Leadership in a 1:1 Computer Learning Environment

by

Beverly J. Miller

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Dissertation Committee:

Dr. Kevin Krahenbuhl, Chair

Dr. Lando Carter

Dr. Angela Hooser

DEDICATION

I dedicate this dissertation to my loving and wonderful family who has supported and encouraged me throughout the time I have been working to achieve my doctorate. I love you all very much!

To my parents who have always taught me that I could do anything I wanted to do. Your patient guidance and support through the years has helped me to become the person I am today.

To my amazing sister who is a constant support and encouragement. Your strength and determination through any situation has always been an inspiration to me. I am blessed to have you as a sister and friend!

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ABSTRACT

Business and industry leaders across the world are seeking employees who possess 21st century skills—problem-solving, critical thinking, communication, collaboration, and creativity to name a few. Schools and districts across the country and the world are stepping up efforts to meet the demands of business and industry. Many are spending large sums of money to increase technology access for students. One-to-one computer initiatives are increasing dramatically based on the belief the access to technology will assist in developing these skills.

In order for these initiatives to be successful, careful steps to plan and implement the program must be taken. School leaders play a crucial role in the success of these programs. This explanatory sequential mixed-methods, quan-QUAL study, sought to determine how school leaders in a 1:l learning environment experience and enact the recommendations for technology integration. School leaders were asked to complete the Principals' Technology Leadership Assessment (PTLA). Based on the results of open-ended questions in the PTLA, criterion sampling was used to identify school leaders to be interviewed for the qualitative portion of the study. Two overarching themes were identified from the qualitative data: leadership and 21st century skills.

Implications of the study include development of a collaborative vision and strategic plan which includes a common vocabulary, professional development for both leaders and teachers around technology integration, and the consideration of best practices in other education related areas such as professional development or school improvement.

TABLE OF CONTENTS

Page

LIST OF FIGURES x

LIST OF TABLES xi

CHAPTER I: INTRODUCTION 1

Statement of the Problem 4

Statement of Purpose 5

Significance of Study 7

Theoretical Framework 8

Summary 10

Definition of Terms and Abbreviations 12

CHAPTER II: LITERATURE REVIEW 13

Historical Review of the Impact of 1:1 Computing on Student Learning . . . 13

Leadership for Technology 15

ISTE Standards 17

Equity and citizenship advocate. 17

Visionary planner. 18

Empowering leader. 20

Systems designer. 22

Connected leader. 23

Culture and Change 25

21st Century Skills 27

Professional Development 31
Effective professional development for technology integration. 33
Importance of alignment. 35
Core content. 36
Active learning. 36
Collaboration and duration. 37
Follow-up and feedback. 38
Delivery mechanisms for professional development. 38
Summary 41
CHAPTER III: METHODOLOGY 44
Overview 44
Restatement of the Problem 44
Research Question 45
Research Design and Procedures 46
Population. 46
Sampling design. 51
Instrumentation. 52
PTLA. 52
Validity and reliability. 54
Data collection procedures. 57
Data analysis procedures. 60
Summary 64

CHAPTER IV: QUANTITATIVE DATA ANALYSIS 66
Overview 66
PTLA Results 66
Leadership and vision. 68
Learning and teaching. 70
Productivity and professional practice. 71
Support, management, and operations. 73
Assessment and evaluation. 74
Social, legal, and ethical issues. 76
Discussion. 77
Identifying individuals for follow-up interviews. 78
Determination of professional development needs. 79
School leader use of technology. 79
The effective use of technology. 79
CHAPTER V: QUALITATIVE DATA ANALYSIS 81
Overview 81
Interview Questions 83
Interviews 85
Individual interview summaries. 87
Lily. 87
Rose. 87
Ruth. 88
Sarah. 89

Chris. 89
William. 90
Themes 91
Leadership practices. 91
Distributive leadership. 91
Culture development. 93
Communication. 94
Leadership use of technology. 94
Trust. 95
Risk. 95
Visionary planning. 96
Continuous learning. 100
Supportive environment. 103
Development of 21st century skills. 106
Communication. 106
Innovation and creativity. 107
Critical thinking and problem-solving. 108
Collaboration. 109
Summary 109
CHAPTER VI: DISCUSSION AND FINDINGS 111
Overview 111
Summary of Results and Findings 112
Quantitative. 112

PTLA. 112
Qualitative. 117
Technology integration defined. 117
Vision. 119
Academic achievement. 123
21st century skills. 124
Trust and risk-taking. 126
Supportive environment. 127
Discussion 129
Reflections 136
Implications for Practice 137
Implications for Policy 139
Recommendations for Future Research 140
Limitations 140
Summary 141
REFERENCES 142
APPENDICES 160
APPENDIX A: PRINCIPALS' TECHNOLOGY LEADERSHIP
ASSESSMENT 161
APPENDIX B: INTERVIEW QUESTIONS 169

List of Figures

Figure 1 *21st Century Skills* 29

Figure 2 *P21 Framework for 21st Century Learning* 30

Figure 3 *State and District Average Assessment Scores* 47

Figure 4 *STEM School District Demographics* 48

Figure 5 *Creativity School District Demographics* 49

Figure 6 *Innovation School District Demographics* 50

Figure 7 *Reviewer Feedback on PTLA Items* 55

Figure 8 *Researcher Reflective Analytic Memo* 60

Figure 9 *Word Cloud of In Vivo Codes* 62

Figure 10 *Code Mapping* 64

Figure 11 *PTLA: Leadership & Vision* 69

Figure 12 *PTLA: Learning & Teaching* 71

Figure 13 *PTLA: Productivity & Professional Practice* 72

Figure 14 *PTLA: Support, Management, & Operations* 74

Figure 15 *PTLA: Assessment & Evaluation* 75

Figure 16 *PTLA: Social, Legal, & Ethical Issues* 77

Figure 17 *In Vivo Coded Interview Transcript* 86

List of Tables

Table 1 *Delivery Mechanisms for Professional Development* 39

Table 2 *Reliability of PTLA Dimensions* 56

Table 3 *Survey Participants* 67

Table 4 *Descriptive Information for Participants in the Qualitative Phase* 82

Table 5 *Average PTLA Scores* 113

Table 6 *Continuous Learning Opportunities for Teachers* 128

Table 7 *Commonly Used Technology Tools* 133

CHAPTER I: INTRODUCTION

Leadership plays an important role in any school improvement effort. Technology initiatives are no different. Leaders attitude and actions toward technology integration projects tremendously impact teacher perceptions of the projects (Machado & Chung, 2015; Waxman, Boriack, Lee, & MacNeil, 2013). As more and more schools are implementing 1:1 computer to student programs, leaderships attitude, actions and support can determine the success of the programs.

Public schools now provide a computer for approximately 1 in every 5 students, with some estimates placing this ratio at 1:3 (Gray, Thomas, Lewis, & Tice, 2010; Herold, 2015). In addition, schools spend over $3 billion dollars yearly on digital content that, in many instances, results in little change in instruction (Herold, 2015). According to Schiller (2008), the Australian government has invested millions of dollars into infrastructure, hardware and software, yet there are concerns that the potential for change that information communication technology (ICT) brings to teaching and learning have not been realized. This is not merely an issue for Australian school systems but is something faced in the United States as well. Researchers indicate “the increased availability of technology in schools does not necessarily lead to improvement in classroom teaching practices” (Berrett, Murphy & Sullivan, 2012, p. 200). Teachers and students having access to technology provides them the tools of the 21st century;

however, “the energy is only potential waiting to become kinetic upon integration” (Machado & Chung, 2015, p. 43).

With the increased availability of technology, governments, policymakers, educators, students and parents have called for its greater integration into classroom instruction (Keengwe & Onchwari, 2009; Liu, 2013; Tarling & Ng’ambi, 2016). Congress, in 2008, authorized the Digital Promise which supported comprehensive research and development to provide American students with the knowledge and skills necessary to compete in a global market (McKnight, O’Malley, Ruzic, Horsley, Franey, & Bassett, 2016). The Obama administration in 2013 announced ConnectED, an initiative to connect American students to high-speed or broadband internet within five years (https://tech.ed.gov/connectivity/). The LEAD report, created by the US Department of Education and the Federal Communications Commission, along with other education leaders, proposed a plan to expand digital learning into all K-12 schools in the nation (LEAD Commission, 2013).

This focus on technology is further evidenced by the increasing numbers of schools and school systems implementing a 1:1 computer initiative (McKnight et al, 2016). In 2008 the Office of Education Technology reported the student to internet connected computer ratio was 3:1 (Gray, Thomas, Lewis, & Tice, 2010), down from a student to computer ratio of 125:1 in 1983 (Russell, Bebell & Higgins, 2004). Between 2010 and 2011, Sauers (2012) reported that the number of 1:1 computer programs in Iowa almost doubled to a total of 90 schools.

The access to technology is the first step in a digital conversion for schools; however, technology in the classrooms requires shifts in instructional practices. To

effectively integrate technology, the focus must shift to how technology enables teaching and learning (McKnight et al, 2016). Leadership will play an important part in making this shift. To be competitive in the global job market, students need to develop the skillset employers are seeking. Business and industry are looking for employees with the ability to think critically, take initiative, communicate globally, problem-solve, and be creative (Hilton, 2008). Classroom instructional practices must provide opportunities for students to develop these 21st century skills and leadership will have an impact on this shift in practices.

Since 1998, the International Society for Technology in Education (ISTE) has created and published standards for students, teachers and education leaders (ISTE, 2016). During this time, the standards for students have shifted from learning with technology, to using technology to learn, to the current standards which focus on transformative learning with technology (ISTE, 2016). The standards for teachers and leaders are designed to assist in successfully integrating technology into teaching and learning (ISTE, 2018). The standards for teachers, revised from the National Educational Technology Standards (2009), call for teachers to be learners, leaders, citizens, collaborators, designers, facilitators and analysts who use technology to improve student learning (ISTE, 2017). The standards for leaders highlight the importance of developing a shared vision for technology integration and establishing a culture that supports this shift in instructional practices (Brown & Jacobsen, 2012; ISTE, 2018; Yee, 2000). In addition, the ISTE standards call for leaders to advocate for equity and citizenship, empower leaders, design systems to improve the use of technology to support learning, and be a connected learner who promotes continuous learning for themselves and others (ISTE,

2018). Leaders providing professional development, on-going collaboration, support, and time are crucial if teachers are going to incorporate the ISTE standards and change their pedagogical practices to enable student transformative learning (Rabah, 2015).

Without this leadership support and teacher training, the impacts of technology in the classroom may not be realized. Research comparing the effect of digital learning to traditional learning shows inconsistent results (Zheng, Warschauer, Lin, & Chang, 2016). Some researchers indicate digital classrooms outperform traditional classrooms, yet other research reports the opposite or no difference at all (Silvernail & Gritter; 2007, Penuel, 2006). Comparisons are typically made using state standardized assessments, which are not necessarily the best tools to use to determine the impact of technology on learning (Sheninger, 2014; Silvernail & Gritter, 2007).

Statement of the Problem

Gaining a better understanding of the research related to leadership practices with regard to technology access and integration in the educational setting is of utmost importance as schools and school systems around the world are making the transition to ubiquitous technology access for all students. Various studies have focused on academic achievement of traditional classrooms as compared to 1:1 classrooms (Bebell & Kay, 2010; Shapley, Sheehan, Mahoney, & Carankias-Walker, 2011; Suhr, Hernandez, Grimes, & Warschauer, 2010; Zheng et al, 2016). In addition, there is considerable research available on the effects of 1:1 technology on changes to classroom environments, effects on student motivation and engagement, classroom uses of technology, and the challenges that arise with the availability of technology (Harper &

Milman, 2016). A shift in the research on 1:1 to a focus of how, why, and under what conditions a 1:1 initiative will impact student learning is recommended by Harper and Milman (2016). Leadership plays a critical role in establishing these conditions. Determining how administrators in a 1:1 learning environment experience and enact recommended practices for technology integration can provide insight to the shifts recommended by Harper and Milman (2016). Identifying how administrators in a 1:1 experience and enact recommended practices for technology integration will provide information needed to successfully develop the skills called for in the ISTE Standards for Leaders (2018).

Statement of Purpose

Technology access for students across the world has increased dramatically in recent years (Björkvall & Engblom, 2010; Rosen & Manny-Ikan, 2011; Schiller, 2003), yet technology has had limited impact on students, teachers, and learning (Sauers & McLeod, 2018). To meet the demands of the 21st century and compete in a global economy, students must develop the ability to think critically, problem solve, communicate with people around the world, take initiative, and innovate (Kay, 2010; Robinson & Aronica, 2015; Sheninger, 2014, Wagner, 2014). Leaders must transform schools and classrooms to provide opportunities for students to develop these skills. Increasing technology access within schools can provide one avenue to develop these skills within students (Rosen & Manny-Ikan, 2011). However, as Cuban (2006) indicated, the technology should be considered a mechanism for a paradigm change in

teaching, learning, and 21st century skill development rather than the source of the change.

The paradigm shift should not be about every student having access to a device. The technology is simply the vehicle to drive the change. Rather, the shift should be about changes in instructional practices to foster the development of 21st century skills and learning within students (Cuban, 2006). Leadership can help to facilitate these changes in classroom instruction by providing support, training and time for teachers to develop these skills. In a study conducted by Hutchison and Reinking (2011), literacy teachers identified the development of 21st century skills as important; however, they were not integrating information communication technologies (ICTs) into their instruction by using activities typically associated with 21st century literacy. For example, the use of new genres of reading and writing, such as online chats, blogs, wikis, and emails, was not considered important by teachers to include in literacy instruction (Hutchinson & Reinking, 2011). In another instance, a principal, interviewed by Herold (2015), indicated that only a small portion of her teachers, approximately 5%, had truly integrated technology and embraced student-centered learning, another 5% were completely resistant to technology. The remaining 90% of her teachers used technology to enhance teacher practices but had not given students control of the technology (Herold, 2015). Critics of education over the past several years have called for teachers to use more student-centered, problem-solving instructional strategies (Michael, 2006). This change in pedagogy is a challenge for many educators and education leaders.

