities were identified as having provided previous technology learning experiences, although limited, which resulted in a more successful transition to one-to-one. Principal P10 indicated:

> It was not much of a leap from what students had previously in the classroom to one-to-one. The expectations surrounding the use of the technology were in place with our previous use of computer carts and computer labs in the classroom.

Districts that incorporated student groups in shared leadership roles regarding one-to-one device implementation realized strong benefits. Utilizing students in pilot projects to examine student devices, student software, and infrastructure functionality brought forth

sound questions to consider, while simultaneously increasing student buy-in prior to whole-building commitment. Principal P03 provided an example of the power of piloting with students, "We felt we had selected a solid device for students. We purchased 60 devices and had a pilot group of students provide feedback, and inevitably we changed to another device due to the questions students brought forth." Furthermore, responses from principals indicated the use of students in committee settings; seeking student input and research on products and processes had positive effects in student preparation.

Interview question #4. What are some of the most challenging elements in preparing students for devices?

When examining challenges with student preparation, commonalities in principal responses focused on communication and training of students on the expectations of use of the one-to-one devices. Middle-level principals (grades 6-8) voiced greater concern about student struggles with appropriate use of devices than did secondary principals. Middle-level principals described more difficulties with physical care of the devices and accessing inappropriate websites, while secondary principals described inappropriate use as bypassing district web filters, downloading movies, and altering device settings to circumvent school safety features.

Principals described using device boot camps, computer nights, and designated time during the school day during the first semester of one-to-one deployment to assist students in digital citizenship and appropriate care and use of the devices. Principal P11 described middle level student preparation, "The first two days of implementation the students did not go to their regular classes; we created a two-day boot camp to train students. I believe we received positive dividends from the two days."

Interview question #5. In coaching staff for successful one-to-one classroom instruction, what professional development approaches were most effective?

When discussing professional development to prepare staff for one-to-one implementation, three commonalities surfaced: early teacher access to devices, professional support from technology coaches, and faculty piloting devices prior to full implementation. Principals communicated the critical need for teachers to have access to devices prior to student device implementation. Length of lead time for teachers ranged from six months prior to 12 months prior to students receiving devices. In addition to early access, principals used structured professional development for teachers and their new devices. As Principal P05 stated, "We didn't just provide them a device and say figure it out; we provided guidance and systematic professional development plan with the device."

The early teacher preparation time resulted in staff dialogue about core beliefs of learning. Principal P08 described the preparation time:

> What stands out for me was the opportunity for staff to state what they truly believe about teaching and learning and how technology can be used to support that. It provided a time for the staff to come to more agreements on what one-to-one looks like.

To support staff in professional growth, principals indicated a key component to success was the addition of instructional and technology coaches who assisted staff in instructional improvement. The coach works with staff to provide assistance and guidance in not only working with improving technology skills but shifting instructional practices. In describing teacher support mechanisms, Principal P01 stated, "Our

instructional support personnel is available 24/7 basically to deliver professional development to teachers at the teacher request." Principals acknowledged the costliness of adding personnel specifically to target teacher improvement; however, the instructional support positions provided quality differentiated professional development beyond the growth measures led by the principals.

Piloting technology implementation by a department or grade level prior to building-wide implementation was identified to be a positive resource to gain insight for upcoming professional development. Additionally, grade-level or department-level pilot implementations provided opportunities for peer-to-peer conversations about instructional effectiveness. Sharing strengths and pitfalls among staff members indicated a shift in ownership of instructional transformation and promoted healthier staff buy-in. Empowering teachers to share and support each other was considered effective professional development. Principal P09 expressed, "One of the best outcomes occurred when I walked into a classroom and a teacher was sitting by another teacher at a computer and having dialogue about how to do something. Leaders quickly emerged from within the staff." Piloting staff technology devices was defined as providing a trial-and-error testing time for teachers prior to full building implementation.

Interview question #6. What challenges, if any, became evident in coaching staff for successful one-to-one classroom instruction?

A thread that emerged when coaching staff in adopting technology for their classrooms centered on professional development opportunities. Responses from principals revealed the initial professional development plans for staff were inadequate and described by Principal P06 as "packaged or standardized."

In addition, principals described frustration during the early phases of one-to-one preparation as teachers were seeking more personalized or customizable professional development. Principal P06 explained, "We realized we were missing the mark. We asked, how do we create professional development that is personalized for each staff member?" Principals also articulated the difficulty in reinforcement and support of recent professional development learning and the pitfalls of one-day professional development scenarios without year-long follow-up. The identified one-day professional development scenarios were categorized as "one hit wonders" by Principal P05. Principals also conveyed the difficulty in universal or building-wide professional development in grades 6-12. The departmentalization of content and wide range of teacher growth needs were identified as problematic, and flexible professional development structures were acknowledged as vital in staff growth. Furthermore, principals reinforced the importance of technology coaches in facilitating personalized growth.

Interview question #7. What professional development training is currently providing the most benefit in transforming the one-to-one classroom?

The purpose in asking this interview question was to provide participants an opportunity to identify any outstanding professional development practices or products discovered during one-to-one implementation. Responses yielded few commonalities among building principals. Principals identified specific software packages and learning management systems as delivery systems for professional development. Participant responses were specific to the culture and needs of the buildings.

Interview question #8. What influence have one-to-one devices had on classroom instruction?

Several topics surfaced quickly when discussing the influence of one-to-one devices on instruction within classrooms. A common thread noted was the obvious change in student learning taking place as technology became more readily available in schools. Principals also noted the shift in learning occurring at school and off campus evolved from teacher-centered to a more learner-centered approach. Principal P07 supported the evolution of student learning by stating, "There is so much information out there [on the web]. It is 24/7. You are not limited to 50 minutes in a class anymore, and there are incredible resources for students and teachers that make learning exciting."

The connectivity between students and school provided opportunities not available previously. Devices and student connectivity to the Internet were viewed as equalizers in student opportunities. Principal P02 stated, "All children will not receive the same level of experiences and support from home. I believe by providing devices, we are also providing opportunities for students to discover all sorts of things outside of our community." Furthermore, Principal P06 described the power of anytime, anywhere learning, "We have a very migrant, mobile community. We have been able to connect learning when students are home with illness, when students are on vacation, and expand learning time into the summer."

Principals who were interviewed illustrated a shift in student ownership of learning and the effects on classroom structures. One-to-one devices provided teachers an ability to create a framework for learning and provided students the ability to make decisions about how they would master many concepts. Principal P03 described the

changes in student instruction, “It has really given the students a little bit more power.” Furthermore, one-to-one devices were identified as a cornerstone in modifying instructional delivery outside of school hours and without school personnel.

Through conversations with building principals, examples of instructional changes were identified. Flipped classroom structures were described as a model in which the classroom leader provides a segment of the lesson on an external site. Principals expressed the most prevalent use was a video recording of the teacher providing content. Principal P06 illustrated a secondary math student in flipped learning model, “Students receive instruction through a video. Then students can review the mathematical instruction as many times as they like from any location.” Prior to technology devices, principals described students as having an opportunity to grasp instruction in class, then once away from school, students relied on other resources such as their parents or tutors to support learning.

Moreover, the impact of one-to-one devices on instruction was illustrated as an amplifier of feedback. Principals noted levels of feedback from students increased due to equity of devices and resources. Principal P01 acknowledged, “We encourage group and project work. During these settings, students receive nearly instantaneous feedback from other students. We believe our technology landscape has multiplied the level of feedback to students.”

Student engagement was also reported as increasing with one-to-one instruction. Principals saw students as more engaged because of a new connectivity to school. Principal P11 reported, “Students collaborate, set calendar dates, share data and images on Facebook, Twitter, Instagram, Snapchat every day. Schools are just catching up

where the students already are." Other principals credited increased engagement as a direct connection to the shift in classroom instructional practices. Students were described as the creators of their own educational journeys. In addition, students were portrayed as having higher levels of motivation when provided additional decision-making opportunities in their learning.

Moreover, engagement levels were linked to the newness of one-to-one implementation. Principals identified early concerns received from staff, who expressed decreasing engagement as the novelty diminished. Principal P11 explained, "We [staff] had several discussions early believing engagement may be up because of the novelty of the devices, after three years of one-to-one, we don't see this as a valid concern."

Interview question #9. Discuss the most challenging components of creating effective instruction with embedded student devices.

Three points of focus were expressed as challenging components in creating effective instruction with embedded devices. The topics included adjustments to classroom management practices, the shift in classroom learning structures, and balance of technology use in the classroom.

Classroom management surfaced when principals discussed the difficulties in creating effective instruction with embedded one-to-one devices. Principals noted challenges in providing classroom management strategies to reduce distractions when using one-to-one devices. Principal P09 discussed distractors:

> Our teachers were struggling with the distraction issues of one-to-one. We [the school district] mitigated some of the distractors, such as blocking access to

> certain sites; however, other teachers became frustrated when the newly restricted resources were unreachable. We provided significant focus toward classroom management strategies to help teachers when dealing with distractors in the classroom.

Coupled with distractors for students, principals noted difficulty for teachers to recognize appropriate engagement of students. Principals shed light on the difficulties in classroom management when each student has a device and noted a simple classroom walk-through observation was insufficient in measuring student engagement in lessons. Principal P11 illustrated, "I have entered classrooms and every student was using their devices with eyes focusing on their screens; however, as I walk around the room, students were off task of the lesson and highly engaged in their personal device." Professional development opportunities were identified as the primary tool used to assist teachers in monitoring student engagement.

The supervision of teachers through walk-through observational processes and peer observations from colleagues exposed engagement and class management concerns. Principals mentioned one-to-one devices as amplifying the visibility of teacher strengths and weaknesses. Principal P05 defined one-to-one teacher amplification, "Teachers who struggle with class management and engagement, the technology in the classroom amplifies the weaknesses of the teacher. By the same token, it exposes how great your master teachers are." Moreover, principals explained the importance of student feedback in identifying teachers who need assistance. Building leaders portrayed student feedback as information coming through student committees, surveys, and student leadership organizations. Principals P08 and P09 echoed the importance of listening to students,

"Students were one of my best sources of indicating teachers who needed support early in our one-to-one adoption."