As with any paradigm shift, change takes support and time. Some professional organizations, such as the International Reading Association (IRA), are providing

guidance and support as they promote the development of 21st century skills (IRA, 2009). The IRA (2009) adopted a position statement that includes the following:

> To become fully literate in today's world, students must become proficient in the new literacies of 21st-century technologies. As a result, literacy educators have a responsibility to effectively integrate these new technologies into the curriculum, preparing students for the literacy future they deserve (p. 2).

School leaders can help teachers to make this transition by developing a culture that supports innovation (Sheninger, 2014). Encouraging teachers to regularly incorporate 21st century skills through technology integration will require the development of a culture that supports and encourages teachers to take risks and try new things (Sheninger, 2014).

This study will investigate the following research question:

How do administrators in a 1:1 environment experience and enact recommended practices for technology integration?

Significance of Study

Technology has dramatically changed the world and the way we work and communicate globally (Wagner, 2014). For students to be prepared to compete in this ever-changing global environment, they must be prepared to meet the demands of the 21st century (Kay, 2010). Employers are looking for people who have the ability to think critically, problem solve, take initiative, and communicate effectively (Abdullah & Osman, 2010; Robinson & Aronica, 2015; Wagner, 2014). Schools across the world are spending vast sums of money implementing 1:1 computer programs in an effort to graduate students with the skillset required to succeed in the 21st century (IRA, 2009).

However, the technology alone is not going to result in developing the skills students need to be successful. Instructional practices must also change if schools hope to produce graduates who will be competitive in the global market. The shift in instructional practices requires a "modern, progressive form of leadership" (Sheninger, 2014, p. 22) if it is to be successful.

There have been many studies completed that have analyzed the impact of a 1:1 initiative on student academic achievement (Bebell & Kay, 2010; Shapley et al, 2011; Suhr et al, 2010; Zheng et al, 2016). Gaining a better understanding of how school administrators in a 1:1 environment experience and enact recommended practices for technology integration will assist others as they work to fully integrate technology within their schools. In addition, this research can assist governments, private entities, and other funding bodies to know they will be getting a return on their investment.

The present study will add to the body of literature because it seeks to understand how administrators in a 1:1 environment experience and enact the recommended practices for technology integration. This study will provide insight into how administrators are implementing the recommended practices for technology integration in a 1:1 computer initiative. This information can guide others in the development of their plans for digital conversions.

Theoretical Framework

The study and research question are connected to social, constructivist learning theory. Social constructivism is at the heart of the pedagogical practices needed to develop 21st century skills in students. Social constructivism is based on the premise that

knowledge is developed through the interactions of people and situations (Schunk, 2016). Teachers identified the need for on-site support and purposeful peer interactions to assist and support them in integrating technology into their instruction (Brown & Jacobsen, 2016). Many of the 21st century skills identified by researchers, such as communication, collaboration, problem solving, self-direction, and curiosity, are dependent on students becoming actively involved in their learning (Abdullah & Osman, 2010; Robinson & Aronica, 2015; Schunk, 2016; Wagner, 2014). The opportunity for teachers to collaborate and communicate with others, both inside and outside their school, will assist them in developing these relevant, meaningful, and fun opportunities for students (Sheninger, 2014). Leaders must create a culture that supports these opportunities for teachers and students.

Participants in this study were leaders in schools in three rural, southeastern school systems. Each of the systems participating in the study had been involved in a 1:1 implementation for a minimum of 2 years. Participants were asked to complete an on-line survey and potentially participate in a follow-up interview. Thirty-four surveys were emailed to school administrators in the 3 school districts. Fifteen administrators responded to the survey and 10 were asked to participate in interviews based on their responses to open-ended questions and how the responses related to current research regarding teacher input in determining the focus of professional development; administrator use of technology to communicate with stakeholders; and administrators definition of "effective use of technology."

This study used an explanatory sequential mixed methods design. In this design the initial research is conducted using quantitative methods (Creswell & Creswell, 2018).

The results are analyzed, and then qualitative research methods are used to further explain those results (Creswell & Creswell, 2018). The Principal's Technology Leadership Assessment (PTLA) provided the quantitative data in this study. The (PTLA) was developed to assess principals' technology leadership tendencies and activities over a specified period of time (CASTLE, n.d.). Based on ISTE's original technology standards for administrators, the National Educational Technology Standards for Administrators (NETS-A), the PTLA was developed and validated by the American Institutes for Research (CASTLE, n.d.). Following analysis of the PTLA results, criterion sampling was used to identify principals for follow-up interviews. In criterion sampling a predetermined criterion of importance is used to identify and select cases for follow-up data collection (Palinkas, Horwitz, Green, Wisdom, Duan, & Hoagwood, 2016). In this study interview candidates were chosen based on their responses to the PTLA and alignment with what research suggests are the most effective leadership practices for technology integration, as well as, participants definition of technology integration.

Summary

Across the world student access to technology has increased dramatically in recent years. With this increased technology access comes the expectation of improved student learning outcomes. This research study sought to gain a better understanding of how administrators in a 1:1 environment are experiencing and enacting the recommended practices for technology integration. Through the use of school leader self-assessment and follow-up interviews, this study looked at leadership practices that supported technology integration in 1:1 schools to determine how administrators in a 1:1

environment are experiencing and enacting recommended practices for technology integration. The research is guided by the social, constructivist theory of learning and the PTLA. This study will provide guidance to schools and districts currently in a 1:1 initiative or schools considering starting a 1:1 initiative.

The following chapter includes a review of the recent literature related to 1:1 programs. Chapter 3 will focus on the methodology of the study. Chapter 4 will report the results of the study. The final chapter, chapter 5, will be a discussion of the results and recommendations for future study.

Definition of Terms and Abbreviations

Information Communication Technologies (ICTs): Technology resources which include such things as computers, graphing calculators, digital video equipment; peripherals such as scanners, digital cameras, digital projectors, and science probes; and software (MacDonald, 2008).

ISTE: International Society for Technology in Education

One-to-one (1:1) program: a school that provides a computing device for each student (Sauers & McLeod, 2018).

P21: Partnership for 21st Century Skills

Technology Integration: the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools (Lawless & Pellegrino, 2007).

CHAPTER II: LITERATURE REVIEW

The purpose of this review was to identify the recommended practices for integration technology in a 1:1 environment. The specific question addressed in this study is *how administrators in a 1:1 environment experience and enact recommended practices for technology integration*. The review of literature is divided into six sections. The first section provides a brief historical review of 1:1 programs and their impact on student performance on state assessments. The second section focuses on the International Society for Technology in Education's (ISTE) standards for education leaders and leadership practices which support the successful integration of a 1:1 program. The third section discusses culture and change along with risk-taking in education to support teachers and students as they master the 21st century skills students need to ensure success after high school. Effective professional development practices and the needs of teachers as they shift to a more digital classroom are discussed in the next section. The final section discusses the conceptual framework for the study, the PTLA.

HISTORICAL REVIEW OF THE IMPACT OF 1:1 COMPUTING ON STUDENT LEARNING

School districts across the world have spent billions of dollars over the past 40 years integrating technology into schools (Anderson & Dexter, 2005). Most of those funds have been for the purchase of additional computer devices. The availability of

computers for student use has changed dramatically during that time. In 1983 student to computer ratios were 125:1 (Russell et al, 2004). By 2002 the ratio had dropped to an average of 4:1 (Ertmer, 2005). In 2008 the Office of Educational Technology reported the ratio of students to computers with internet access was 3.1 to 1 (Gray et al, 2010).

The belief is that increasing availability and use of computers in classrooms will result in improved student learning (Bebell & Kay, 2010). However, not all scholars agree with this. Cuban (1992) argued that the introduction of computers to classrooms would have no more impact on student academic achievement than radio and television had in the 1900s. Zheng et al. (2016) agree with Cuban if the computers are scattered throughout the building. However, it is argued that when each student has access to an individual computer, the technology has the greatest opportunity to impact instruction (Warschauer, 2006). This argument leads to the advocacy for 1:1 (device-to-student) ratios in schools.

One-to-one programs provide all students within a class, grade level, school or district with a computer for use throughout the school day and, many times, at home (Zheng et al., 2016). State standardized assessments are a primary source of information related to academic performance in 1:1 initiatives. Some researchers question whether standardized tests are the best source of data to determine the changes in student learning that result from increased computer technology usage (McNabb, Hawkes, & Rouk, 1999; Russell, 2000; Silvernail, 2005). Researchers also acknowledge that additional scientifically based research on the impact and efficacy of 1:1 laptop programs on student learning is needed (Dunleavy & Heinecke, 2007; Suh, 2014). Studies reveal mixed results with regards to student achievement in the core academic areas. However, Harper and

Milman (2016) report in their meta-analysis that most researchers noted 1:1 initiatives had at least some achievement-related benefits for students.

Shapley et al. (2010) reported that student use of computers outside of school was a strong positive predictor of student academic achievement. Students in a 1:1 laptop program that used their computers more frequently at home tended to have a higher total ELA score and higher literature and reading sub-scores than their non-1:1 counterparts (Kay, 2010). Burden, Hopkins, Male, Martin, & Trala (2012) concluded students personal "ownership" (p. 9) of the devices 24/7 was the "single most important factor" (p. 9) for successful use of technology to impact learning. The following section will look at leadership's role in technology integration and the ISTE standards for administrators.

LEADERSHIP FOR TECHNOLOGY

Principal leadership plays an important part in any school improvement effort. It is well documented that teachers have the greatest impact on student learning, but principals have been identified as having a major influence on student learning also (Briggs, Davis, & Cheney, 2012; DuFour & Marzano, 2011; Leithwood & Louis, 2012; Marzano & Waters, 2009). Although not as direct as that of a teacher, school leaders impact many facets of the learning environment. With regard to technology, principal leadership has been identified as "the most important catalyst" (p. 3) affecting the integration of technology tools within schools (Rabah, 2015). The principal's involvement with technology responsibilities—developing a technology budget,

personally using technology, and technology planning--had a more positive impact on teacher and student classroom technology use than did infrastructure or spending (Dexter, 2011). Yet, there is little research related to school technology leadership (Machado & Chung, 2014; McLeod & Richardson, 2011).

To assist principals and school leaders in effectively integrating technology into teaching and learning, as well as develop digital age schools and classrooms, the International Society for Technology in Education (ISTE) developed standards for school leaders (ISTE, 2018). ISTE updated their Standards for Educational Leaders in 2018 to include:

1. Equity and Citizenship Advocate—leaders use technology to increase equity, inclusion, and digital citizenship practices.
2. Visionary Planner—leaders engage in establishing a vision, strategic plan and ongoing evaluation cycle for transforming learning with technology.
3. Empowering Leader—leaders create a culture where teachers and learners are empowered to use technology in innovative ways to enrich teaching and learning.
4. Systems Designer—leaders build teams and systems to implement, sustain and continually improve the use of technology to support learning.
5. Connected Learner—leaders model and promote continuous professional learning for themselves and others.

Leaders have indicated the use of the 2009 ISTE Standards for Administrators as a guide in integrating technology within their districts (Brown & Jacobsen, 2012; Pautz & Sadera, 2017). In the following section, the ISTE standards for leaders will be discussed.

ISTE Standards

The ISTE Standards for Leaders assist with the implementation of the ISTE Standards for Students and the ISTE Standards for Educators. They provide leaders with a framework to guide digital age learning (ISTE, 2018). Leaders can rely on these standards to assist them in developing the knowledge and behaviors necessary to empower teachers and ensure student learning is possible. The ISTE Standards for Leaders were updated in 2018 to include some of the most relevant topics in education—equity, digital citizenship, visionary leadership, team and systems building, continuous improvement, and professional growth (ISTE, 2018).

Equity and citizenship advocate.

The ISTE Standards for Education Leaders (2018) call for leaders to "use technology to increase equity, inclusion, and digital citizenship practices." This standard includes the need for leaders to ensure (ISTE, 2018):

- all students have skilled teachers who regularly use technology to meet learning needs.
- all students have access to technology and connectivity in order to participate in authentic and engaging learning opportunities.
- model digital citizenship by critically evaluating online resources, engaging in civil discourse online and contributing to positive social change through the use of digital tools.
- develop responsible online behavior, to include safe, ethical and legal use of technology.

Ensuring equity through innovative teachers and the availability of resources is a challenge to leadership. Providing all students choice in their education and ensuring all teachers use innovative teaching practices is one way to accomplish equity (Reigeluth & Karnopp, 2013). In addition, it is argued that providing students better access to computers through 1:1 programs results in more equitable access to resources and learning opportunities (Penuel, 2006).

Sheninger (2014) identifies the most important aspect of digital leadership as the development of a clear "vision and a strategic plan for increasing authentic engagement of students in the teaching and learning process' (p. 159). Proactively teaching students about digital citizenship is an important aspect of digital leadership. Schools need to set the direction for how to use technology tools to ensure digital citizenship (Ribble, 2012). With the rapid changes in technology, it is important to regularly monitor how technology is being used to ensure school practices are appropriate (Fullan, 2014). Ensuring students understand how to operate, think, learn, communicate, and collaborate in an online environment is an important aspect of leadership in a digital world (Farrace, 2011). Teaching students to properly cite web-based resources, ensuring staff models the effective use of technology, and providing digital citizenship programs for both students and parents can assist in developing responsible use of digital resources within students (Sheninger, 2014).

Visionary planner.

In order to effectively integrate technology, a leader must be able to develop and articulate a vision for technology and change, as well as foster an environment and culture conducive to the realization of that vision (Brown & Jacobsen, 2012; Yee, 2000).

ISTE (2018) identified engaging "stakeholders in developing and adopting a shared vision for using technology to improve student success" as one component of a visionary planner. Research supports the need for principals to develop partnerships, as well as, stakeholder and community support for the vision (Pautz & Sadera, 2017; U.S. Department of Education, 2017). Incorporating the perspectives and values of all stakeholders in building the vision for technology integration will increase stakeholder support in bringing the vision to fruition (Berrett et al., 2012; Rabah, 2015). Although not all stakeholders will be involved in the execution of the vision, a collaborative effort of all groups in developing the vision will ensure community support and a plan that reflects the goals and needs of the community (U.S. Department of Education, 2017). The vision can assist in keeping everyone focused by providing a vehicle for logical communication among stakeholders (Ertmer, 1999). This focus will help keep everyone on track when issues, problems or opportunities arise (Ertmer, 1999).

A second component of the ISTE visionary planner is the ability to "build on the shared vision by collaboratively creating a strategic plan that articulates how technology will be used to enhance learning" (ISTE, 2018). Participants in a study in Quebec stressed the importance of having a leader who can articulate a clear vision (Rabah, 2015). Collaborating with teachers and other stakeholders on the vision helps to ensure the successful integration of technology and technology initiatives (Richardson, McLeod, & Sauers, 2015). The vision should include a clear definition of what technology integration is and what its function will be in the school community (Berrett et al., 2012). The vision establishes a shared purpose to motivate all stakeholders to complete the work and should include how technology can support learning (Leithwood, Harris, & Hopkins, 2008; U.S

Department of Education, 2017). In a study conducted by Dexter (2011), schools that established a technology vision with a more instructional focus saw better results in student academic achievement than did schools with more of a focus on access to technology.

Leaders must model behaviors aligned with the vision in order to inspire and share responsibility in achieving technology integration (Berrett et al., 2012). In a study conducted by Yee (2000), one principal stated, "If you don't use it and have an understanding of what is possible; how can you possibly have any vision of how it [ICT] can add value [to teaching and learning]" (p. 294). Principal modeling and use of technology leads to a culture of technology integration within the building (Pautz & Sadera, 2017). It can also lead to the development of teacher leaders within the school building.

Empowering leader.

ISTE identifies an empowering leader as one who empowers educators "to exercise professional agency, build teacher leadership skills and pursue personalized professional learning" (ISTE, 2018). Providing the necessary support structures to assist teachers in integrating technology into their instruction is an important role of leadership. Professional development, technical support, and time are cited by teachers as support structures needed to assist them in integrating technology (Brown and Jacobsen, 2012).

Teachers identify they need additional professional development to successfully integrate technology into their instruction (Rabah, 2015). Early adopters of technology indicate they need training on innovative practices and more learning opportunities focused on pedagogical practices to effectively integrate technology rather than

technology training, which is often the need of later adopters (Brown & Jacobsen, 2012; Rabah, 2015). Building teacher leadership skills by providing opportunities for teachers to advance their skills in facilitating opportunities for students to be prepared for a more technical and globalized world is a function of leadership (Brown & Jacobsen, 2012). Anderson & Dexter (2005) found that when administrators became technology leaders and provided funding and training for new technology, technology integration and student use of technology tools increased.

According to the ISTE Standards for Leaders (2018), an empowering leader will support teachers in pursuing "personalized professional learning" and "inspire a culture of innovation and collaboration which allows time and space to explore and experiment with digital tools." Encouraging teachers to collaborate with others to increase their learning is an important function of leadership. Leaders should consider developing collaborations with other school districts or post-secondary institutions to provide access to additional resources (Rabah, 2015). Providing on-going, job-embedded, relevant professional learning designed and led by teachers is another effective strategy for personalized, professional learning (U.S. Department of Education, 2017). Teachers in a study conducted by Brown & Jacobsen (2016) indicated the need for human infrastructure (on-site support) and social support (purposeful peer interaction) to provide professional learning opportunities to support them in integrating technology. These peer interactions function as informal technology support networks to guide teachers in implementing technology (Waxman et al., 2013). Early adopters or innovators are strong candidates to serve as the resources for the social support other teachers are seeking; however, the early adopters require training also (Brown & Jacobsen, 2012). It is

important that training be participatory and that principals learn alongside teachers. Principals learning with their teachers ensures the learning will be supported by technology resources and time (Brown & Jacobsen, 2012; U.S. Department of Education, 2017).

Time is another needed support identified by teachers to effectively integrate technology into instruction. Truly integrating technology into instruction is a slow, time-consuming process in which teachers need a lot of support and encouragement (Byrom & Bingham, 2001). Recent research recommends leaders provide time, at least monthly, for teachers to collaborate on technology integration (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2010). Principal collaboration with teachers further supports technology integration (Afshari, Bakar, Luan, Samah, & Fooi, 2008). Collaboration plays an important role in developing a systemic plan to sustain the technology as well.

Systems designer.

ISTE (2018) defines a systems designer as a leader who builds "teams and systems to implement, sustain, and continually improve the use of technology to support learning." This standard calls for leaders to (ISTE, 2018):

- develop a plan to establish an infrastructure which can support the demands of the technology within the school.
- establish a system to ensure a consistent funding stream to support the technology integration along with a system to monitor progress toward the ultimate goal of student learning.
- Protect the privacy of student data and ensure data management is a component of the plan.

In conjunction with developing a system to create and monitor progress toward the school vision, leaders need to ensure others know and understand the vision. As a part of the vision for technology integration, leaders have to plan for it comprehensively, aligning all technology investments so they cohesively connect to classroom use and don't become a series of unrelated initiatives (Rabah, 2015). In addition, leaders should collaborate with teachers and other staff to understand and plan for professional development needs to successfully realize the vision (Richardson et al., 2015).

Connected leader.

As a connected learner, the ISTE Standards for Education Leaders (2018) include developing the skills needed to lead and navigate change, advance systems and promote a mindset of continuous improvement for how technology can improve learning. Leading change requires establishing a trusting culture. An important responsibility of a school leader is to establish a culture which supports and accepts that teachers and students can take risks (Pautz & Sadera, 2017; Richardson et al., 2015). Taking risks requires trusting the leadership. Teachers have to know they will be supported if they try something new and it doesn't work. A culture where failure is seen as an opportunity to learn will encourage teachers and students to step out of their comfort zone and try new things (Pautz & Sadera, 2017). Teaching with technology and shifting to a student-centered learning environment brings many challenges. Trust in leadership increases the chances that a teacher will try something that is unfamiliar to them (Handford & Leithwood, 2013). The teacher has to know the principal will consistently support them, problem-solve with them, and encourage them to try again (Hanford & Leithwood, 2013; Schrum, Galizio, & Ledesma, 2011).

Technology forces teachers to change the established and, often, effective practices they have used in their teaching (Byrom & Bingham, 2001). Many teachers struggle with accepting the change to teaching with technology when they have been successful with their current teaching practices. Leaders must consider how teacher's classroom practices are guided by their existing pedagogical beliefs (Ertmer, 2005). Changing teacher's pedagogical beliefs to include integrating technology was identified by Ertmer (2005) as the "final frontier" of technology integration. A strong leader can help a teacher see the benefits of trying new technologies by capitalizing on the teacher's knowledge and listening to the needs of the teacher (Berrett et al., 2012). One approach to encourage technology integration is to introduce teachers to technology that will meet their most immediate needs (Ertmer, 2005). The leader can also show teachers support of technology integration by demonstrating a positive attitude to both technology and technology use (Waxman et al., 2013). Creating an environment that is supportive of open and honest communication between teachers and leaders will provide reflective opportunities for both teachers and leaders (Berrett et al., 2012).

Another component of the connected leader identified by ISTE (2018) is "to use technology regularly to engage in reflective practices that support personal and professional growth." Leaders can accomplish this by modeling for teachers. Leading by example is crucial for those attempting to integrate technology into classroom practice (Anderson & Dexter, 2005; Berrett et al., 2012). A leader who models the use of technology tools for the teachers in the building can inspire and lead others to use technology to enhance student learning (Yee, 2000). Principals who are supportive of technology can inspire even the most reluctant teachers to integrate technology into their

instruction (Peled, Kali, & Dori, 2011). Likewise, principals that resist the use of technology can cause teachers who were early-adopters of technology to lose their drive for integrating technology within the classroom (Peled et al., 2011).

Culture and Change

Creating a culture of learning is important for any school leader. Teachers and leaders within a building must be continually learning with one another if technology integration is going to be successful. As a connected learner, the ISTE Standards for Education Leaders (2018) include developing the skills needed to lead and navigate change, advance systems and promote a mindset of continuous improvement for how technology can improve learning. Muhammad (2015) defined school culture as "a school's set of norms, values, rituals, beliefs, symbols, and ceremonies that produces a school persona." This persona can be impacted by the introduction of technology into a school resulting in tension within the existing culture as educational practices change (Berrett et al., 2012). Principals play a crucial part in establishing a culture which will support change and the integration of technology within teaching and learning. The transformation to a technology-rich environment and a culture that supports its use requires time and leaders must be supportive of teachers as they make this transition (Byrom & Bingham, 2001).

If school leaders want teachers to risk changing their instruction and embracing the 21st century skills students need in today's global society, they have to create an environment that is conducive to risk-taking. This culture should be one of trust in which failure is an accepted result of creativity and innovation (Kelly & Kelly, 2013; Sheninger,

2014). Leaders must learn to cultivate the talent that exists in their school buildings. Couros (2015) says,

> As leaders in education, our job is not to control those whom we serve but to unleash their talent. If innovation is going to be a priority in education, we need to create a culture where trust is the norm. This must be modeled at the highest level of the organization if we expect teachers to create the same culture in their classrooms (p. 69).

Trust takes time to develop and relationships are a critical component of trust. Lencioni (2002) says "trust lies at the heart of a functioning team" (p. 195). When trust is the norm and teachers know they have the support of their leadership, taking chances—such as new teaching strategies—seems less risky (Couros, 2015). People open themselves up to vulnerability when they trust someone (Lencioni, 2002). This vulnerability and trust in the people you work with can lead to overcoming many of the barriers to "creative thinking and constructive behavior" (Kelly & Kelly, 2013, p. 58). Leadership can help to navigate these barriers to change.

Technology brings about change within any organization. It is often considered a disruptive force and it requires a strong leader to guide the change process (Afshari et al, 2008). The integration of technology into instruction is a paradigm shift for many (Reigeluth & Duffy, 2008). It is a paradigm shift that requires thinking outside the norm in order to move schools forward (Richardson et al., 2015). This shift will require a different mindset about education for all stakeholders. In order for the shift to be successful, it is important that all stakeholders be involved in the process (Reigeluth & Duffy, 2008). Long-term, carefully devised plans are necessary for the successful

integration of technology (Rabah, 2015). Throughout this change process, leaders should communicate with all stakeholders by using appropriate media and technology tools thus creating effective feedback loops (U.S. Department of Education, 2017). The more all stakeholders know about the change process, the less they will resist it (Reigeluth & Duffy, 2008). The change process will require time and support for all stakeholders to progress through the stages of change (Rabah, 2015). Leaders staying connected to stakeholders and teachers throughout the process can assist them with the changes being implemented. This connection can also assist stakeholders in gaining a better understanding of the skills required for students to be successful after high school.

21st Century Skills

Researchers suggest that schools have not changed much in the last one hundred years (Couros, 2015; Muhammad, 2009; Reigeluth & Karnopp, 2013). Ken Kay (2010), president of the Partnership for 21st Century Skills, says "the moment is at hand for a 21st century model for education that will better prepare students for the demands of citizenship, college, and careers in this millennium" (p. xiii). This moment at hand, almost 20 years into the 21st century, requires leaders and teachers to prepare students for the challenges of the 21st century.

According to Wagner (2012), business leaders agree the long-term health of our nation's economy depends on innovation. Income and wealth will come from applying technology and new ideas to create new products and processes (Abdullah & Osman, 2010). Business and industry are looking for employees who leave either high school or college with a skill set that will equip them to be innovators and risk-takers (Wagner,

2012). They are looking for employees who are willing to risk taking initiative to ensure more effective and efficient operation of business or improved services or products. Business leaders are also seeking employees who can communicate effectively both in writing and orally, adapt quickly, problem-solve and make decisions (Fischer, 2013). Business leaders say they need "more young people who can create innovations in the areas of science, technology and engineering" (Wagner, 2012, p. X). According to Abdullah and Osman (2010), entrepreneurs, technology and innovation will drive the economy of the 21st century.

There is a strong push for schools to develop critical skills for student success in the 21st century. Several authors and groups have identified what these skills are and many of them are common to more than one list (see Figure 1). These skills align with the skills business and industry need in their employees.