In examining challenges to effective instruction, the type of instructional structures used in one-to-one classrooms emerged. Principals described one-to-one device implementation as an instrument to shift classroom learning structures from a teacher-centered to a learner-centered approach. Teacher-centered classrooms were illustrated as classrooms in which the teacher is the primary source of all information and the focal point of the learning. Principal P08 described teacher-centered classrooms, "Teachers are the source of correct information. Information or skills are communicated to the student to increase their level of understanding of the standard or concept. The sage on the stage paradigm."

Principals identified a desired classroom model as the learner-centered model and defined learner-centered models as classroom structures in which students have increased autonomy in how they learn the identified standards or concepts. Principal P06 summarized, "[In] the learner-centered classroom, the role of the teacher is a guide, a facilitator, a supporter to the learner. The learner with devices has voice and choice of how, when, where they learn."

The transition from teacher-centered classroom approaches to learner-centered models was portrayed as challenging in respect to teacher preparation and training. Principals described conversations with teachers requesting administrators to provide robust examples of technology-embedded learning structures utilizing student-centered approaches. Principal P04 described the challenges faced in changing classroom instruction, "I have great people leading classrooms; however, let's be honest. Every one

of my teaching staff experienced a teacher-centered classroom as a student. We are asking teachers to transition to a learner-centered model that most have never experienced."

In the transition to learner-centered approaches, principals revealed early teacher pitfalls in shifting classroom instructional approaches. Teachers were personified as merely substituting technology for learning strategies they were using prior to one-to-one devices. Principals noted frustration with a lack of examples modeling effective instruction with one-to-one technology embedded into learning.

In shifting to learner-centered approaches, building principals identified the SAMR model as a guide used to assist in transforming instruction with the support of technology. The SAMR model, identified as Substitution, Augmentation, Modification, and Redefinition, was developed by Dr. Rueben Puentedura (Romrell, Kidder, & Wood, 2014), who established four levels of technology-infused learning. Principals identified teachers in the initial enhancement levels, which are levels one and two, as substitution and augmentation, respectively. In embedding the SAMR model, principals specified using teacher professional development goals to move staff forward to transformative instructional levels of modification and redefinition within the SAMR model.

Building leaders characterized instructional balance as a difficult campaign for their buildings. Principal P02 illustrated:

> We provided a professional development segment on flipped classroom. The next thing I knew, I had parent phone calls indicating their students had five hours of video to watch to be prepared for tomorrow's lessons. Our teachers were video recording themselves and flipping their content, but teachers didn't communicate

to each other. Students were being bombarded.

Principals stressed the importance of collaboration within the building to provide a balanced day for students. One-to-one buildings were portrayed by Principal P04 as a "learning team, and good teams communicate where each other will be in the designated play."

Interview question #10. How has one-to-one implementation changed you as a facilitator of learning?

Principal responses brought significant reflection on the structure of school. Examples were given on how providing technology to both students and staff has shifted building administrators' thinking process. Principal P02 described the identified change and stated, "Technology availability for every student has caused me to rethink school and student learning. I continue to believe students still need some levels of educator face-to-face time, but they don't need a 1970s, 1980s, or 1990s classroom model."

Building leaders also reflected on their beliefs before and after one-to-one implementation and conveyed a change in perceived areas of importance. Leaders described early structures were in place to prohibit students from using devices in ways that were inappropriate. Principal P11 explained, "We were exploring what it meant to educate the technology-equipped student, but we looked at some of our school practices and procedures and thought…they are just silly." Principal P04 shared:

> I think about three to five years from now. I question myself as a leader. Am I providing the right tools in my teachers' hands? Am I presenting teachers opportunities to be successful and allowing students to be innovative in their thinking?

Principals also described how their leadership style changed with staff. Principal P03 noted, "Within a few years, I have moved to more of a teacher empowerment model of leadership. Similar to the learner-centered classroom, we are empowering teachers in a collaborative mission to find effective learning practices." Principals described the implementation of one-to-one as liberating and providing an opportunity to explore a variety of instructional approaches to future learning. Principal P01 expressed excitement as a building leader of the one-to-one initiative when purporting, "I remember when we received the official word we would get devices for staff and students; I felt like the district gave me a green light to move away from the traditional classroom textbooks, chair rows, paper, and pencil school."

Building leaders identified the importance for staff to witness building leaders setting examples of available learning strategies. Principal P08 stated, "I try to model what I am expecting," and Principal P02 noted, "I try to model viable classroom examples." Principal P01 illustrated the responsibility of demonstrating for staff and students, "I work hard to keep up with current examples to model to the students and staff. I am fortunate that I have technology coaches who can assist me and help me in providing strong instructional examples."

As principals presented conversations of best practices, a common thread, risk-taking and handling unexpected issues in class, emerged. Principals discussed the importance of risk-taking on the part of leadership when modeling for staff and students. Principal P04 provided an example, "I was leading a student assembly, my technology completely crashed. I initially panicked, then I realized what a great opportunity for staff and students to see the expectation."

Interview question #11. How has student learning benefitted in your building upon implementing one-to-one devices?

Principals provided multiple threads of thought to describe benefits to student learning. Flexibility in student learning, personalization of learning, and levels of student engagement were noted as of the most benefit. Further conversations of significance included differentiation of student learning and greater equity in student learning opportunities.

In regard to flexibility in student learning, building principals noted with the adoption of one-to-one technology came the opportunity for increased learning as the devices traveled from classroom to home. Flexibility was described by interviewees as the when, where, and how of learning. In examining student assignment submissions, building leaders noted the unique times at which students were found to be online submitting assignments, involved in chat sessions with teachers, and collaborating with other students. Principal P03 illustrated, "Our data demonstrated the devices were allowing students to tailor the learning around their life activities."

Principals reported teachers provided examples of student work, and the digital time stamp on assignments brought realization to staff of the diversity of student learning. Principal P04 described, "Our staff has seen students weave learning activities after school with work, at church, or any place they choose." Communication and collaboration between teacher and student altered as one-to-one provided opportunity to receive quick help from teachers online. Principal P11 shared:

> Our staff have online computer chats with students over assignments, receive emails, or tweet-ups related to the classroom, all occurring after school hours

> when teachers were once considered unavailable. Our message to new secondary teachers, get ready, you will be contacted by students at all hours about their learning….and our district is OK with that.

Principals also noted an increase in communication and collaboration between teachers and students after school hours.

Principals described significant variance in household support of one-to-one devices with wireless access and detailed pre-implementation processes in obtaining home connectivity information from families. Conversely, in post-implementation data connection regarding home connectivity, principals described students as very resilient in finding connectivity. Principal P01 related of students' ability to find wireless connectivity, "Our teens can sniff out wireless almost as fast as free food. We learned our students almost always find a way to connect. Instead of borrowing a pencil, our students will ask each other to use their hotspot to get online." One aspect of the use of technology revealed was students using wireless hotspots, which had become the norm for outside-of-the-building connectivity. Principals gave examples of students on devices at football games, band competitions, or in parts of the district where wireless is not provided.

In addition, principals spoke to the ease of distance learning when situations forced the students to miss school. Examples provided of distance learning through one-to-one devices helped mitigate absenteeism when disruptive family situations and long-term student illnesses occurred. Principal P05 described, "One student was required to be with their family in Europe. While away, our student accessed information, completed

lessons, and we used the opportunity to connect the classroom with the student in a video conference based lesson."

Personalization of learning was described as a significant benefit to student learning. Principals declared one-to-one implementation allowed students to be released from the assembly line learning path. Principal P04 supported, "Our students are not required to take traditional notes and complete abundance of worksheets. One-to-one [has] provided more autonomy for students in using software tools to demonstrate their knowledge." Principal P10 illustrated, "In most situations students are allowed to use apps or software of their choice to produce their papers, presentations, videos. By allowing the student more choice in the tools for their learning, we see higher levels of interest." Principal P05 described tailoring student learning, "It's their learning; it should be personalized." Building principals shared one-to-one devices have provided students an opportunity to create learning systems that best fit their learning styles, their activity schedules, and their family structures.

Since beginning a one-to-one structure in their buildings, principals again reported a higher level of engagement in students. Principals restated higher motivation as students were provided more control and increased ownership of their learning. Principal P04 explained, "When our teachers have appropriate classroom instructional models, our students with devices have demonstrated more engagement. The learning is driven by them." Furthermore, Principals P02, P03, P04, P06, and P10 specifically identified the terms "voice and choice" as critical components to increased student motivation and investment in the learning processes. Principals noted the difficulty in

attributing student engagement to one specific event or factor; however, they attributed strong support for student involvement in learning decisions.

Interview question #12. If implementing one-to-one for the first time in your building, what would you do differently?

When reflecting on the entire one-to-one device implementation process, principals conveyed the importance of implementation struggles and successful experiences for students and staff. Principal P10 explained, "When we went through these processes people had to work together. Our students, teachers, and administrators had to find solutions, and we learned plenty." Building leaders identified one-to-one implementation as a rallying point and provided a sense of unification of staff toward a mission. Principal P01 illustrated, "I think one-to-one implementation is experiential, and you have to go through it. If I miscalculated anything it was the importance of the journey. The plodding through and perseverance was very beneficial." Principal P06 noted, "I don't think I would change anything simply because it allowed us to see our strengths and weaknesses, and it pushed us into looking at our model and is this best for students." Furthermore, building leaders expressed the importance of timelines and pacing. Principal P01 explained:

> We are a smaller district. We entered into the one-to-one arena a little later than some of our area colleagues. Early, we observed where others were in other districts, and thought, we will be this far along at this point, not so. Implementation and changing instruction is not a race, and we had to put on some blinders and build our structure for our students and community.

Principals expressed implementation as a balance and described at times the process in their buildings going too fast and other times going too slow. Principal P07 provided an analogy, "Like a swimming pool, if you don't get in the water, you can't swim. We got in the water and learned."