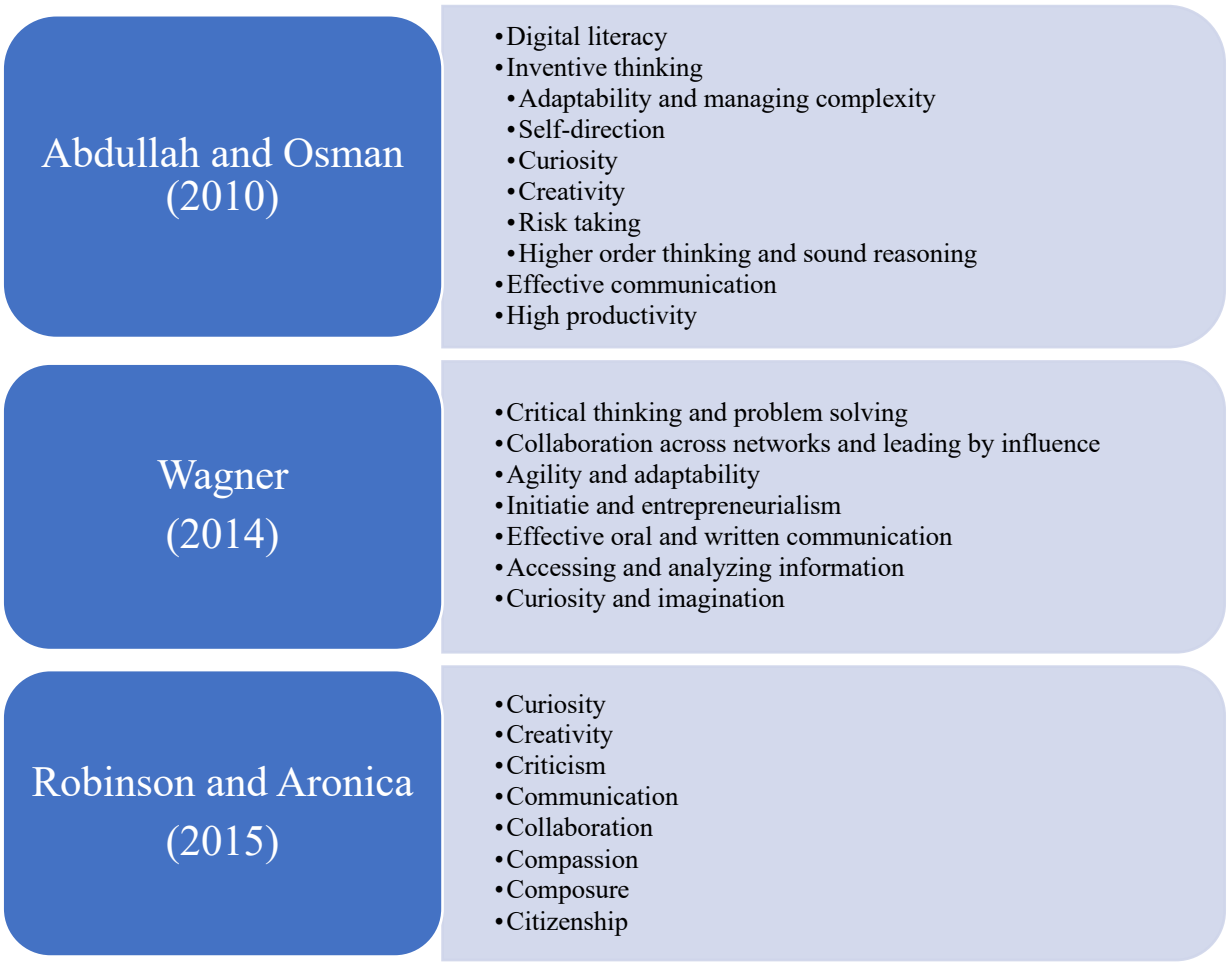


Figure 1

21st Century Skills

The Partnership for 21st Century Skills (P21) (2009) developed a framework for 21st Century Learning (see Figure 2). Their framework is an "all-encompassing vision for a 21st century education" (Kay, 2010, p. XIV). It not only addresses the needs of the students, but also the needs of the teacher and school (P21, 2009). For students the framework includes learning and innovation skills; information, media, and technology skills; and life and career skills all integrated into the core curriculum. For teachers the

P21 framework includes a focus on standards and assessment; curriculum and instruction; the need for professional development; and the importance of the learning environment in the 21st century. P21 recognizes the need for teacher learning along with student learning if we are to be able to prepare students for success in the 21st century (P21, 2009).

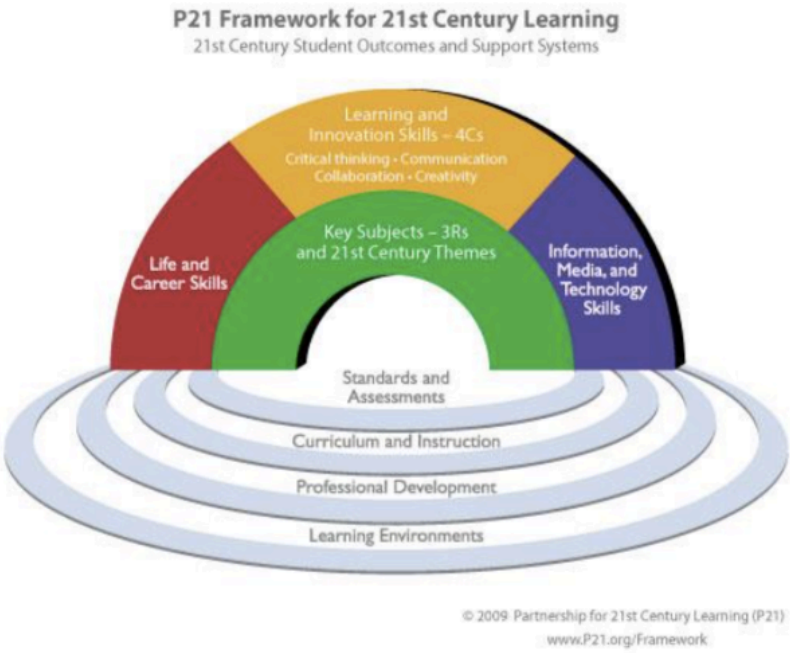


Figure 2

P21 Framework for 21st Century Learning

The European Parliament and the Council of Europe developed the Key Competences for Lifelong Learning recommendation 2006/962/EC (Soby, 2015). The Key Competences Recommendation recognized eight key competencies for lifelong learning:

- communication in the mother tongue
- communication in foreign languages
- mathematical competence and basic competences in science and technology
- digital competence
- learning to learn
- social and civic competences
- entrepreneurship
- cultural awareness and expression

These competencies were used to develop Finland's National Core Curriculum (Soby, 2015).

Each of these researchers or organizations has included skills on their list that business and industry are seeking in their employees. Skills that many of our students, the innovation generation as Wagner (2012) calls them, possess and use outside of the classroom. Unfortunately, although teachers consider 21st century skills important, students are too often not using these skills in their learning inside today's classrooms (Hutchinson & Reinking, 2011). Students need the opportunity to practice and develop these skills in order to be ready to call upon them when the situation demands. Leaders can assist teachers in developing these opportunities by providing training and time for collaboration.

Professional Development

Increasingly state and federal governments have emphasized the importance of all students having access to highly effective teachers. The ISTE Standards for Leaders

(2018) include ensuring all students have skilled teachers who actively use technology to meet the diverse needs of students. The most effective teachers, according to Wiliam (2011), increase student learning at four times the rate of the least effective teachers. The existing knowledge base in education is increasing rapidly so to ensure all classrooms are taught by highly effective teachers, teachers must continually increase their pedagogical and subject area expertise (Guskey, 2000). High quality professional development is a critical component for leadership in ensuring effective teachers are in all classrooms. Professional development is defined as "those processes and activities designed to enhance the professional knowledge, skills, and attitudes of educators" (p. 16) so student learning can improve (Guskey, 2000).

According to the National Comprehensive Center for Teacher Quality, high quality professional development must be delivered in a manner that will yield a direct impact on teacher practice (Archibald, Coggshall, Croft, & Goe, 2011). Concerns exist that teacher preparation programs may have focused too much on teacher knowledge and beliefs and not enough on the "core tasks" of teaching (Stronge, 2018). High-quality professional development is one of the best avenues to address these concerns. Professional development, according to Guskey (2000), should be an intentional, ongoing, and systemic process. To influence student achievement, the practice identified for change during professional development must clearly relate to student learning in order for it to result in more students learning the content at higher levels (Archibald et al., 2011). To effectively engage teachers, the professional development should take into account adult learning principles which include being self-directed, bringing a foundation

of experience, being goal oriented, covering relevant and practical content, and respecting the learner (Knowles, Holton & Swanson, 2011).

Increasing teacher understanding of technology integration and resources is important if leaders expect to see greater use of technology in the classroom. Lawless and Pellegrino (2007) define technology integration as "the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools" (p. 577). Technology resources, which MacDonald (2008) calls Information Communication Technology (ICT) tools, include such things as computers, graphing calculators, digital video equipment; peripherals such as scanners, digital cameras, digital projectors, and science probes; and software. Technology workshops that focus solely on software or hardware skills fail to help teachers understand how technology connects with specific pedagogies or content (Koehler & Mishra, 2005). In addition to assisting teachers in gaining a better understanding of ICT tools, leaders need to ensure teachers have a greater understanding of the different strategies for using technology tools to support learners in constructing their own knowledge via frequent creative activities which enhance meaningful learning (Keengwe & Onchwari, 2009). Participating in at least one computer-related activity a week is considered frequent use of technology (Hixon & Buckenmeyer, 2009).

This section will discuss the components of effective professional development and the various delivery mechanisms for professional development.

Effective professional development for technology integration.

Professional development is considered an essential method for deepening teacher content knowledge and developing their instructional strategies (Desimone, Porter, Garet,

Yoon, & Birman, 2002). In 1999 the CEO Forum recommended that all professional development programs integrate technology as part of all training components (Overbaugh & Ruiling, 2008). Effective professional development has a clear focus on learning and learners; has an emphasis on individual and organizational change; is guided by a vision; and is on-going and embedded in the daily activities of educators (Guskey, 2000). For professional development to be effective, however, it must be high quality. High quality professional development includes a focus on content and how students learn the content; in-depth, engaging learning opportunities; links to standards; extended duration; and the participation of groups of teachers from the same school, grade level or subject area (Desimone et al., 2002).

High quality professional development, according to Archibald et al. (2011) and Desimone et al (2002), exhibits the following five characteristics:

1. Alignment with school goals, state and district standards and assessments, and other professional learning activities including formative teacher evaluation.
2. Focus on core content and modeling of teaching strategies for the content.
3. Inclusion of opportunities for active learning of new strategies.
4. Provision of opportunities for collaboration among teachers over an extended period of time.
5. Inclusion of embedded follow-up and continuous feedback.

Technology professional development sessions should incorporate these characteristics and provide connections between content and the technology tools.

Importance of alignment.

Teachers have reported greater impact on their knowledge and skills when professional development connects to their prior learning and supports instruction. Teachers identified beneficial professional development sessions as those that (Archibald et al., 2011)

- build on learning from prior professional development.
- emphasize content and pedagogy aligned with state and local standards, frameworks, and assessments.
- support teachers in developing on-going professional collaboration opportunities with other teachers who are trying to implement the same or similar change initiatives.

It is important, however, for the professional development to be guided by a vision that focuses clearly on learning and learners (Guskey, 2000).

Leadership should provide opportunities for teacher collaboration (DuFour, DuFour, Eaker, Many, & Mattos, 2016; Potter & Rockinson-Szapkiw, 2012). Collaboration provides opportunities for teachers to reflect on their new learning and pedagogy, as well as, opportunities to share unit and lesson plans (Lawless & Pellegrino, 2007). Guskey (2003), however, stresses the need for the collaboration to be structured and purposeful, guided by goals for improved student learning. Teachers are more likely to integrate training, especially with regard to technology, if time is devoted to showing how the strategy can be used in a pedagogically sound manner (Potter & Rockinson-Szapkiw, 2012). Training which connects the use of technology to core content increases the likelihood the technology will be integrated (Wilson, Gielniak, & Greaves, 2017b).

Core content.

Many professional development opportunities, especially technology PD, assume that the kinds of knowledge required of teachers are the same regardless of what they teach (Harris, Mishra, & Koehler, 2009). This approach ignores the inherent differences in the forms of disciplinary knowledge and the various pedagogical strategies most appropriate to teach content (Harris et al., 2009; Koehler & Mishra, 2005). Leadership can assist in improving teacher practice by providing professional development focused on content and the teaching and learning of content (Archibald et al, 2011; Wilson et al., 2017b). This type of professional development is the most likely to bring about positive changes in teacher practice (Archibald et al., 2011). Classroom teaching requires "teachers to possess a substantial knowledge base which encompasses subject matter knowledge, pedagogical knowledge, curricular knowledge, learner knowledge, and cultural and community knowledge" (Stronge, 2018, p. 15). Connecting content with active learning strategies assists in changing teacher practice also.

Active learning.

Opportunities for active engagement in the learning have been identified by teachers as leading to changes in instructional practice (Archibald et al., 2011). Polly and Hannafin (2010) share strategies used by teachers in a learner-centered teacher professional development (LCPD). In a LCPD, teachers analyze data, look at student work, identify student misconceptions, and develop plans to close the gaps in student learning. This leads to increased ownership of the learning because teachers select the content and the activities (Polly & Hannafin, 2010). A hands-on approach to professional development is also effective when introducing specific technology applications and

curricular applications (Hixon & Buckenmeyer, 2009). Opportunities for teachers to practice, over an extended-period of time, the strategies they have learned during professional development, as well as, follow-up activities should be included in professional development (Potter & Rockinson-Szapkiw, 2012). Collaboration and reflection provide these opportunities for teachers to follow-up on their professional learning.

Collaboration and duration.

Leaders can support teachers in implementing the new learning from professional development by providing opportunities for collaboration. Teachers often need extended time to reflect on ideas, internalize beliefs, and refine practices associated with professional development (Polly & Hannafin, 2010). The highest quality professional development is long-term and embedded in day-to-day practice (Potter & Rockinson-Szapkiw, 2012). Collective partnerships of teachers from within the same school, grade level or department have been identified as effective in improving teacher practices (Desimone et al., 2002). Professional learning communities (PLCs) are an excellent avenue to provide the structure for these partnerships (DuFour et al., 2016).

Leaders can further support teachers to implement the learning from professional development by developing a systematic and on-going plan for PD. In order for the professional learning to build upon prior learning, professional development must move from being one-shot professional development, such as a one-hour or two-hour training, to a sustainable model that can systematically change classroom instruction (Wright, 2010). Professional development that includes a one-day or several hour workshop, without follow-up support is not effective (Potter & Rockinson-Szapkiw, 2012).

Follow-up and feedback.

Modeling and coaching can be used to provide follow-up and feedback to support teacher professional learning. These support strategies can help teachers overcome barriers, think outside the box, and develop creative purposes to use technology specific to classroom or curricular needs (Wright, 2010). Student academic performance increases when teacher professional development is supported by ample teacher reflection and practice opportunities, both of which can be supported through mentorship and professional learning communities (Potter & Rockinson-Szapkiw, 2012). The number of hours required to shift teacher practices to learner-centered practices through sustained professional development was identified as 30 hours, with 60 hours being required for a significant impact on student learning (Banilower, Boyd, Pasley, & Weiss, 2006).

Delivery mechanisms for professional development.

There are multiple delivery mechanisms for professional development for technology integration (see Table 1). Some are more effective than others. Research and evaluation of professional development must take into consideration the nature of the professional development program design with respect to features that make a difference (Lawless & Pellegrino, 2007). These features include how the PD was delivered, the nature of the activities that were completed, the duration of the activity, and the nature of the content about technology and instruction (Lawless & Pellegrino, 2007).

Table 1

Delivery Mechanisms for Professional Development

Type of Professional Development	Description	Impact of Professional Development
Face-to-Face	Traditional, face-to-face training	Fragmented, disconnected from day-to-day classroom practice
Design-mediated	Provides opportunity to learn the use of specific technologies situated in the context of curricular needs	Teachers take ownership, increased confidence in integrating unit as tool, reflection opportunities and collaboration
Mentoring or Coaching Model	Assistance provided through relationship and is focused on teacher needs	Increased comfort with technology; greater proficiency in computer use
Train-the-trainer model	One group of teachers trained who will later redeliver content to larger group	Successful in reaching larger audience; often fails to account for local needs of teachers

Instructional coaching has been identified as an effective strategy for modeling content (Archibald et al., 2011). To be most effective, instructional coaching requires

strategically selecting the instructional practices to be modeled (Matsumura, Sartoris, Bickel, & Garnier, 2009). In addition, the development of personal relationships in the coaching or mentoring model is a key feature in its success because it provides an opportunity to focus on the individual needs of the teacher (Lawless & Pellegrino, 2007). Developing relationships with coaches or mentors provides opportunities for dialogue with colleagues around key issues in student learning to include technology integration (Wright, 2010). Peer mentoring has also been found to be effective in improving teacher integration of technology (Liu, 2013).

In addition to the types of professional development identified by Lawless and Pellegrino (2007), Professional Learning Communities (PLCs) or Communities of Practice (CoPs) were identified as viable opportunities for teacher development (Barab, MaKinster, & Scheckler, 2003; DuFour et al., 2016). A PLC is defined as "an ongoing process in which educators work collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve" (DuFour et al., 2016). Similar to a PLC is a Community of Practice (CoP). A CoP is a "persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set beliefs, values, history and experiences on a common practice and/or mutual experience" (Barab, MaKinster, & Scheckler, 2003). CoPs provide the time and space for teachers to study similar challenges, collaboratively discuss possible solutions, try the solutions, determine success, and reassess the challenge (MacDonald, 2008).

Summary

Access to computers in schools has changed dramatically over the past 40 years, resulting in student to computer ratios of approximately 3:1 as of 2008 (Gray et al., 2010). The idea behind increased access to technology is that student academic achievement will improve (Bebell & Kay, 2010). Studies of the various academic areas show mixed results (Harper & Milman, 2016). English/language arts and writing scores show generalized improvements, while reading, science and math scores vary with regard to a 1:1 environment (Bebell & Kay, 2010; Dunleavy & Heinecke, 2007; Suhr et al., 2010; Shapley et al., 2010; Silvernail & Gritter, 2007; Williams & Larwin, 2016; Zheng et al., 2016).

Technology alone will not transform learning, but it can help enable transformative learning (U.S. Department of Education, 2017). Leadership plays a crucial role in ensuring technology is integrated into the teaching and learning culture within a school. The ISTE Standards for Educational Leaders (2018) assist school leaders in identifying strategies to ensure the transformation of traditional classrooms into digital age classrooms. Educational leaders who promote equity and digital citizenship, who demonstrate the skills of visionary planning, who create a culture that empowers leaders, who develop systems to support successful technology integration, and who develop a culture to support collaboration and the development of teacher leaders will assist teachers within their schools to successfully navigate the challenges of integrating technology into instruction.

Leaders creating a culture where it is safe for teachers and students to take risks will assist in the integration and innovation process (Pautz & Sadera, 2017; Richardson et

al., 2015). Community and business leaders are looking for graduates who possess 21st century skills such as oral and written communication, adaptation, problem-solving, decision-making, innovation and risk-taking to drive the economy of the 21st century (Abdullah & Osman, 2010; Fischer, 2013). Multiple organizations have identified the 21st century skill sets that students will need to be successful in a global economy (Abdullah & Osman, 2014; Robinson, 2015; Wagner, 2014). The traits on the various lists are often common to one another. Creative and curious thinkers who possess the ability to communicate and collaborate are just a few of the skills identified by various researchers as skills business leaders are looking for in graduates of the 21st century (Abdullah & Osman, 2014; Robinson, 2015; Wagner, 2014).

To support teachers in the transition to technology integration, leaders must provide professional development on a regular basis. This professional development needs to move beyond training teachers in how to use technology tools, to preparing teachers to fully integrate technology into appropriate pedagogical instruction (Keengwe & Onchwari, 2009; Koehler & Mishra, 2005). Incorporation of instructional standards is a critical component of technology integration (Lawless & Pellegrino, 2007). Technology should be used to enhance learning rather than simply replace current practices. To successfully integrate technology, professional development for teachers should include active learning over an extended period of time (Archibald et al., 2011; Desimone et al., 2002; Guskey, 2000). Resources should be put into place to allow for reflection, feedback and follow-up (Potter & Rockinson-Szapkiw, 2012).

Leaders and teachers face a great challenge in effectively integrating technology into instruction. However, there are multiple resources to assist them in this journey to

include the ISTE Standards for Education Leaders (ISTE, 2018) and ISTE Standards for Educators (ISTE, 2017). Careful planning, collaboration and evaluation can assist in the success of 1:1 technology programs. Understanding how administrators in a 1:1 environment experience and enact the recommended practices for technology integration can assist others in the move to a 1:1 environment.

CHAPTER III: METHODOLOGY

Overview

The purpose of this study was to determine *how administrators in a 1:1 environment experience and enact the recommended practices for technology integration*. This chapter communicates the methods utilized to answer the research question. Included in this chapter are the research question, statement of the problem, research design and procedures, research methodology, population and sample, instrumentation, data collection procedures, and the data analysis procedures.

Restatement of the Problem

Gaining a better understanding of the research related to leadership practices with regard to technology integration in the educational setting is of utmost importance as schools and school systems around the world are making the transition to ubiquitous technology access for all students. Various studies have focused on academic achievement of traditional classrooms as compared to 1:1 classrooms (Bebell & Kay, 2010; Shapley et al., 2011; Suhr et al., 2010; Zheng et al., 2016). In addition, there is considerable research available on the effects of 1:1 technology on changes to classroom environments, effects on student motivation and engagement, classroom uses of technology, and the challenges that arise with the availability of technology (Harper & Milman, 2016). A shift in the research on 1:1 to a focus of how administrators in a 1:1 environment experience and enact the recommended practices for technology integration will support the Harper and Milman's (2016) suggestions for future research. Leadership

plays a critical role in establishing the conditions for successful integration of technology. Identifying effective leadership practices in 1:1 learning environments that support this shift in focus will provide leaders with the information they need to successfully develop the skills called for in the ISTE Standards for Leaders (2018).

Research Question

The following question was the focus of this study. The tools described in this chapter and the methodologies described herein were chosen because they appeared to be the most reasonable, effective techniques to answer the question.

How do administrators in a 1:1 environment experience and enact recommended practices for technology integration?

Answering this question can provide guidance to schools and policy makers when making decisions regarding 1:1 programming. Determinations about funding and support of a 1:1 program are dependent upon the effectiveness of the program and leadership impacts that effectiveness. Improved student academic achievement is a primary goal of many 1:1 programs (Lawless & Pellegrino, 2007; Stansberry & Case, 2011; Wenglinsky, 2006). Policymakers, educators, researchers and others want to gather information regarding teachers' technology-related concerns, professional development needs, technology use in the classroom, and student use of technology (Mehta & Hull, 2013). Answering the question of how administrators in a 1:1 environment experience and enact recommended practices for technology integration can provide guidance to schools currently implementing or considering implementing a 1:1 computer learning environment in their schools.

Research Design and Procedures

This mixed-methods study was designed to determine the leadership practices which impact technology integration in a 1:1 environment. The purpose of this study was to determine how administrators in a 1:1 environment experience and enact the recommended practices for technology integration. Cross-sectional surveys were utilized to gather the data.

The decision to use an administrator survey in this study was based on the availability of a validated and reliable survey which had been frequently used in educational research (Banoglu, 2011; Duncan, 2011; Epslin, 2017; Gregory, 2015; Melton, 2015; Metcalf, 2012; Page-Jones, 2008). In addition, the survey used in the study is available for free to educational institutions (CASTLE, n.d).

On-line survey administration is relatively easy and provides data from a large number of participants in a timely manner. Research studies support the use of on-line surveys for gathering data (Berry, 2005; Creswell & Creswell, 2018). The results of the survey data will be examined for descriptive purposes to determine the use of effective leadership practices in 1:1 learning environments.

Population.

In order to examine the leadership practices that exist within 1:1 learning environments, research must be completed in systems in which 1:1 programs exist. For this reason, STEM District, Creativity District, and Innovation District (names changed) were purposefully chosen as the population to complete this study. Since many school districts are moving towards a 1:1 initiative providing a descriptive analysis and

examining the leadership practices of school districts that have been engaged in 1:1 for multiple years can provide relevant data (Penuel, 2006; Zucker, 2004).

All three districts are located in a state in the southeastern United States. The state revised their standardized assessment in 2016 and shifted to an on-line assessment for students in grades 9-12 at the same time. The state and district average scores in ELA, math and science are presented in figure 3. Some researchers question whether standardized tests are the best source of data to determine the changes in student learning that result from increased computer technology usage (McNabb et al., 1999; Russell, 2000; Silvernail, 2005). Researchers also recognize additional scientifically based

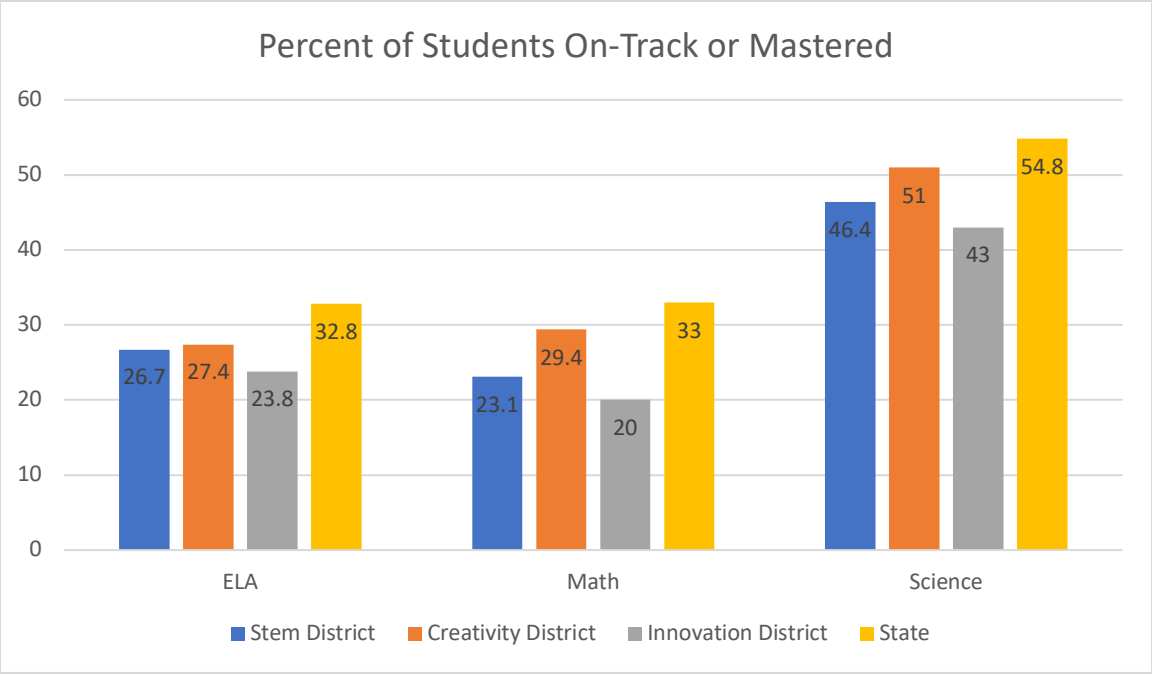


Figure 3

State and District Average Assessment Scores

research on the impact and efficacy of 1:1 laptop programs on student learning is needed (Dunleavy & Heinecke, 2007; Suh, 2014).

STEM School District is a rural school district located in a community with a population of approximately 41,000 residents. The school district serves about 5,200 students in grades K-12. There are 344 teachers and 23 administrators in the district. The district consists of 7 elementary schools, 2 middle schools, one high school and one unit school. A unit school serves students in grades K-12. The demographics of the district are provided in figure 4.

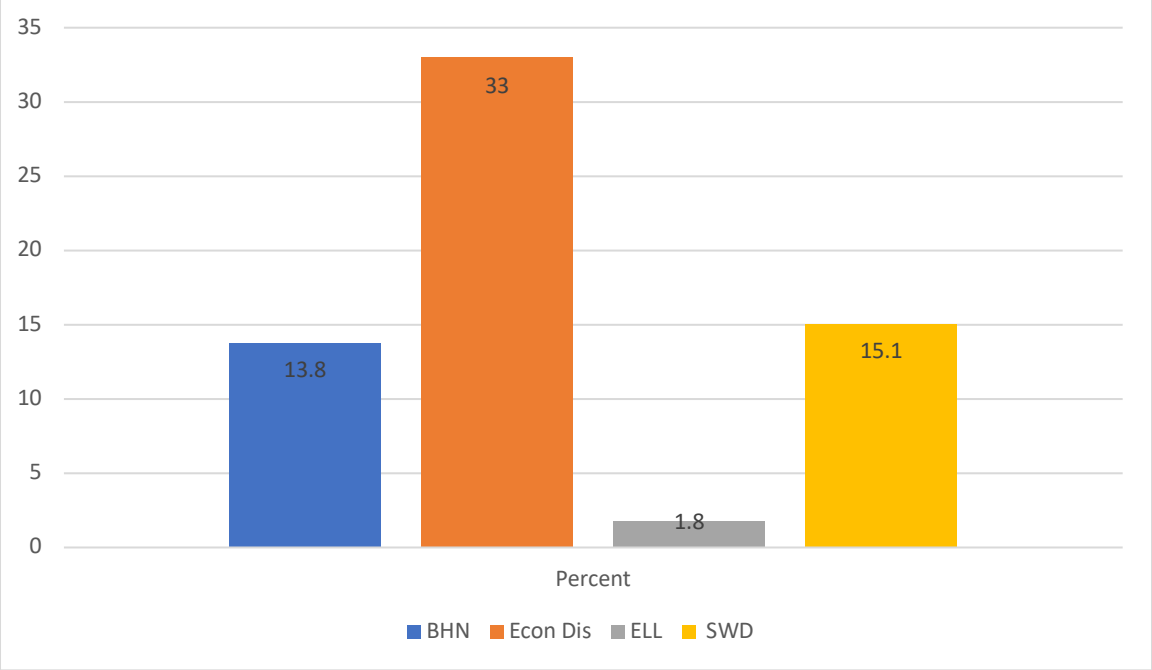


Figure 4

STEM School District Demographics

The district is in year 3 of their 1:1 program. The program began by providing 8th grade students in one middle school with devices during the spring semester of 2016. The following year devices were provided for all students in grades 6-12. Because only students in grades 6-12 participate in the 1:1 program, administrators in the middle and high schools were asked to participate in this research study.