Communication to parents and community also emerged from discussions with principals when reflecting on implementation. Principals described parental communication was not as successful as desired. Leaders described difficulty finding successful methods to connect parents to the changes in the learning process. Principal P02 noted the struggle:

> I don't have the answers, but I would like to have more parents to understand our processes. In the beginning, parents were very fearful that we were going to laptops and teachers weren't teaching anymore. We offered opportunities after school and evenings to communicate and answer questions. We had very low turnout. We are still looking for ways to increase parent education.

Principals illustrated multiple opportunities were provided for parents to engage in the implementation process and to learn how the classroom was going to change. Principals offered food opportunities such as chili night and targeted family convenience with scheduled device learning sessions prior to sporting or activity events.

Additional reflection yielded responses targeting device selection and purchases. Principal P08 stated:

> We were one of the front runners in implementation. Our Board of Education and administration wanted the best for students; however, I think we learned a lot from our device selection. If I had a second chance, I would advocate for piloting

a few different devices prior to a district-wide purchase. No blame aimed at anyone, but you don't know what you don't know.

Principal P09 supported, "We jumped in and purchased devices and cases. The cases turned out to be a flop. It's not the big picture, but maybe we should have investigated a bit better." Principal participants conveyed the implementation process in each district had small issues; however, principals indicated they would change very little if given the opportunity.

Teacher focus group results. Teachers participated in the study from various classroom assignments and grade levels. To protect teacher participant responses, pseudonyms were used in the focus group structure to protect identities. Interview Question #1 and Interview Question #2 obtained demographic information from the participants. Teacher participants consisted of mostly females with only one male participating. The average teaching experience of participants was 12 total years, with a range from three years to 20 years. Since building-wide, one-to-one implementation is recent to southwest Missouri, the teacher participants averaged 3.08 years of experience in a one-to-one classroom environment.

Interview question #3. In one-to-one device implementation, what are the most successful components in preparing students for devices?

Commonalities in responses from teachers identified previous learning and preparation as an integral part of students receiving a device for school and home. Teachers noted students in general had a solid understanding of the functionality of one-to-one devices and required less class time to prepare for learning. Ms. Brown explained, "The students' previous knowledge really allowed me to get into my lessons much

quicker that I thought I would." Supporting the advantages of student technology familiarity prior to one-to-one, Miss Smith stated, "As far as the technology goes, I quickly reviewed with students the computer skills and moved into the lesson. I just had to be patient, but for the most part students using the device was not an issue."

Teachers also indicated students gained previous technology expertise and skills from home and social settings and from previous exposure in school settings. Ms. Brown noted, "We weren't one-to-one until a few years ago; however, our district had computer labs and computer carts for teachers in lower grades, so our students had prior training, not to mention their use of computers at home." Classroom teachers reported because students had previous computer knowledge and skills, the implementation of one-to-one required less time than anticipated in pre-implementation preparation plans.

Additionally, teachers believed clarity of vision and communicating expectations were key to student preparation success. Miss Smith noted the importance of the district vision statement, "Our district has a strong vision statement. The kids heard our vision statement every morning. We feel it is important that the students know where we are headed and the expectations." Furthermore, teachers discussed providing vision and expectations for one-to-one implementation to students and parents in the same setting was key. Mr. Grey described, "In the fall prior to devices, we had parent nights, which we spent time going over our one-to-one implementation and the expectations. We found this helpful."

Teachers conveyed having opportunities to meet with parents and students to review the devices and to provide a district message of the vision for using technology in learning. In Miss Green's district, a different plan of communication was used to cast

vision and expectations. She noted, "We designed a special day. Community members and the School Board participated as students took their device to different stations. Our goal was to remove assumptions, teach about the device, teach about expectations, and ensure everyone was connected."

Interview question #4. What are the most challenging components in preparing students for devices?

In examining challenges in preparing students for one-to-one, a difficulty that emerged was student maturity. Miss Jones illustrated this point when she stated, "You can't keep them off Spotify. I feel I have good classroom management, but some students struggle with distraction temptations." Ms. Brown shared:

> I have older students, and time wasted from immature actions can be a challenge. In Google docs, I had students deleting, altering, editing other's work. Things like that wasted lots of instructional time, and I don't have a solution yet.

Teachers in the focus groups described student class preparation as a struggle and listed concerns such as students leaving their devices at home or not being able to use the devices due to the batteries needing charged. Miss Rose summarized how classroom preparation has changed when she stated, "Same student organizational issues, just with different tools." Frustration was expressed with students not grasping the gravity of the one-to-one device value. Miss Jones clarified, "It's a $1,000 piece of equipment. We repeatedly examined how to grow a seventh grader in being careful with their devices. However, we witnessed backpacks being slung around, and we knew one of our devices was probably inside."

Interview question #5. What components of staff professional development leading up to the implementation were most helpful?

The most prominent response to this question was early access to the technology devices. Teachers defined lead time as the amount of time teachers had prior to student one-to-one technology implementation. Classroom instructors reported feeling more confident and having an increased comfort level when districts provided six to eight months of preparation prior to students receiving devices. Miss Green communicated the importance of lead-time, "Giving the staff their own computer eight months prior to the students was our number one thing. It provided us time to learn, explore, and get prepared at our own pace."

The most common length of lead time teachers received devices prior to students was six months. The most common faculty device rollout was noted by teachers as being a July purchase and setup, August delivery to teachers, and first semester lead time to become comfortable with the devices before student devices deployed in the initial weeks of second semester. Miss Rose explained her building's expectations about faculty devices, "We received devices a semester before the students. Our principal communicated that he had no expectations. That was the best message we could have received. Everyone was able to take a deep breath and just dig in." Furthermore, Mr. Grey discussed the trust provided to teachers in his district, "We were given time to go through as a department to find best practices and examine applications we felt were appropriate. I was confident, because I had time to be prepared."

When discussing professional development, teachers described their districts using learning management systems to deploy professional development training.

Learning management tools such as Canvas, Google Classroom, and Schoology were identified as delivery mechanisms for teacher growth. Mrs. White shared, "Our building used Google Classroom as a tool to provide professional development. We would enter our Google Classroom account, and we would have targeted lessons to assist us in preparing for classroom instruction." Miss Scarlet defined her building's use of Canvas, "The use of Canvas was huge for teachers. Our professional learning helped us prepare to use Canvas with our students."

In examining best practices of staff professional development, classroom leaders identified teachers coaching fellow teachers in a capacity-building approach as effective. Mr. Grey explained, "Key staff members attended multiple professional developments and would return and present during faculty meetings to provide professional growth on using the tools and strategies they had observed." Teachers conveyed the use of lead teachers and technology coaches when professional development opportunities were presented.

Additionally, teachers described the use of peer observation practices as a professional development opportunity. Peer observation was described as teachers visiting other classrooms in a non-evaluative capacity to gain insight into what strategies are most beneficial. Miss Rose provided an example of a district peer observation, "We created a technology team which visited schools who were already involved in one-to-one. The technology team visited peer district classrooms, took notes, asked questions, and established connections with teachers for future resources." Teachers who were interviewed for this study communicated the power in teachers observing other successful teachers. Miss Rose reflected on the power of peer observations, "We found

two strengths. One, teachers in midst of teaching do not always realize what is going very well. And two, we picked what we thought was best, and what we wanted to learn more about."

Interview question #6. What are the most challenging pieces of staff professional development?

When discussing challenging pieces of staff professional development, teachers identified issues such as time, staff turnover, and being overwhelmed with new applications and tools. Time emerged as a challenge in professional development. Teachers called attention to the struggle of finding time outside of classrooms to practice, learn, and integrate technology applications into the lessons. Ms. Brown shared:

> When I looked at apps and new software, I never had the time to see a fraction of them, let alone master any of them. I would witness a colleague being highly successful and would find she is using an app that I am unfamiliar with. I would work at night, while at home, trying to learn and integrate the app to be effective. It takes an incredible amount of time in the background away from class.

Additionally, teachers described the difficulty in finding job-embedded time. Professional development days were described as very positive and motivators to dive into new applications in the classroom; however, very little job-embedded time was given to work together in teams to develop strategies for implementation. Miss Smith expressed the difficulty in keeping up with limited time during the day, "I would get so much from professional development days, and I was so pumped. Then I get to my prep period, and I have 1,000 other things to do before I can get to explore the new practice."

Teacher responses indicated classroom teacher turnover as a significant frustration with professional development. District or building professional development models were depicted as moderately successful as principals struggled to differentiate for individual staff members. Miss Smith articulated how professional development was impeded by staff turnover, "We adopted a program, received training, and by the end of the year we lost a third of our department. The next fall we literally started over with the training to get the new people up to speed." Teachers in the focus groups explained professional development was presented to the whole group and was identified as cycling at remedial levels because of teachers leaving the district.

Interview question #7. What types of ongoing professional development provide the most benefit?

In examining teacher beliefs of beneficial professional development, two topics surfaced: time and freedom. One practice deemed crucial was the creation of additional time for teachers to research and examine tools and implementation protocols prior to embedding into lessons. Miss Green explained, "Our district offered time in the 'parking lot.' The parking lot is professional development established to allow teachers to learn new strategies or tools. It allowed us time and a place to go and play and use the tools." Furthermore, time was also directed to teachers for vertical grade-level work. Miss Jones stated, "We worked vertically. It was beneficial for me to observe my fellow teachers in grades seven and eight. It was bizarre that I am only two grades removed and I did not know their practices worked so well."

Exploratory freedom for teachers and designated time to allow exploration were identified as fundamental in pursuing successful classroom strategies in one-to-one

implementation. Mrs. White voiced the importance of teacher freedom within the professional development framework for her building:

> In the fall semester our building principal challenged us to come up with something you wanted to learn and then implement in second semester. The challenge provided first semester time to work with instructional coaches, principals, and content colleagues. Prior to implementation in second semester, we were required to meet with our supervisor and describe our learning goals, and how we were going to use it in the classroom. On a professional development day at the beginning of second semester we presented our learning to a group of eight teachers. It was extremely positive.