Creativity School district is located in a rural district with a population of approximately 30,000. The district serves about 3,800 students and has 21 administrators. The district is comprised of 4 elementary schools, 2 schools serving students in grades K-8, one middle school, and two high schools, one of which serves students in grades 6-12. The demographics of the district are provided in figure 5.

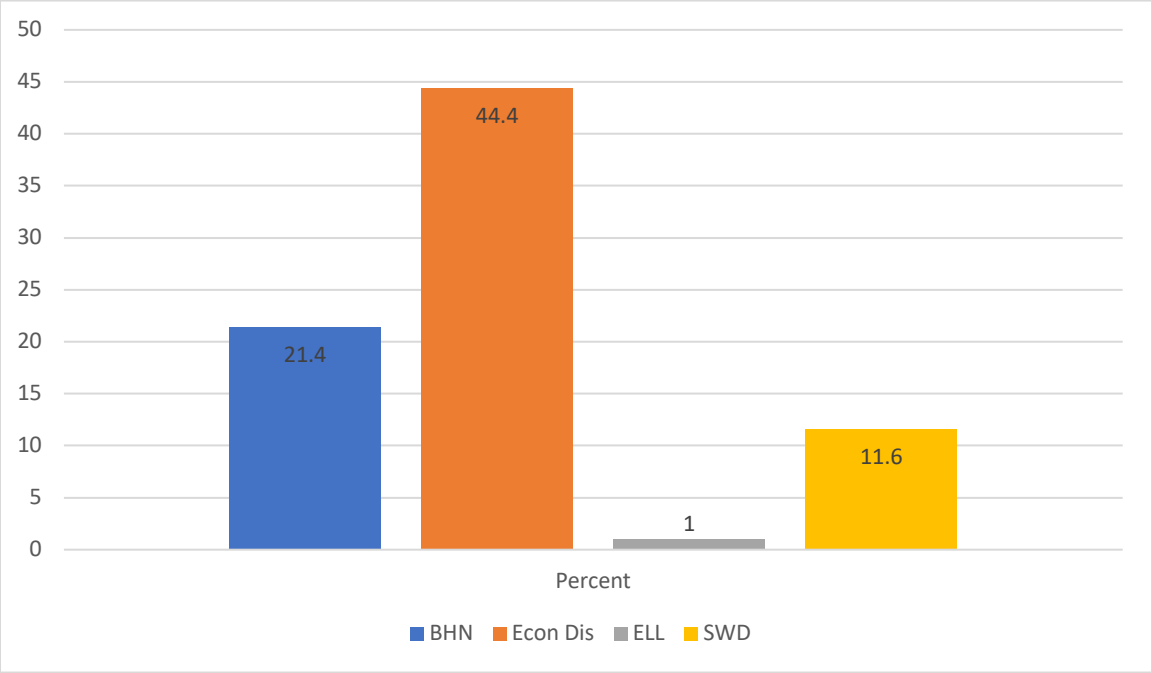


Figure 5

Creativity School District Demographics

The district began its 1:1 program in 2016. The first year of implementation devices were provided to students in grades 5 and 6. Each year thereafter a few grade levels were added so that after 3 years all students in grades 3-12 had devices. Because all students in grades 3-12 have 1:1 devices, administrators in those schools were asked to participate in the study.

Innovation School District is a rural school district located in a community with a population of approximately 81,000. The district serves about 13,000 students, has approximately 850 classroom teachers and 56 administrators. There are 10 elementary schools, 4 middle schools, 3 high schools and 3 unit schools in the district. The demographics of the district are provided in figure 6.

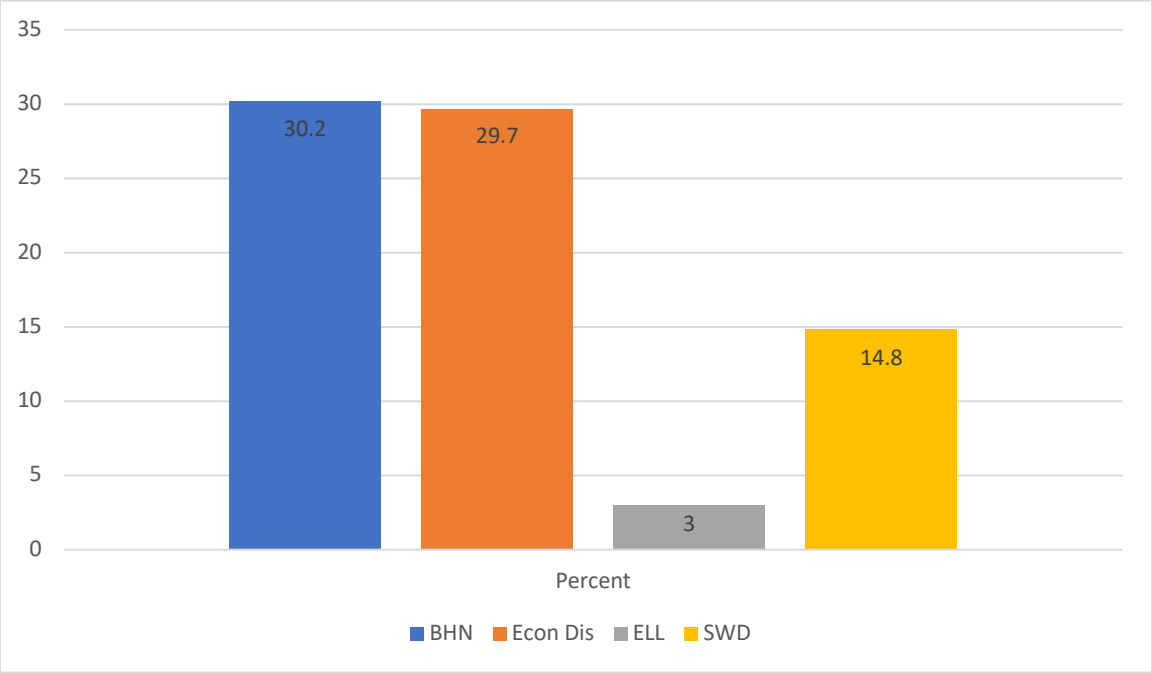


Figure 6

Innovation School District Demographics

Innovation School District implemented its 1:1 program through an application process in which either grade levels or subject areas within a school had to apply collectively for approval to receive devices. The district used the Technology Integration Matrix from the Florida Center for Instructional Technology (2011) to determine teacher and student readiness for devices. Because the implementation varies across the district, only leaders in schools that were fully 1:1 were asked to participate in the study.

Sampling Design.

This study utilized a Criterion Sampling Design in which all administrators in the district or school with full 1:1 implementation were asked to participate in the survey (Patton, 2015). Administrator names and email addresses were obtained from the school webpages. In the STEM school district, all middle and high school administrators were asked to participate. All Creativity School District administrators in grades 3-12 were asked to participate in the study. In the Innovation School District only administrators with full 1:1 implementation were asked to participate in the study. Resulting in the survey being sent to 34 school leaders in 3 school districts, ranging from 2-3 years of 1:1 implementation. Of those asked to participate in the survey, 15 completed the survey resulting in a 29% completion rate. Subsequent interviews were purposefully chosen through exemplar cases whose written responses indicated they would provide important information as to the dimensions of the issue and who were accessible (Patton, 2015). Interview participants were selected based on their responses to open-ended questions which related to principal use of technology, individual definitions of technology integration, and determination of professional development needs. Each of these open-response questions were related to the recommendations of current research to analyze

principal use of technology, how leadership defined technology integration, and how teacher professional development needs were determined (Archibald et al, 2011; Berret et al, 2012; Dexter, 2011; Brown & Jacobsen, 2012; Byrom & Bingham, 2001; Desimone et al, 2002; Ertmer, 2005; Guskey, 2000; ISTE, 2018; Knowles et al, 2011; Lawless & Pellegrino, 2007; Pautz & Sadera, 2017; Rabah, 2015; Richardson et al, 2015; U.S. Dept. of Education, 2017; Yee, 2000).

Instrumentation.

In this study one survey instrument was utilized to collect quantitative data, the Principals Technology Leadership Assessment, PTLA. The PTLA was chosen because it provides information related to leadership and vision for technology within the school, technology implementation and planning, and principal use of technology. The PTLA is aligned with the ISTE NETS-A (UCEA CASTLE, n.d.a). The PTLA was used to provide descriptive data for the study. In addition, open-response questions added to the survey, based on current research (Archibald et al, 2011; Berret et al, 2012; Dexter, 2011; Brown & Jacobsen, 2012; Byrom & Bingham, 2001; Desimone et al, 2002; Ertmer, 2005; Guskey, 2000; ISTE, 2018; Knowles et al, 2011; Lawless & Pellegrino, 2007; Pautz & Sadera, 2017; Rabah, 2015; Richardson et al, 2015; U.S. Dept. of Education, 2017; Yee, 2000), were utilized to identify potential interview candidates.

PTLA.

The Principals' Technology Leadership Assessment (PTLA) is used to assess a principal's technology leadership inclinations and activities over the course of a specific period of time (UCEA CASTLE, n.d.a). It was designed to align with ISTE's National

Educational Technology Standards for Administrators (NETS-A) which include (UCEA CASTLE, n.d.a; Thannimalai & Raman, 2018):

a. Leadership and vison.
b. Learning and teaching.
c. Productivity and professional practice.
d. Support, management, and operations.
e. Assessment and evaluation.
f. Social, legal, and ethical issues.

In addition, it is based on the data from the responses of all principals who completed the survey in August 2005 (UCEA CASTLE, n.d.b).

The NETS-A standards outlined what a tech-savvy leader should know and be able to do (UCEA CASTLE, n.d.b). These standards represent an ideal standard for administrators (UCEA CASTLE, n.d.b). Alignment to ISTE NETS-A is accepted as important for schools moving towards a more technology enriched setting, such as a 1:1 initiative (Richardson et al., 2015).

The PTLA consists of 38 questions with a 5-point Likert scale with ranges from ‘not at all’ to ‘fully’ It consists of five constructs (Thannimalai & Raman, 2018).:

a. Visionary Leadership
b. Digital Age Learning Culture
c. Excellence in Professional Practice
d. Systemic Improvement
e. Digital Citizenship

The PTLA should be viewed as a tool to highlight a principal's relative strengths and needs in technology leadership (UCEA CASTLE, n.d.b). The survey was psychometrically validated by the American Institutes for Research as a part of a grant CASTLE received from the United States Department of Education Fund for the Improvement of Postsecondary Education (FIPSE) (UCEA CASTLE, n.d.a).

Validity and reliability.

Development of the PTLA survey started with a review of the NETS-A standards to determine specific behaviors, activities, and practices associated with each of the standards (UCEA CASTLE, n.d.c). The information gathered from the review was used to guide development of individual items within the PTLA. Developers also reviewed existing surveys and assessments, literature, and gathered advice from researchers to identify best practices in leadership assessment, self-assessment, and item development. Through this research, the developers identified practices to optimize assessment items and scales to gather more reliable responses. From these practices, the developers decided to inquire about respondents past behaviors rather than current or intended behaviors (UCEA CASTLE, n.d.c)

Developers compared draft items to the NETS-A standards to determine face validity and alignment with the six dimensions of the NETS-A standards (UCEA CASTLE, n.d.c). Reviewers assigned each item to one of the NETS-A standards. When disagreement around an item occurred, revisions to the item were made until consensus was reached with regard to the related NETS-A standard. A summary of the reviewer's feedback is included in figure 7 (UCEA CASTLE, n.d.c).

Exhibit 1. Reviewer Feedback (n=10)	Scale of Item Relevance to NETS-A (1-5)	Scale of Item Quality (1-5)
Lowest Average (single item)	4.13	3.38
Highest Average (single item)	5.00	4.71
Lowest Median Value (single item)	4.00	3.00
Highest Median Value (single item)	5.00	5.00
Overall Average	4.70	4.21

(UCEA CASTLE, n.d.c)

Figure 7

Reviewer Feedback on PTLA items

The review process resulted in a draft instrument containing 35 items with four to six items per NETS-A dimension (UCEA CASTLE, n.d.c).

The draft document was subsequently reviewed by a team of experts in the field of education technology and school leadership (UCEA CASTLE, n.d.c). Each reviewer determined a score for each item based on two scales: one addressed the item's relevance to the NETS-A standards and the other addressed the overall quality of the item. The experts provided evidence of the assessment's face validity and assisted in confirming the alignment of the ISTE NETS-A standards and the assessment (UCEA CASTLE, n.d.c).