Additionally, teachers conveyed the importance of all teachers sharing new learning and ideas with others. Teachers described a component of professional development relied on sharing of practices among the staff. Miss Green explained, "We were provided time, but we were accountable to share our research and ideas with others."

Interview question #8. What influence have one-to-one devices had on classroom instruction?

Teachers shared the importance of equity of devices and the importance of equal availability of resources for every student. When speaking of resources, teachers described the significant change in classroom resource needs for students. Mrs. White discussed resources pre- and post- one-to-one device implementation, "I had a stack of magazines used to gain ideas and information for class projects. I prepare the resources electronically, or students can search and find resources that fit within our learning. Accessibility of resources has been increased tremendously."

Additionally, the time taken to arrange library and computer lab time was also described as diminished. Miss Green explained the change with resources, "The library is not obsolete, but I competed with other teachers to get library or computer lab time. With one-to-one, my students remain in the room and research online. I believe we are more efficient with our time." Teachers also described the efficiency of resources for students away from school. Mr. Grey described, "Many students do not have the learning resources at home, nor does the family have the ability to take the student to the public library. With the school devices, our students access the resources at home."

Teachers also described an increase in student communication and collaboration skills as a benefit of one-to-one devices. Mrs. White shared her view of the increase in communication and collaboration:

> In secondary, we have multiple sections of the same class, such as English I. Prior to one-to-one, student-to-student or teacher-to-student collaboration occurred face-to-face. With our devices, students are collaborating with each other at all hours of the day.

Teachers described online collaboration and communication as a key component in liberating learning from the confines of school walls. Mrs. Lavender explained, "A colleague and I were able to place 50 students in the same room, an electronic room. We created an interdisciplinary piece, which we grouped students outside of our classroom walls. Students collaborated through chats, peer editing, resource sharing." The quality of work emerged as a benefit when speaking of student collaboration. Mrs. White conveyed, "I find that my students collaborate together, and I am constantly amazed what

they come up with. They [students] typically surpass expectations and do more than what you asked them to do."

Teachers noted the benefit of anytime-anywhere learning and how one-to-one had mitigated the boundaries of school or classroom walls. Miss Jones conveyed the extension of the learning day:

> In the past we have had learning outside of the school day; it was called homework. However, it was up to the parent, or the onus was on the student to figure it out. I use Screencast-o-matic to create a recording of my lesson and post the video to YouTube. I also add a virtual nerd that has great two-minute videos of how to do one concept. The devices have enabled us to move the classroom to home.

Mrs. White expressed the importance of learning outside of school walls, "When students graduate, we do not want learning to cease, we want to model that learning is anytime and anywhere. Learning is not confined to the school."

Interview question #9. Discuss the most challenging components of creating effective instruction with embedded student devices.

Classroom leaders noted unclear and inconsistent expectations from leadership when addressing classroom instruction with embedded devices and a lack of consistency in app use. Teachers identified a lack of understanding of appropriate integration of technology in lessons and portrayed the expectations of the district as an unclear target. Ms. Brown explained, "Technology-embedded lessons were difficult to determine the appropriate amounts of student computer use in the lesson construction." Teachers within the focus groups identified colleagues who transferred all components of lessons

to a digital format. Mrs. White clarified, "Teachers must understand that it is possible to substitute everything into the devices, but that is not best. Instructional models such as the SAMR model are used to reach a higher level of learning, but not replace everything." Furthermore, teachers indicated difficulty in finding high-quality examples of classroom lessons. Mrs. White noted, "Everyone speaks of SAMR, but is there a site with access to sample lessons which accomplishes the SAMR frameworks? I haven't found such a site."

Furthermore, classroom teachers described difficulty in discerning the appropriate balance of student learning within the classroom versus the amount occurring outside of the school walls. Ms. Brown explained the difficulty in assessing the balance between school and non-school learning, "When thinking about creating learning experiences, I find it difficult to determine how much face-to-face versus online time should be involved." Mrs. White provided an example of the importance of helping students with the balance, "Checking my email a couple of hours after a class, I noticed an email from a student asking to go to the restroom. Instead of asking verbally, they sent an email. It made me reflect, are my lessons out of balance?"

Additionally, teachers described flipped instruction models as another area they struggled with balancing. Ms. Brown shared:

> When flipping, the balance of what I teach, and what should be discovered by the student, can become tricky. I have colleagues, in my view [who] are not teaching at all. They are having students watch videos and then just checking on them during class time. Not all learners do well with that type of classroom.

The long-standing classroom practice of note-taking emerged as a difficult topic with focus group participants. Mr. Grey described:

> I have gone back and forth with colleagues and the administration on class note-taking. I believe it improves retention of content, and there is some research that indicates the benefit; however, I know our administration wants us to use the laptops.

Furthermore, the importance of teacher professional development surfaced as a key piece in reducing frustration in creating effective classrooms. Miss Scarlet clarified:

> We had a lot of teachers on board with one-to-one. However, a clear mental image of what a good classroom looks like was not there. Throwing out tutorials and saying, "Watch this video and complete this assignment," the teachers were not prepared for flipped instruction.

In describing other difficulties, the participants communicated a wide range of platforms and applications can be problematic with students. Teachers identified students had difficulties when district-defined core applications and programs were not agreed upon. Mr. Grey described his experience with implementation and multiple programs, "We had 6-8 different platforms that teachers were using. Kids were trying to remember passwords and how to submit, where to submit; there was not a consensus on the key tools we were to use." Teachers conveyed identification of building-wide programs and applications as essential in supporting students and staff in implementation.

Interview question #10. How has one-to-one implementation changed you as a facilitator of learning?

Teachers identified two changes in student learning which emerged as affecting teachers: first the source of information, and secondly, the ownership of learning. Miss Jones explained the change in teacher responsibility, "Historically, the teacher researched, gathered, assimilated, and organized information prior to providing a lesson to students. I do not have to be the information source anymore. In fact, I tell my students frequently, 'Let's find the answer.'" The release from being the primary information source for students was described as beneficial to teacher effectiveness. Mr. Grey explained:

> One-to-one has provided opportunities for teachers to be more efficient. You can use the technology when it is applicable and more effective in the flow of the lesson. Previously, there were two days in the computer lab available, so I would save all my technological stuff for these two days and try to squeeze it all in. Teachers use devices when it is coordinated with the lesson, not based on the computer lab schedule.

Additionally, teachers communicated the shift in teacher roles as facilitator of learning. Miss Smith described shifts in teacher-leader to learner empowerment, "Students are becoming the leaders of their learning. They are empowered to find the truth, instead of listening to what I say or another teacher says." Teachers defined inquiry-based and problem-based approaches as frequent practices in one-to-one settings. Teachers believed using inquiry and problem-based approaches increases student empowerment of their learning.

Teachers reflected on new classroom formats with one-to-one. Miss Rose explained, "Teachers can examine upcoming standards, connect them to real world

obstacles, and allow the students to investigate, to problem solve, and be inquisitive of their world. Students explore at their desks; we just need to provide guidance." Miss Smith explained classroom management, "The building beginning one-to-one and learner-centered structures has made me a better manager in the classroom. I focus on keeping students on track of the learning road ahead."

Interview question #11. How has student learning benefitted from one-to-one devices in your district?

Teachers expressed three areas of learning most affected by one-to-one implementation. Teachers identified equity in student access to information, along with a shift in the ownership of learning. Lastly, the classroom leaders described students utilizing the Four Cs of 21st Century Skills at an increased level after the implementation of devices.

Equity of student access to information was observed to increase as every student received a device. Equity, as defined by teachers, consisted of all students receiving equivalent access to information and learning resources in school and non-school settings. Miss Green stated, "All students underwent training in use of search engines and best practices in researching information. Our devices provided access to information and learning in both inside and outside of school."

Ownership of learning was an augmented result of building one-to-one implementation. Miss Smith noted the increased levels of students taking charge in the learning process at her school:

> Since obtaining one-to-one in our district, students are asked to lead in their learning. Each year we ask our students to sign up in our Tech Camp, where

students lead and instruct teachers on different areas of technology.

The shift to increase student access to information was identified by teachers as modifying the role of the teacher. Miss Smith described the benefits of the learning shifting to students, "Students have choice in the learning. The individual devices opened a door for student individualization, allowing for a multitude of ways to demonstrate their understanding."

Teachers communicated the implementation of one-to-one devices had increased the amount of student usage in the Four Cs of 21st Century skills in student learning. Teachers defined the Four Cs as Communication, Collaboration, Critical Thinking, and Creativity Skills (P21 Partnership for 21st Century Learning, 2016b). The teacher group identified student collaboration and communication skills were present in social media networks prior to one-to-one devices in their buildings. Miss Jones championed:

> One-to-one devices prepared our graduates for the world they were about to enter. Whether it was college or the workforce, I believe moving to one-to-one provided students with tech skill development and abilities to work with others through digital platforms.

Teachers viewed the Four Cs as critical in preparing students for post-secondary success.

Interview question #12. What would you do differently if the district was just beginning to implement one-to-one devices?

Teachers indicated one-to-one implementation was smooth and reflected they would change very little about the process. Miss Smith explained the teachers' perspective, "I don't know that we would have done anything differently, or that we did anything wrong." Miss Jones echoed a similar sentiment, "I do not believe we would

have done anything differently; however, we just plunged in and tried to figure it out." Teachers stressed the importance of district commitment to one-to-one and for teachers to be active in the process of implementation. Miss Smith believed teacher commitment to one-to-one was like an analogy to swimming in a cold pool, "We did not dip our toe in the water when it came to one-to-one; we jumped in and got started. I believe that was best for our school district."

Additionally, teachers specified the significance of the employment of a technology coach to assist teachers in the transition. Ms. Brown explained, "Our implementation went very well. I think we could have used another technology coach to help teachers in being more prepared for students." Furthermore, districts purchased extra devices to help during the early phases of implementation. Ms. Brown described the benefits of extra devices, "Early part of implementation, students had issues with their devices. It would have been helpful to have extra devices available so students would not spend half the hour messing with their device."

Superintendent feedback results. Superintendents who participated in the study represented school districts of various demographic characteristics and population sizes. The superintendents received the culminating responses from the teacher and principal interviews through electronic communication and reviewed the summarized information about one-to-one implementation. Pseudonyms were used to represent superintendent responses to protect the identity of participants. All participants were males with an average of 5.6 years as district leaders. All superintendents participating in the study were involved in one-to-one implementation within their districts.

Superintendent question #1. In examining the provided teacher and principal responses and reflecting on your school district's one-to-one implementation, what are the most challenging components in preparing for one-to-one devices?

Superintendents described students as the easiest component of preparation for one-to-one device integration. Superintendent responses aligned with teachers and principals when student adaptability was described. Superintendent S01 conveyed, "The preparation of students was the easiest part of the transition to one-to-one. The students in our district were up for the task and demonstrated a willingness to try new things." Superintendent S02 concurred and added, "Our students live with technology 24/7 and are far more comfortable with experimenting with apps and software."

Superintendents depicted preparation of district staff and infrastructure readiness as the greatest hurdles for implementation. Superintendent S03 described his district implementation, "Our concern was the infrastructure not being ready and not handling the pressure of the students and teachers calling upon it. If the infrastructure was weak, it would have been frustrating for everyone, and we were fearful of losing momentum." Superintendent S01 supported concerns with infrastructure, "We were trying to match the infrastructure to the needs of students. That can be difficult when not having many area districts around us to glean experiences from."

The superintendents in the study described students as flexible in preparation for one-to-one; however, they indicated even students required preparation for devices. Superintendent S04 reiterated, "Students need training in dealing with the added temptations of potential distractions that one-to-one devices bring to the learning environment." Superintendent S05 agreed and stressed the importance of understanding

demographics and the cultural position of the community, “Many of our families have access to email and the web at home; however, the level of access was limited. Many of our students needed additional training to be on task and working toward the lesson and learning.”

Superintendent question #2. In comparing and contrasting the commonalities from building administrator and classroom teacher responses, what conclusions did you draw about professional development?

Superintendents expressed the critical importance of professional development in implementation and preparation for district one-to-one devices. Superintendent S05 shared his district’s beliefs about staff professional development, “Professional development was a critical component to our one-to-one implementation. We knew our principals needed support for the task.” Superintendent responses aligned with those of the teachers and principals in the importance of instructional support personnel described as technology coaches. Superintendent S05 expressed the importance of technology coaches to his district, “The technology coaches were a huge success in our decision-making when it comes to professional development.” Superintendent S02 echoed a similar sentiment, “Professional development for teachers came from a vision of what we wanted our classrooms to look like in the future. We provided teachers early access to devices and lead time and collaborated on a start date for implementation.” Furthermore, superintendents noted the focus on devices and equipment as an early pitfall; however, the process brought a focus on ways to transform learning.

Additionally, superintendents expressed difficulty in establishing a timeline for professional development prior to implementation. Superintendents described early plans

for four to five months of professional development and transition to one-to-one with students. However, superintendent responses identified some buildings within the districts were not as ready for one-to-one students as other buildings. Superintendent S01 expressed the importance of analyzing the staff prior to implementation, "Our staff received devices prior to students. We used that window of time to provide professional development and to assess the readiness of the staff."

Superintendents communicated the importance of an assessment of staff readiness prior to student device implementation. Superintendent S03 discussed his district staff professional development, "I believe our staff was prepared. You can never have enough professional development to get everybody ready. At some point we agreed, it was time to move forward and get devices in the hands of students." Superintendents identified the building principal as the primary assessor of staff preparedness.

Superintendent question #3. What conclusions did you draw regarding the impact of one-to-one devices on instruction?

Superintendents expressed high levels of pride in leading their districts to one-to-one technology initiatives. However, superintendents conveyed the importance of the teacher as the primary reason for success in the classroom. Additionally, superintendents noted the importance of teachers using the right tools in classroom instruction to assist students in current learning and in future preparation. Superintendent S04 noted the impact of the teacher on student learning, "I still believe the impact of instruction depends on the teacher in the room." Superintendent S01 expanded on the classroom teacher being instrumental to student learning, "The teacher is the key. We asked this question. Are teachers using technology as a tool to lead learning, to coach students, to

guide students, or are they simply using technology and teaching the same way as they always did?" Superintendent S02 supported the importance of professional development to prevent simple substitution of technology for pencil and paper, "For a one-to-one environment to impact students in a meaningful way, we must provide support through professional development and training. If not, the devices will be used to replace worksheets and other instructional tools of the past."

Additionally, superintendents viewed technology devices as responsible for significant instructional change in classrooms. Superintendent S03 conveyed:

> The impact on instruction has been monumental with devices for each student in the classroom. The ability of a device for each child has increased the learning at the hands of students, and the learning is available at anytime and anyplace.

Superintendent S05 pointed toward teacher responses of one-to-one devices' effect on instruction, "Our district will look back on one-to-one implementation as a time where classroom learning changed."

Superintendent question #4. What impact has one-to-one implementation had upon student learning?

Superintendents believed one-to-one has had a positive impact on student learning. However, superintendents expressed the evidence is not easily discernable to attribute one-to-one as directly linked to student improvement. Superintendent S03 related, "We communicated to parents that you cannot attribute one tool from the toolbox as the most important. All the tools are important to student learning, and all are needed for students to be ready for life." In describing the difficulty to have quantifiable evidence of the impact, Superintendent S05 explained further:

> One-to-one implementation is an initiative that our school board, administrators, teachers, and community believed would be beneficial for students. We developed focus groups to gain input prior to going the one-to-one direction. We know it is the right thing for students, but the evidence of success won't necessarily show up on state test scores or college placement levels.

Superintendent S03 agreed there is difficulty in finding data to prove one-to-one impacts student success, "Our district hopes we are preparing students for success after school, and I believe one-to-one devices are instrumental in student preparation for life; however, I can't verify that with data."

Furthermore, superintendents indicated level of access for students has a significant impact on learning. Superintendent S02 stressed the importance of access in his district, "The biggest impact that one-to-one implementation had on our district is the accessibility to classroom learning. Our students have 24/7 access to classroom materials and to communicate with peers and their teachers through the use of the technology." Superintendent S04 noted the access as liberating and described it as an equalizer of students:

> Our district consists of a significant free and reduced lunch population. The level of access of information, resources, and experiences and resources has not been equal. We believe the technology in the hands of every student has equalized that disparity.

Additionally, superintendents explained the need for educators to change and adjust teaching and learning to meet the needs of the current learner. Superintendent S05 stated:

> For our district, one-to-one devices were critical to matching student learning to

> the world environment our students live in. Students have technology readily available in every part of their life except at school. We needed to align instruction, or the school world, to the way students learn and live. I see the impact as a re-alignment.

Superintendent S03 agreed, "We have to recognize the world we live in. I would have been frustrated as a student if we threw away paper/pencil and used an inkwell and a feather quill."

Superintendent question #5. If implementing one-to-one for the first time in your district, what factors, if any, might you do differently?

Superintendents conveyed a sense of pride in the implementation of one-to-one, with little response to changing the processes of implementation. Superintendent S02 shared, "We would like to think we did things right in our implementations. I don't believe I would change much in the way we did things." Superintendent S05 conveyed a similar belief, "We worked very hard to think of every scenario and every group of constituents. I think for the most part, our implementation was well-organized and successful."

In reflecting on implementation, superintendents communicated the importance of leadership being committed to the vision and of moving forward without having all answers available. Superintendent S02 related:

> We could have and possibly should have taken another year prior to implementation; however, you have to be willing to make the jump and get started. I am most proud of our staff and their commitment to move instead of remaining as is.

Superintendent S01 provided support in moving away from the status quo:

> We knew we were taking a big leap. We knew our parents were observing and waiting. We were prepared with our infrastructure, our teachers were ready, and it was time to place the devices in the hands of the students.

Superintendents described the reward of initiating one-to-one as strong enough to move forward with implementation without every aspect of the rollout being finalized.

Emerging Themes

Principals, teachers, and superintendents shared their perspectives of the process of implementing one-to-one devices. An extensive review of the data was conducted, and several themes emerged as important when a district is deciding to begin a one-to-one technology initiative.

Time. As participants described and reflected on one-to-one preparation and implementation, time emerged as a theme throughout all participant group responses. In an analysis of responses, time was an overarching component in both the preparation phase and the implementation phase of one-to-one devices for students. In analysis of preparing students and staff prior to devices, participants linked community culture, prior levels of technology within the district, and overall building dispositions to change in teaching and learning as key factors in the amount of time necessary before providing devices.

Key personnel. A theme emerged from the responses identifying the importance of employing key personnel specifically to assist teachers and students with one-to-one implementation. Participants agreed districts should employ personnel described as technology coaches to assist staff and students in the transition to one-to-one devices.

Participants emphasized the importance of establishing a non-supervisory and non-evaluative role of technology coaches when working with teachers. Technology coaches were seen as highly effective resources prior to and after student device implementation.

Shift in teaching. A theme emerged from the collective responses of the principals, teachers, and superintendents regarding the evolution of the role of teachers in the classroom setting. Participants conveyed a change occurring in teacher roles as devices provide significant learning resources to students. Responses identified teachers as having a diminishing role as the primary source of information. Clarity of effective teaching in technology-enhanced environments was identified as critical for teacher growth. The transition from teacher-centered classroom to learner-centered classroom was seen as requiring significant commitment to professional development from the district and teachers.

Shift in learning. When analyzed, the responses centered around a shift in learning as a prevalent theme. Participants viewed schools as the place where student learning once occurred, and with the aid of technology viewed learning occurring in any location. Additionally, participants viewed school, and specifically the classroom, as a place to guide student learning. The level of access to information provided by technological devices was seen as moving learning away from school walls.