The PTLA was piloted in August 2005 in seven states and provinces: Alberta (Canada), Arizona, Illinois, Minnesota, New York, Ohio, and Texas. This data was used to determine the instruments reliability (UCEA CASTLE, n.d.c). The reliability of the assessment as a whole was high: Cronbach's alpha (α) = 0.95. The item-test correlation indicated the correlation between each item and the overall instrument, the range of correlations were r = 0.39 to 0.80, with 7 items correlated at less than 0.50. However,

> the item-rest correlation shows how the item is correlated with a scale computed from all other items, minus the item under consideration. For all items, this correlation is lower than the item-test correlation, indicating that each item contributes to measurement of the PTLA construct. Further, the values associated with 'Alpha if item removed' indicate that the instrument does not benefit from the removal of individual items (UCEA CASTLE, n.d.c, p. 3).

Based on this information, all 35 items were left in the assessment for this research study.

Like the NETS-A standards, the PTLA is comprised of items in six separate, but related, dimensions. Of the six dimensions, five showed high reliability (UCEA CASTLE, n.d.c):

Table 2

Reliability of PTLA Dimensions

Dimension	Reliability
Leadership & Vision	$\alpha = 0.88$
Learning & Teaching	$\alpha = 0.84$
Support, Management, & Operations	$\alpha = 0.84$
Assessment & Evaluation	$\alpha = 0.84$
Social, Legal, & Ethical Issues	$\alpha = 0.81$

The lower alpha coefficients for each item as compared to the overall reliability (α = 0.95) was expected and were a function of the reduced number of items in the analysis. Productivity & Professional Practice (α = 0.65) showed

> markedly lower reliability…This decrease in reliability when compared to the five other dimensions indicates that, although the items may be appropriate when considered in the context of the overall instrument, this dimension should not be taken as an independent measure of the construct. The Productivity & Professional Practice dimension may be removed without detriment to, and only marginal enhancement of, the psychometric quality of the instrument (UCEA CASTLE, n.d.c, p.3).

Overall, the PTLA instrument appeared to appropriately measure the construct of school technology leadership (UCEA CASTLE, n.d.c). For the purpose of this research study, all dimensions were left in the survey.

Data collection procedures.

This study used an explanatory sequential mixed methods, quan-QUAL design. In this design the initial research is conducted using quantitative methods (Creswell & Creswell, 2018). The quantitative results are analyzed, and then qualitative research methods are used to further explain those results (Creswell & Creswell, 2018). The quantitative portion of this study was used primarily for contextual information and to assist in identifying exemplary case candidates for qualitative interviews.

The PTLA provided the quantitative data in this study (see Appendix A). Administrators were asked to complete the PTLA on-line. A link to the survey, which consisted of Likert-scale responses and open-ended questions, was emailed to 34

administrators in the participating schools by the researcher using Qualtrix software. Participants had a three-week window to complete the survey. Follow-up emails were sent at one-week and two-week intervals to school leaders who had not completed the PTLA. The software collected data on those who had not completed the survey and follow-up emails were sent only to those who had not completed the survey. Ultimately, 15 administrators responded to the survey.

Following analysis of the PTLA results, criterion sampling was used to identify administrators for follow-up interviews. In criterion sampling a predetermined criterion of importance is used to identify and select cases for follow-up data collection (Palinkas et al., 2016). In this study interview candidates were chosen based on their responses to the PTLA and the open-ended questions added to the PTLA and how those responses aligned with what research suggests are the most effective leadership practices for technology integration. Interview candidates were purposefully chosen through exemplar cases whose written responses indicated they would provide important information as to the dimensions of the issue and who were accessible (Patton, 2015). Interview participants were selected based on their responses to open-ended questions which related to administrator use of technology, individual definitions of technology integration, and determination of professional development needs. Each of these open-response questions were related to the recommendations of current research to analyze principal use of technology, how leadership defined technology integration, and how teacher professional development needs were determined (Archibald et al, 2011; Berret et al, 2012; Dexter, 2011; Brown & Jacobsen, 2012; Byrom & Bingham, 2001; Desimone et al, 2002; Ertmer, 2005; Guskey, 2000; ISTE, 2018; Knowles et al, 2011; Lawless & Pellegrino,

2007; Pautz & Sadera, 2017; Rabah, 2015; Richardson et al, 2015; U.S. Dept. of Education, 2017; Yee, 2000).

The interview candidates were contacted via email to request an interview. Upon agreement to participate in the interview portion of the study, the researcher and the interviewee scheduled a time for the interview. Interviews were conducted at the participants school, with one exception, which occurred at the local public library by request of the interviewee. Interviews were recorded using Google or Microsoft speech-to-text software. There were 16 interview questions (see Appendix B). and each interview lasted approximately 60 minutes.

Following the interviews, the researcher documented general attributes of the participants and initial reactions to the interview in analytic memos (see Figure 8). The interview transcripts, totally 64 pages, were then formatted and sent to participants for member-check. The member checking allowed participants to verify the data in the interview transcript before the researcher analyzed the data (Patton, 2015). Upon approval of the transcripts by the participants, the researcher coded the interviews using In Vivo coding and code mapping. Following coding of each interview, the researcher completed an analytic memo regarding the interview. The analytic memos were reviewed to determine if additional interviews were necessary.

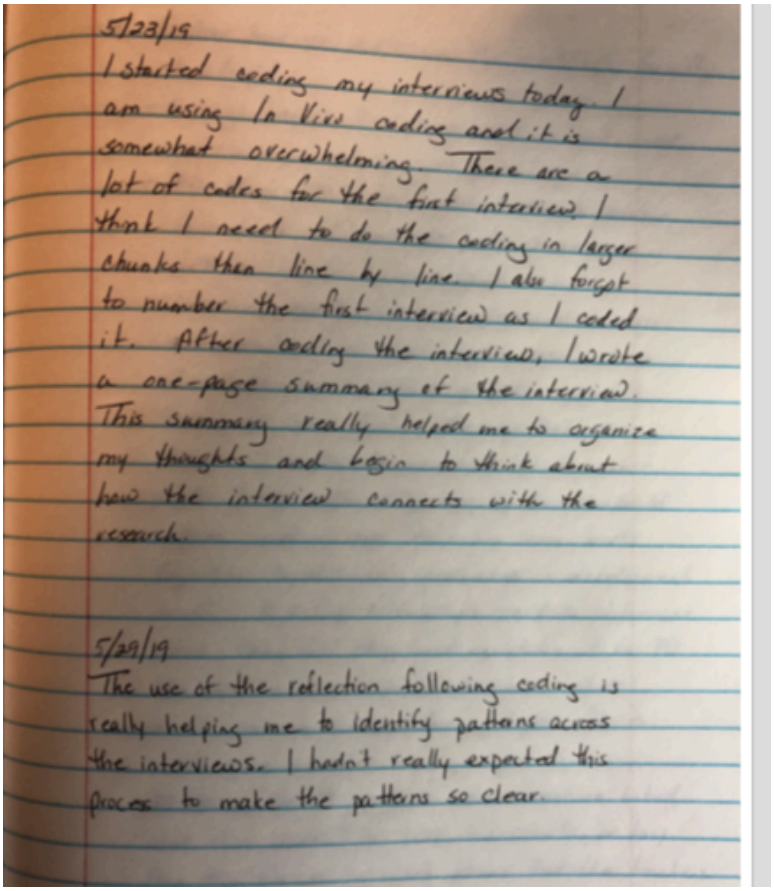


Figure 8

Researcher Reflective Analytic Memo

Data analysis procedures.

The quantitative data analysis was completed using the statistical software package SPSS in order to summarize descriptive statistics of participant responses. This data provided contextual evidence for the research study. These results will be discussed in Chapter 4.

The qualitative portion of the data was analyzed through multiple rounds of coding and reflection. Coding assists in providing standardization and rigor to the

analytical process (Patton, 2015). Coding allows the researcher to organize and group similarly coded data into categories which share some characteristic (Saldaña, 2016). Coding for this study was completed using In Vivo coding and code mapping. When using In Vivo coding, actual words or short phrases of the participants are selected as the code (Saldaña, 2016). The In Vivo coding resulted in the identification of 1,060 codes from the 64 pages of interview transcripts. The results of the In Vivo coding are presented as a word cloud in figure 9. A word cloud is an electronic image that shows words used in a particular piece of electronic text or series of texts (https://dictionary.cambridge.org/us/dictionary/english/electronic). The words differ in size according to how often they are used in the text.

Following the initial coding of each interview, the researcher completed a reflective analytic memo. Analytic memos are similar to journal entries or blogs (Saldaña, 2016). They engage researchers with their data and early comparative analyses, help to identify analytic gaps, and encourage researchers to develop their ideas throughout the research project (Patton, 2015). In addition, they provide a place to record the reflections of the researcher about the participants, phenomenon or process being investigated (Saldaña, 2016).

Figure 9

Word Cloud of In Vivo Codes

Second round coding was completed using code mapping. Second round coding requires the researcher to classify, prioritize, integrate and synthesize the data to identify themes or patterns (Saldaña, 2016). After all interviews were coded in the initial round

using In Vivo coding, the researcher used code mapping, multiple iterations of organizations of the codes, to narrow the list of initial codes. Code mapping allowed the researcher to reorganize the initial codes into categories and then further categorize the categories into themes or concepts (Saldaña, 2016).

Code mapping was accomplished through the use of Excel spreadsheets. All the In Vivo codes were entered into a spreadsheet. The researcher then cut and pasted the codes into additional spreadsheets to reorganize the codes into 16 different categories. The categories were then combined and reorganized into 2 overarching themes—leadership practices and 21st century skills (see figure 10). The qualitative data will be discussed in Chapter 5.

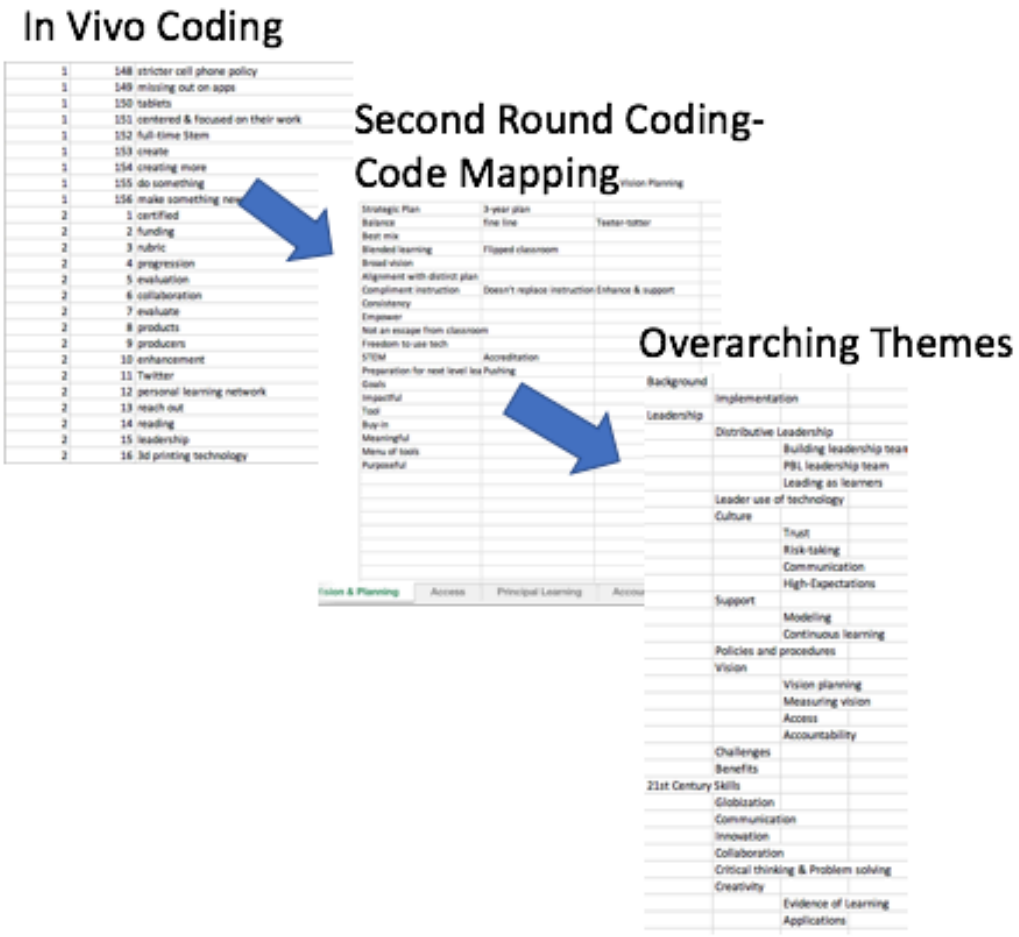


Figure 10

Code Mapping

Summary

The purpose of this mixed-methods study was to answer the question of how administrators in a 1:1 environment experience and enact recommended practices for technology integration. In this quan-QUAL study, the PTLA was used to generate descriptive data and criteria for selection of participants for follow-up interviews. The

data from the interviews was analyzed using In Vivo coding and code mapping. The next chapter will discuss the results of the quantitative data.

CHAPTER VI: QUANTITATIVE DATA ANALYSIS

Overview

The present study seeks to determine *how administrators in a 1:1 environment experience and enact recommended practices for technology integration*. To answer this research question, the Principals' Technology Leadership Assessment (PTLA) was administered to study participants to obtain contextual information with regard to the study. The PTLA is used to highlight a principals' relative strengths and needs in technology leadership (CASTLE, n.d.a). The survey consists of 35 multiple select questions, in addition, 3 open-ended questions were added to the PTLA survey to identify potential participants for follow-up interviews. In this chapter, results from the PTLA will be reviewed to provide contextual evidence for the study. Qualitative data results to include themes and patterns identified through the interviews will be discussed in Chapter 5. Discussion and findings will be discussed in Chapter 6.

PTLA Results

The PTLA survey (see Appendix A) was sent to 34 school leaders in 3 districts in the southeastern United States. Fifteen leaders completed the survey, resulting in a completion rate of 29%. A breakdown of the number of school leaders in each district who received the survey and the number that completed the survey is provided in Table 3.