Furthermore, data indicated the call for greater levels of critical thinking, problem solving, and collaboration skills to be integrated into learning. The participants agreed on the importance of working toward greater personalization of learning. Participants identified the need to incorporate learning systems that provide students with options to increase ownership.

Summary

The data collected for this study were comprised of teacher and administrator perceptions of one-to-one technology device implementation. Interviews were conducted with principals, and a focus group was formed to gather teacher perceptions. Additionally, an electronic questionnaire was utilized to gather reflections of superintendents who reviewed the culminating responses of teachers and principals.

Teacher and principal responses conveyed the importance of pacing in implementing one-to-one in building environments. Furthermore, a multiyear phase-in of technology was suggested to provide teachers and students opportunities for new instructional methodologies to be refined. Pilot testing prior to implementation as a way to gain information and knowledge of possible successes and pitfalls prior to building-wide implementation of devices was also encouraged.

While teachers and principals conveyed an overall positive outcome to their implementation, both groups described challenges faced prior to and during implementation. Staff professional development practices were perceived as difficult to create and implement due to a wide range of support required by teachers. Furthermore, principals described the necessary shift from teacher-centered instruction to student-centered instruction required significant professional development time to assist teachers.

Teachers and principals described one-to-one implementation as the avenue to bring greater personalization of student learning, providing equity of resources for all students and greater opportunities for learning to occur outside of the classroom. The importance in the learning gained by the process of implementing one-to-one within the

building was noted. In reflecting on the implementation process, principals indicated very few changes if given the opportunity to repeat the implementation journey.

Superintendents echoed the responses of teachers and principals, describing students as the easiest group to adjust to one-to-one implementation. Furthermore, superintendents indicated professional development for staff as most challenging and requiring the highest level of resources and flexibility. One-to-one devices were described as bringing resources and learning opportunities outside of the school day to the fingertips of students. Superintendents expressed pride in the accomplishments of their students, staff, and community in moving forward with one-to-one implementation.

In an analysis of the data, themes emerged from the responses of principals, teachers, and superintendents. Four themes emerged from the data: time, key personnel, a shift in teaching, and a shift in learning. In Chapter Five, the findings and conclusions derived from the data and implications for practice are presented. Chapter Five concludes with recommendations for future research in one-to-one device implementation.

Chapter Five: Summary and Conclusions

This qualitative study was designed to provide insight into teacher, principal, and superintendent perceptions of one-to-one device implementation in southwest Missouri school districts. Specifically, the goal of this study was to provide further understanding of which one-to-one implementation practices, procedures, and methodologies introduced beneficial aspects or barriers to school districts' efforts to pursue a future-ready learning environment. Data for this qualitative study were collected through focus group interviews, semi-structured interviews, and superintendent reflections. Teacher, principal, and superintendent responses were analyzed to identify overarching themes.

Previous researchers have examined the levels of technology in schools and the needs of the learner. Prensky (2001, 2010), Jukes (2006, 2012), and Tapscott (1997) promoted the need for a change in educational systems to alter instructional practices to align with the modern student. Despite significant investments and expectations of one-to-one device implementation in many school systems, Bebell et al. (2014) found it difficult to summarize the impacts of various one-to-one programs.

The intent of this study was to examine the perceptions, both positive and challenging, from teachers, principals, and superintendents of southwest Missouri school districts that underwent one-to-one device implementation. Additionally, the study was designed to gain knowledge of actions taken prior to and during implementation which provided benefits or barriers to successful implementation. The findings of this study are discussed in light of Prensky's (2001, 2010) Digital Natives framework, which was reviewed in Chapter Two. This chapter includes a consolidation of the findings of the study in regard to the three research questions posed at the onset of the study.

Conclusions drawn from those findings are discussed in terms of overarching themes which emerged from participant responses. Implications for practice are addressed, and recommendations are offered for further research. Finally, the chapter concludes with a summary of the most significant elements of the study.

Findings

The study involved data gathered from 11 building principals, eight teachers, and five superintendents from school districts which had undergone one-to-one device implementation in southwest Missouri. All participants experienced one-to-one implementation within their respective positions. Focus group and interview questions were utilized to gather teacher and principal perceptions, while superintendent reflections were obtained through electronic questionnaire.

Interviews with building principals brought forth several key points in addressing one-to-one device implementation. Students and teachers required preparation prior to one-to-one device delivery; however, teachers required significantly more preparation than students. Principals described previous technology experiences with computer lab settings, classroom computer carts, or partial classroom device availability resulted in higher levels of student and teacher adaptation to a building-wide, one-to-one environment. Furthermore, in addressing teacher preparation, principals indicated the addition of technology coaches was viewed as beneficial in transforming classrooms from teacher-centered to learner-centered.

One-to-one device implementation as described through teacher focus group interviews brought both similar and contrasting responses to those of building principals. Teachers aligned with principals in identifying students as the easiest stakeholders to

transition to one-to-one devices within school settings. The ease of transition was linked to previous classroom experiences provided by the district in the form of computers labs, computer carts, and partial classroom device levels.

Additionally, in identifying effective processes designed for teacher readiness of one-to-one, teachers sought additional time to design lessons and prepare for device rollout. Additional time was necessary as teachers identified a shift in student learning. Teachers viewed learning moving from the school building to anytime-anywhere as one-to-one devices provided connectivity and access to information.

Superintendent responses provided similar and contrasting viewpoints from teachers and principals. The superintendent participants in the study sided with principals and teachers in describing students as the easiest to prepare for one-to-one device implementation. In addressing staff preparation, effective professional development was identified as difficult to create and implement; however, enlisting technology coach positions to assist with teacher preparation and transition to one-to-one device structures was viewed as highly successful.

Superintendents described establishing and maintaining timelines as very difficult when preparing for one-to-one device rollout. They viewed implementation of technology devices as analogous to diving into a swimming pool. In contrast, teachers and principals related needing more time for preparation prior to student device rollout. Additionally, superintendents noted a change from traditional classroom instructional strategies and structures to a learner-centered environment.

Conclusions

Conclusions were drawn from the data to answer each research question:

1. What perceptions exist, both supportive and challenging, of building principals in regard to one-to-one technology device implementation at the secondary level?

2. What perceptions exist, both supportive and challenging, of teachers in regard to one-to-one technology device implementation at the secondary level?

3. After reviewing the data collected from building principals and teachers, what reflective perceptions do district superintendents have in regard to one-to-one technology device implementation at the secondary level?

Perceptions of building principals. The building principals interviewed for the study were like-minded in the positive benefits of one-to-one implementation. Principals noted the importance of time to successfully implement one-to-one. The amount of time required for students differed from the time needed by staff members. Principals viewed students as adapting quickly and incorporating technology into their learning environments. The ability of students to rapidly adjust to technology aligns with Prensky (2001, 2010) and Jukes (2006, 2012), who described students as Digital Natives, and links a generational connection to technology as identified by Choi and Lee (2015).

Furthermore, preparing teachers for one-to-one classrooms required significant time and support mechanisms prior to and after implementation. The shift of teachers from content expert to learning facilitator, as described by Godsey (2015), was found to be challenging. Personalized professional development in the form of technology coaches was viewed as successful in shifting teachers' instructional practices. Time must be provided to allow teacher-centered classroom learning models, as described by November Learning (2013) and Herold (2015), to meet the needs of Digital Native students, as described by Prensky (2001, 2010) and Jukes (2006, 2012).

Perceptions of teachers. Teachers who participated in the study were unified in their perceptions of one-to-one devices having positive effects on students and learning. In preparing for one-to-one devices, teachers experienced high levels of technology availability and skills in students prior to device distribution. The ease of technology adoption for students in participating districts reinforced Pew Internet's (2014) report stating today's youth are entrenched with technology.

Furthermore, the importance of time surfaced with teachers as instrumental in successful preparation and implementation of one-to-one. Providing opportunities for teachers to create and make instructional changes is necessary to bridge technology with content. November Learning (2013) and UNESCO (2011) identified staff professional development opportunities as critical elements in matching teaching and learning to the modern student.

Perceptions of superintendents. The introduction of one-to-one within a school district was unanimously conveyed as a priority goal among participating superintendents. Supporting research by Ally and Prieto-Blazquez (2014), district leaders recognized the necessity to provide resources for teachers to create opportunities for student success beyond state and national assessment scores. The view of one-to-one devices in school settings aligned with research by Herold (2015), who described the device movement as becoming more prevalent and standardized in student learning structures.

Furthermore, the role of the superintendent in one-to-one implementation reflected a position of less detail than principals and teachers. Bebell et al. (2014) viewed district leaders as providing students an opportunity to increase learning at the hands of a

keyboard or tablet. Superintendents viewed themselves as more global in perspective when reflecting on one-to-one implementation and as having less granularity than teachers and principals. Additionally, superintendents were seen as communicators of one-to-one vision and timeline and as providers of monetary resources and oversight of personnel.

Themes. In examining culminating responses from principals, teachers, and superintendents, four themes emerged from the data. The data forming the themes were gathered through focus groups, individual interviews, and superintendent reflections. The four themes were time, key personnel, shift in teaching, and shift in learning.

***Time*.** In analysis of responses, time was an overarching component in both the preparation phase and the implementation phase of one-to-one devices placed in the hands of students. The discussion and analysis by the staff brought forth discussion of individual needs and personalization of learning frameworks (Godsey, 2015; Jukes, 2006, 2012; Prensky, 2001, 2010). Participants linked community culture, prior levels of technology within the district, and overall building dispositions to change as key factors in the amount of time necessary before providing devices (Jukes, 2012; Maher, 2012; Mitra, 2013; Prensky, 2010; Zur & Zur, 2016).

***Key personnel*.** A theme emerged of the importance of key personnel employed specifically to assist teachers and students in one-to-one implementation. Providing personnel as a resource accelerated the transition of teachers from teacher-centered classrooms to learner-centered models (Ally & Prieto-Blazquez, 2014). Participants identified a significant benefit when districts employed personnel described as

technology coaches to assist staff and students in the transition to one-to-one devices (Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010).

Furthermore, the role of the technology coach personnel aligned as a resource for teachers and staff (Ally & Prieto-Blazquez, 2014). Participants emphasized the non-supervisory and non-evaluative roles of technology coaches in working with teachers (Lasry et al., 2013; Lasry et al., 2014). Technology coaches were seen as highly effective resources prior to and after student device implementation (November Learning, 2013).

Shift in teaching. A theme emerged which identified the evolution of the role of teachers in the classroom setting. Participants conveyed the significant resources provided by technology devices as promoting a change in teacher roles in the classroom (Godsey, 2015; Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010). Participants identified teachers as having a diminishing role as the primary source of information for students (Godsey, 2015; P21 Partnership for 21st Century Schools, 2016a; Scott & Palincsar, 2013). The transition from teacher-centered classroom to learner-centered classroom was seen as requiring significant commitment of professional development from the district and teachers (Ally & Prieto-Blazquez, 2014; Bebell & O'Dwyer, 2010; Goodwin, 2011; Jukes, 2006, 2012; Prensky, 2001, 2010).

Shift in learning. A shift in the learning was identified as a prevalent theme. Participants viewed schools as the place where learning once occurred and viewed the role of teachers and principals to be facilitators of learning (Godsey, 2015; Jukes, 2006, 2012; November Learning, 2013; Prensky, 2001, 2010). The level of information access provided by one-to-one devices was viewed as a catalyst to provide learning outside of school walls (Jukes, 2012; November Learning, 2013; Palfrey & Gasser, 2010).

Furthermore, data indicated the call for greater levels of critical thinking, problem solving, and collaboration skills to be integrated into student learning (Coalition of Essential Schools, 2016; Garrett, 2008; Jukes, 2012; Richtel, 2012b) and for greater personalization of learning (Herold, 2015; Jukes, 2012; November Learning, 2013; Prensky, 2001, 2010). Participants identified the need to incorporate learning systems that provide students with options to increase ownership (Jukes, 2012; Mitra, 2013; Nagaraju et al., 2013; Prensky, 2010; Victor, 2015; Vygotsky, 1978).

Implications for Practice

The principals, teachers, and superintendents who participated in this study had positive perceptions regarding one-to-one device implementation within their respective districts. The findings and conclusions of this study suggest important implications in regard to implementing one-to-one devices in secondary school settings. Many implications for practice are indicated for varying educator populations; however, school districts considering one-to-one devices for students will likely gain the most benefit.

District leadership may value the research gathered in this study because it displays the important factors in successful implementation of one-to-one devices in southwest Missouri schools. Entire district, K-12, one-to-one implementation was not found in participating districts. Device implementation in participating schools was sequential or building-by-building. Therefore, building principals were viewed as having a critical role in overseeing a building one-to-one vision and implementation among participant groups within the study (Shapely, Sheehan, Maloney, & Caranikas-Walker, 2010). Casting a clear technology vision required sound understanding of the knowledge,

skill, and understanding levels of teachers and students (Bebell & O'Dwyer, 2010; Jukes, 2012; Prensky, 2010).

In review of the research and data in the study, a recommendation is to incorporate needs assessment instruments to obtain a wide scope of data from stakeholders. Feedback avenues such as public forums, electronic survey tools, and focus groups would provide school leaders an evidence-based framework to provide devices to each student (Bebell & O'Dwyer, 2010; November Learning, 2013). A needs assessment would furnish district leaders data to construct an implementation vision, align avenues of professional development, and establish a relevant timeline for implementation.

Furthermore, research from the study indicated the need for flexible timelines within implementation. Establishing feedback mechanisms, which assess teacher and student readiness, would enhance building-wide one-to-one implementation. Participants in the study described professional development as a challenge, along with specifically targeting the change in structure of learning with one-to-one device access by students. Using staff assessment strategies, the building principal could target professional development schemes to provide higher levels of teacher assistance.

Teachers can use the information of the study to better understand the significance and importance of transitioning from traditional teacher-centered classroom structures to learner-centered structures when one-to-one devices enter the classroom arena. Advancements in student access to information continue; therefore, teachers must begin to view themselves as facilitators of learning. This study resulted in data to support one-to-one devices extending learning beyond school walls; therefore, adjustments in classroom instructional strategies are necessary.

Superintendents may benefit from the research gathered in this study because it revealed the avenues other districts have selected to address challenges and celebrate successes. The research indicated the need for district superintendents to be flexible and willing to apply resources as challenges arise in the preparation and implementation of devices. District-level administrators may use this information to gain insight to the practices and protocols which could be the most effective in future implementations within their districts.

Most importantly, this study could have significant impact on the future of students. One-to-one implementation and increased access of information to students are challenging previous learning models. One-to-one devices for students in educational settings is a topic growing in popularity. District leaders are examining ways to increase technology access for students, and a device for every child is the final goal.

Recommendations for Future Research

This qualitative study focused on principal, teacher, and superintendent perceptions of one-to-one technology device implementation in secondary schools. Future research analyzing principals and teachers at the elementary levels would be complimentary to this study. The perspectives from all levels of education would offer insight into the vertical implementation of devices for student learning. The successful integration of one-to-one technology tools to increase student learning requires the collaborative effort of students, teachers, and community.

This study was limited in the number of individuals interviewed. It is further recommended research on one-to-one device implementation continue with a greater population outside of the southwest Missouri region. A greater sampling of perspectives

would bring a deeper analysis of implementation successes and challenges. Additionally, this would allow varying perspectives on one-to-one device implementation due to geographical location and larger sample size.

This qualitative research did not include interviews of students associated with one-to-one implementation. Future studies could include student perspectives to gain their insights of the benefits of district processes leading up to device deployment and post-integration perceptions. Furthermore, the inclusion of parents could further the depth of understanding the one-to-one learning transition.

The scope of the research used strictly qualitative measures to obtain data. In the future, a quantitative approach could be utilized to examine how implementation of one-to-one technology affects student achievement on state or national assessments. Furthermore, additional quantitative data may focus on longer-term academic performance as students matriculate through grades 6-12.

Summary

The concept of providing a technology device for every child is a topic becoming increasingly popular nationwide and within the Midwest region. This qualitative study was designed to discover perceptions of principals, teachers, and superintendents of one-to-one schools in southwest Missouri. In this study, the perceptions of principals, teachers, and superintendents were aligned when describing one-to-one device implementation as having positive effects in their respective school districts.

In Chapter One, a historical basis for the research was provided. The conceptual framework, the statement of the problem, and the purpose of the study were presented. The research questions to guide the study were posed. Additionally, the definition of key

terms, limitations, and assumptions were detailed. In Chapter Two, a literature review was included to generalize the climate of technology and corresponding response of schools in providing technology to enhance learning environments. The main topics of discussion were to define the levels of technology, to examine the Digital Native and the way students learn, and to identify the changes that face Digital Immigrants in creating learning systems to meet the needs of the modern student.

In Chapter Three, the methodology used in this qualitative study was described. An overview of the problem and the purpose of the study was presented. Descriptions of the population and sample were provided, as well as the instrumentation used. An overview of the data collection and data analysis processes was identified.

Chapter Four included the perceptions and opinions of principal, teacher, and superintendent participants of the study. Interview, focus group, and electronic responses of participants were analyzed. In this study, the perceptions extrapolated from the responses provided a wealth of qualitative data to support future one-to-one device implementations.

The findings from the analysis of data and a summary of the finding were presented in Chapter Five. Each research question was revisited, and conclusions were discussed. Implications for practice were addressed, and recommendations for future research concerning one-to-one device implementation were presented.

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Appendix A

Teacher Focus Group Questions

General

1. Please share the number of years in education.
2. Please share the number of years your classroom has experienced one-to-one devices.

Student Preparation for One-to-One Implementation

3. In one-to-one device implementation, what are the most successful components in preparing students for devices?
4. What are some of the most challenging components in preparing students for devices?

Professional Development for One-to-One

5. What components of staff professional development leading up to the implementation went well?
6. What are some of the most challenging pieces of staff professional development?
7. What types of ongoing professional development provide the most benefit?

Effect on Classroom Instruction

8. What influence has one-to-one devices had on classroom instruction?
9. Discuss the most challenging components of creating effective instruction with embedded student devices?
10. How has one-to-one implementation changed you as a facilitator of learning?

Student Learning

11. How has student learning benefitted from one-to-one devices in your district?

Reflection

12. What would you do differently, if the district was implementing one-to-one devices?

Appendix B

Principal Interview Questions

General

1. Please share the number of years in education.

2. Please share the number of years you have experienced one-to-one devices as a building leader.

Student Preparation for One-to-One Implementation

3. In one-to-one device implementation, what are the most successful components in preparing students for devices?

4. What are some of the most challenging elements in preparing students for devices?

Professional Development for One-to-One

5. In coaching staff for successful one-to-one classroom instruction, what professional development approaches were most effective?

6. What challenges, if any, became evident in coaching staff for successful one-to-one classroom instruction?

7. What professional development training is currently providing the most benefit in transforming the one-to-one classroom?

Effect on Classroom Instruction

8. What influence has one-to-one devices had on classroom instruction?

9. Discuss the most challenging components of creating effective instruction with embedded student devices?

10. How has one-to-one implementation changed you as a facilitator of learning?

Student Learning

11. How has student learning benefitted in your building upon implementing one-to-one devices?

Reflection

12. If implementing one-to-one for the first time in your building, what would you do differently?

Appendix C

Superintendent Reflection Questions

Student Preparation

1. In examining teacher and principal responses, what are the most challenging components in preparing students for devices?

Staff Professional Development

2. In comparing and contrasting the themes from building administrators and classroom teacher responses, what conclusions did you draw about professional development?

Effect on Classroom Instruction

3. What conclusions did you draw regarding the impact of one-to-one devices on instruction?

Student Learning

4. What impact has one-to-one implementation had upon student learning?

Reflection

5. If implementing one-to-one for the first time in your district, what factors, if any, might you do differently?

Appendix D

Focus Group Proctor Instructions

Thank you for agreeing to be the Focus Group proctor for this study. In order to achieve highest level of consistency and reliability, you are being trained to facilitate this process. Please follow the instructions given and ask any questions to clarify and simplify the process as needed.

1. Equipment. The Focus Group interview session will be recorded both by video and by audio means. You will be provided a video camera, equipped with a blank video cassette, a tripod, an extension cord, a power strip with five AC ports, and an AC cord to connect the video camera to the power outlet strip. A digital audio recorder will be provided to you to audio record the interview session as a backup. The audio recorder uses a SD memory card to house the recording. The memory card will be provided for you and will be inserted into the recording device. Lanyards for each interview subject will be provided to assist in participant identification during the interview process.

2. Physical Environment. Arrive 45 minutes early to examine the Focus Group interview location. Prior to interview subjects arriving, arrange the interview subject chairs in a semi-circle shape facing a single chair for the Focus Group Proctor. The semi-circle should be close enough to the moderator to maintain eye contact during the session. Using the tripod, arrange the video camera to the left or the right shoulder of the Focus Group Proctor to successfully capture all the interview subjects' faces and body language. Arrange a desk, chair, or small table between the Focus Group Proctor and the interview subjects' seating to provide the audio recorder maximum opportunity to pick up all responses. Test the recording devices prior to interview subjects' arrival by pressing record, saying a few words, pressing stop, followed by rewinding to ensure both video and audio recording devices are working properly. Ensure the video frame of the video camera is large enough to capture all subjects; however, "tight" enough in the frame to obtain clarity of responses and body postures.

3. Completion of the session. Upon completion of the session, press stop to both the video camera and audio camera. Power down or turn off both recording devices, leaving the media in both devices. Carefully pack up equipment and return to the researcher.

4. Greet the interview subjects. You will be provided bottled water for the participants. Greet the participants as they enter the room by shaking their hands and introducing yourself to the interview subjects. Offer the interview subjects a bottle of water and communicate the location for the interview subjects to be seated and the expected time to start.

5. **The interview**. Once all subjects have arrived, or it is time to start the interview process, guide the interview subjects to their seating area. Once subjects are in place, turn on the audio recording device followed by the video recording device.

a. Provide each participant with Lindenwood Informed Consent to Participate in Research Activities form. Verbally go over the consent form with the group reminding subjects they do not have to respond to every question and that they can terminate their participation at any time. Remind the participants the session is being recorded and any member who is uncomfortable with being recorded may exit the session at any time.

b. Participants will be identified as Teacher #1, Teacher #2, etc. Participants will use a marker and write the letter of their first name on a 2' x 2' card to be attached to a lanyard.

c. Welcome the participants and begin with brief introductions (example: Let's begin with some introductory comments about ourselves. Teacher #1, why don't you start, and we will go around the table, provide Teacher #1, Teacher #2, etc.). Participants will be asked to communicate 1) the number of years in education, and 2) the number of years teaching in a one-to-one classroom.

d. Focus Group interview questions will be followed in sequential order. Carefully read the questions as worded. Prior practice in reading the questions may provide greater confidence during the session. In presenting questions, utilize the pause and the probe technique. Upon reading the question, provide a five-second pause to elicit responses. Responses may be short or unclear; you may probe the participant by using terms such as **"Tell me more,"** or **"Would you explain further,"** and **"Can you provide us with an example?"**

e. As a proctor, you may assist in ensuring participant meaning is not lost by taking field notes during the session. Field notes are taken by recording major themes, ideas, comments, or observations during the interview session.

6. Closure. Upon completing the battery of questions and when clear all responses are complete, communicate to the participants, "That concludes our interview questions." Thank the participants for participating in the study.

7. Data security. Turn off all recording devices. Leave the video cassette in the video camera and leave the SD card in the audio recorder. Break down the recording devices and return them to the researcher. The data collected will be transferred directly to the transcriptionist, including video camera and recording, audio recording, and field notes taken.

Appendix E

LINDENWOOD

LINDENWOOD UNIVERSITY ST. CHARLES, MISSOURI

DATE:	February 9, 2016
TO:	Stewart Pratt, Ed.S.
FROM:	Lindenwood University Institutional Review Board
STUDY TITLE:	[823745-1] Teachers and Administrator Perceptions of One-to-One Technology Device Implementation
IRB REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	February 9, 2016
EXPIRATION DATE:	February 9, 2017
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this research project. Lindenwood University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the IRB.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the completion/amendment form for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of February 9, 2017.

Please note that all research records must be retained for a minimum of three years.

If you have any questions, please contact Megan Woods at (636) 485-9005 or mwoods1@lindenwood.edu. Please include your study title and reference number in all correspondence with this office.

If you have any questions, please send them to mwoods1@lindenwood.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Lindenwood University Institutional Review Board's records.

Appendix F

Lindenwood University
School of Education
209 S. Kingshighway
St. Charles MO 63301

Dr. xxxxxss, Superintendent
Xxxxxx School District
Xxxxxxx, Missouri, xxxxx

Dr. Xxxxxx,

I am conducting a research study titled, *Teacher and Administrator Perceptions of One-to-One Technology Device Implementation*, in partial fulfillment of the requirement for a doctoral degree in Educational Administration at Lindenwood University. The research gathered should assist in providing insight on the perspectives of teachers, principals, and superintendents who are working with one-to-one technology device implementation.

As a district which has undergone one-to-one device implementation in 6th-12th grade ranges, I am extending an invitation to participate in this study. The scope of the study includes voluntary participation of two core content area teachers from a building with one-to-one technology device implementation. Additionally, the study will include voluntary participation of a lead principal of a building with one-to-one device implementation.

Participation is voluntary. Participants may withdraw their consent at any time without penalty. The identity of the school district will remain confidential and anonymous in the dissertation or any future publication of this study.

Please do not hesitate to contact me with any questions or concerns about participating in the research. My contact information (email: [redacted] or phone: [redacted] You may also contact the dissertation advisor for this research study, Dr. Sherry DeVore (Phone: 417-881-0009 or email: sdevore@lindenwood.edu). A copy of this letter and your response should be retained for future reference.

Respectfully,

Stewart Pratt
Doctoral Candidate
Lindenwood University

Appendix G

LINDENWOOD

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES

Teacher and Administrator Perceptions of One-to-One Technology Device Implementation

Principal Investigator __Stewart Pratt_____
Telephone: [redacted]

Participant _____Contact info _____

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1. You are invited to participate in a research study conducted by Stewart Pratt under the guidance of Dr. Sherry DeVore. The purpose of this research is to gain insight from teachers and administrators in implementation of 1:1 technology devices in secondary school settings.

2. a) Your participation will involve:

- Approval from school district administration to make contact with you to participate in the study.
- Submit Informed Consent for Participation in Research Activities Form.
- Subjects will be selected to participate in either a focus group interview or a face-to-face interview setting.
- Within the interview setting, provide personal attitudes, perceptions, and experiences to the questions presented regarding one-to-one technology integration in your district.
- Anonymity procedures will be utilized in the interview setting and throughout the research.
- Interviews will be digitally recorded to provide the highest accuracy of responses given.
- Classroom teachers agreeing to participate in the study will be contacted to establish a time and location to participate in the Focus Group interview setting.
- Administrators agreeing to participate in the study will be contacted to establish a time and location to participate in the interview setting

b) The amount of time involved in your participation will be 90 minutes of time participating in an interview.

Approximately 18-29 subjects will be involved in this research. The research will take place at two locations. Focus Group interviews will consist of 8-10 participants, while face-to-face interviews will consist of 6-12 participants, and superintendent feedback will consist of 4-7 participants.

3. There are no anticipated risks associated with this research.

4. There are no direct benefits for you participating in this study. However, your participation will contribute to the knowledge about technology implementation in school settings and may assist other school districts in preparing for a successful one-to-one technology implementation.

5. Your participation is voluntary and you may choose not to participate in this research study or to withdraw your consent at any time. You may choose not to answer any questions that you do not want to answer. You will NOT be penalized in any way should you choose not to participate or to withdraw.

6. We will do everything we can to protect your privacy. As part of this effort, your identity will not be revealed in any publication or presentation that may result from this study and the information collected will remain in the possession of the investigator in a safe location.

7. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Stewart Pratt, at [redacted] or the Supervising Faculty, Dr. Sherry DeVore, at 417-881-0009. You may also ask questions of or state concerns regarding your participation to the Lindenwood Institutional Review Board (IRB) through contacting Dr. Marilyn Abbott, Provost, at mabbott@lindenwood.edu or 636-949-4912.

I have read this consent form and have been given the opportunity to ask questions. I will also be given a copy of this consent form for my records. I consent to my participation in the research described above.

_____	_____
Participant's Signature Date	Participant's Printed Name
_____	_____
Signature of Principal Investigator Date	Investigator Printed Name

Revised 8-8-2012

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Vita

Stewart F. Pratt graduated from Carter County R-1 High School in 1978 in Van Buren, Missouri. After high school, Stewart attended Southwest Baptist University in Bolivar, Missouri, where he completed his Bachelor's Degree in Secondary Education in 1982. Upon graduation, Stewart accepted his first position at Marion C. Early School as a K-12 Physical Education and Health teacher with coaching duties. In 1987, Stewart returned to Missouri State University and obtained additional science certifications in Biology and Chemistry. In 2003, Stewart completed his Master's Degree in Secondary Administration from Missouri State University and received the position of High School Assistant Principal and Activities Director at Branson R-IV Schools in Branson, Missouri. In 2007, Stewart became High School Principal for Willard R-II Schools in Willard, Missouri. Stewart completed his Educational Specialist Degree with an emphasis in Educational Administration from Missouri State University in Springfield, Missouri, in 2009. In 2012, Stewart became Assistant Superintendent for Willard R-II Schools and is currently serving in the Assistant Superintendent capacity.