Table 3

Survey Participants

District	# of Administrators Requested to Participate In Survey	# of Administrators Who Completed Survey
Stem	11	4
Creativity	17	6
Innovation	8	5

Survey participants were asked to answer questions related to their technology inclinations and activities. The survey included 35 selected response questions. Response choices were on a Likert scale and ranged from “Not at all” to “Fully”. In addition, there were 3 open-ended questions added to the survey to assist in identifying potential interview candidates. The PTLA is divided into 6 major areas:

1. Leadership and Vision.
2. Learning and Teaching.
3. Productivity and Professional Practice.
4. Support, Management, and Operations.
5. Assessment and Evaluation.
6. Social, Legal, and Ethical Issues.

Each of these major areas will be discussed in this section.

The PTLA was administered to school leaders in 3 Southeastern United States school districts based on their implementation of 1:1. In the STEM district, students in grades 6-12 were in their third year of having 1:1 devices. In this district, the 1:1 implementation began by conducting a pilot implementation which involved providing 8th grade students in one middle school with devices. The following year all students in grades 6-12 were provided devices. For this reason, in the STEM district, school leaders in schools serving students in grades 6-12 were asked to participate in the study.

In the Creativity School district, the 1:1 implementation began by providing students in grades 5 and 6 with devices. Each subsequent year, a few grade levels were added until all students in grades 3-12 had 1:1 devices. Because of the grade levels involved in the 1:1 implementation in Creativity district, school leaders in all schools serving students in grades 3-12 were asked to participate in the study.

In Innovation School district, grade levels or content area teams in grades 3-12 had to qualify to receive their 1:1 devices through the use of the Florida Center for Instructional Technology's (2011) Technology Integration Matrix (TIM). Because the implementation varies across the Innovation district, only 4 schools, which were fully 1:1 in their respective grade bands, were asked to participate in the study.

Each section of the PTLA included between 5-7 questions. The questions were scored on a Likert scale from 1 (not at all) to 5 (fully) as school leaders identified their participation in various aspects of technology leadership.

Leadership and vision.

In the leadership and vision section, there were 6 selected response questions (see Figure 11). The scores ranged from a mean of 3.40 to 3.67. Leaders scored themselves

highest on communicating information to stakeholders about the schools technology planning and implementation efforts (*M* = 3.67, *SD* = 1.047) and engaging in activities to identify best practices in the use of technology (*M* = 3.67, *SD* = .900). They scored themselves lowest on comparing and aligning their school's technology plan with other plans within the school or district (*M* = 3.40, *SD* = 1.056).

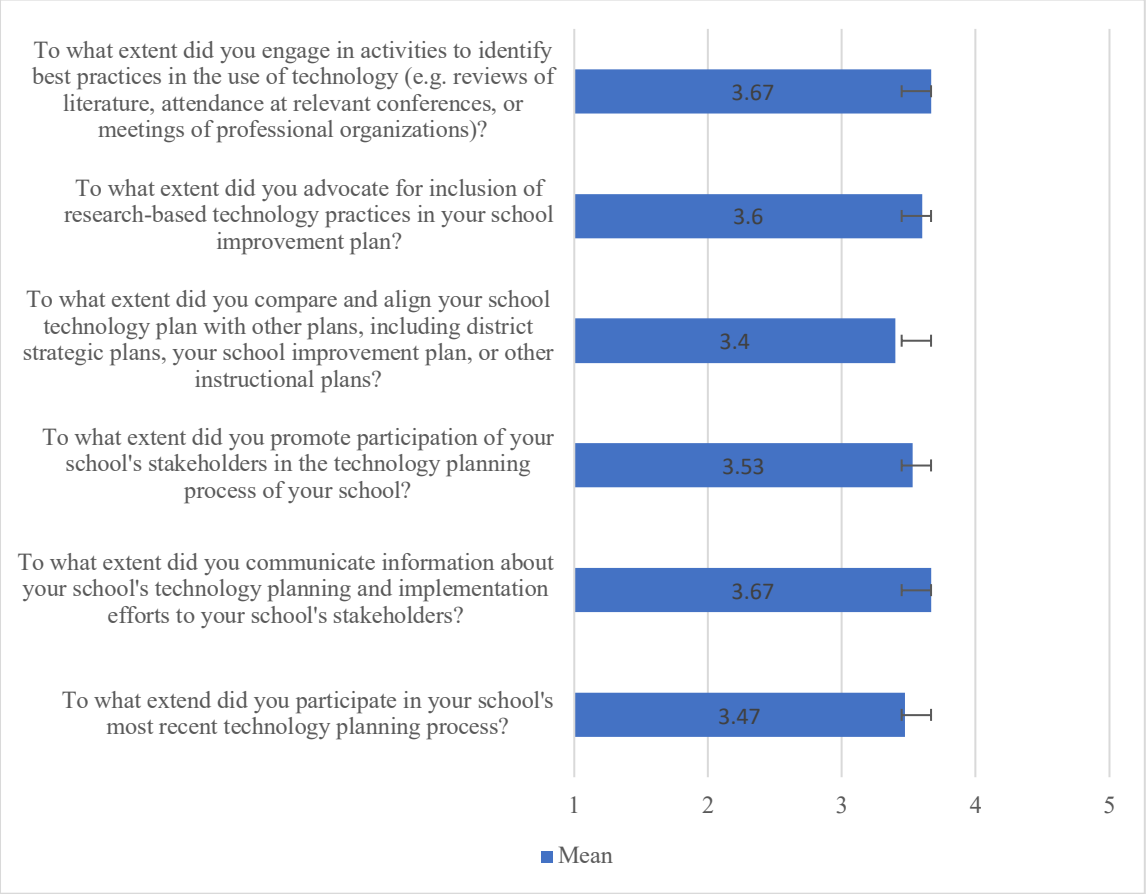


Figure 11

PTLA: Leadership & Vision

Learning and teaching.

The learning and teaching section of the survey also consisted of 6 selected response questions (see Figure 12) which ranged in score from 3.47 to 4.20. School leaders scored themselves highest in providing or making available assistance to teachers to use technology for interpreting and analyzing student assessment data (M = 4.20. SD = .862). Organizing and conducting assessments of staff needs related to professional development on the use of technology (M = 3.47, SD = 1.060) and facilitating or ensuring the delivery of professional development on the use of technology to faculty and staff (M = 3.47, SD = .915) scored the lowest.

This section of the survey also included an open response question related to how professional development needs of faculty and staff were determined. Survey participants reported the following means to identify the PD needs of their staff:

- use of surveys.
- teacher evaluation data.
- classroom observations

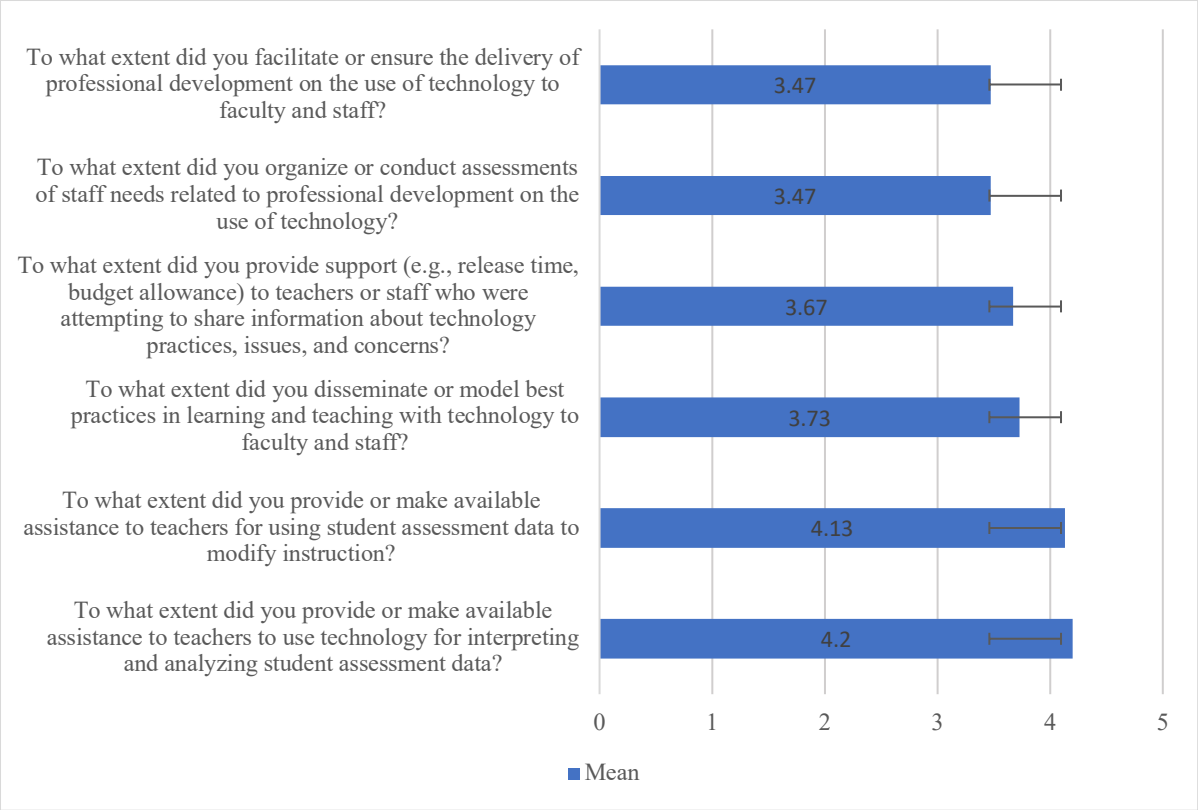


Figure 12

PTLA: Learning & Teaching

Productivity and professional practice.

The Productivity & Professional Practice portion of the survey had 5 selected response questions (see Figure 13). Scores on this section ranged from 3.27 to 4.53. Leadership scored themselves highest in using technology-based management systems to access student records ($M = 4.53$, $SD = .640$). They scored themselves lowest in participating in professional development activities meant to improve or expand their use of technology ($M = 3.40$, $SD = .828$).

The productivity and professional practice section also included an open response question about how school leaders encourage or use technology to communicate with

education stakeholders, including peers, experts, students, parents/guardians, and the community. Leaders indicated they used technology in the following ways to communicate with their stakeholders.:

- E-mail.
- Webpages.
- Blogs.
- Student broadcasts.
- Facebook Live and other social media outlets such as Twitter.

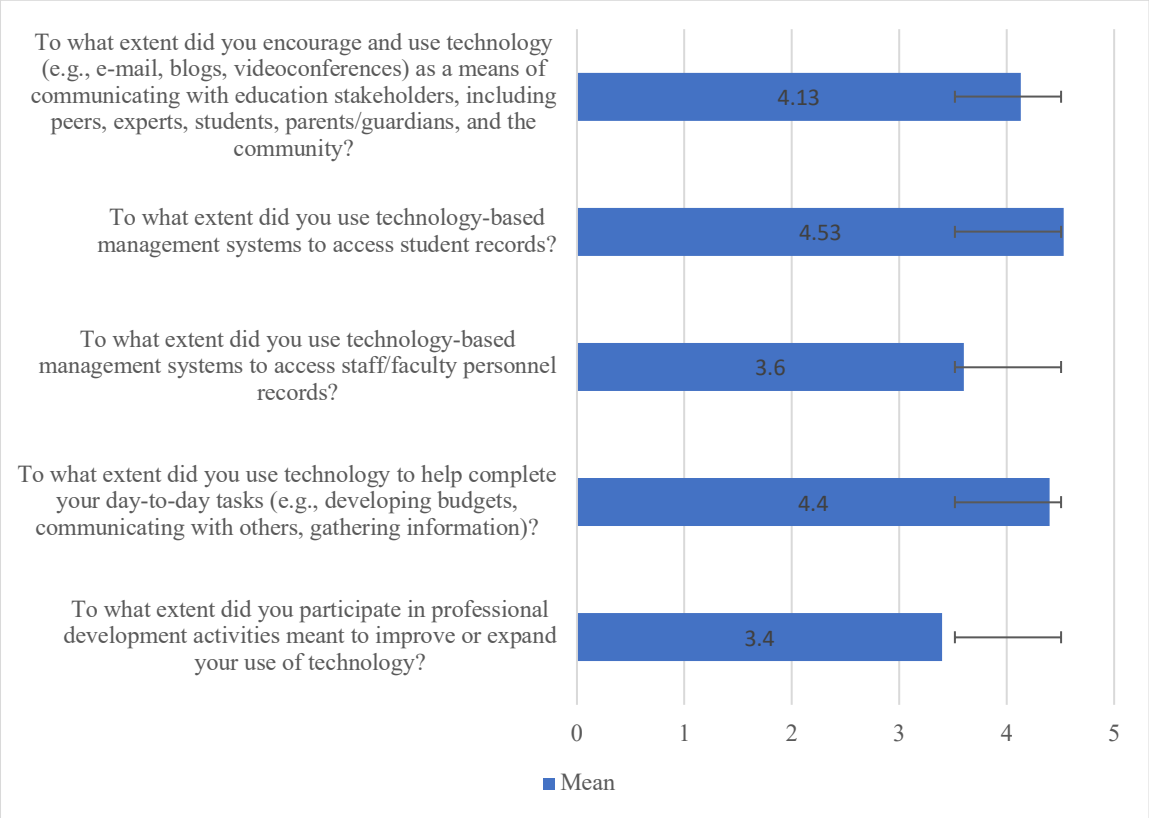


Figure 13

PTLA: Productivity and Professional Practice

Support, management, & operations.

Six selected response questions were used to determine the school leaders inclinations and activities with regard to Support, Management, & Operations (see Figure 14). Scores for this section of the PTLA ranged from 3.27 to 4.00. Participants scored supporting faculty and staff in connecting to and using district- and building-level technology systems for management and operations highest (M = 4.00, SD = .926). Allocating campus discretionary funds to help meet the school's technology needs (M = 3.27, SD = 1.163) and pursuing supplemental funding to help meet the technology needs of their school (M = 3.27, SD = 1.280) were scored lowest.

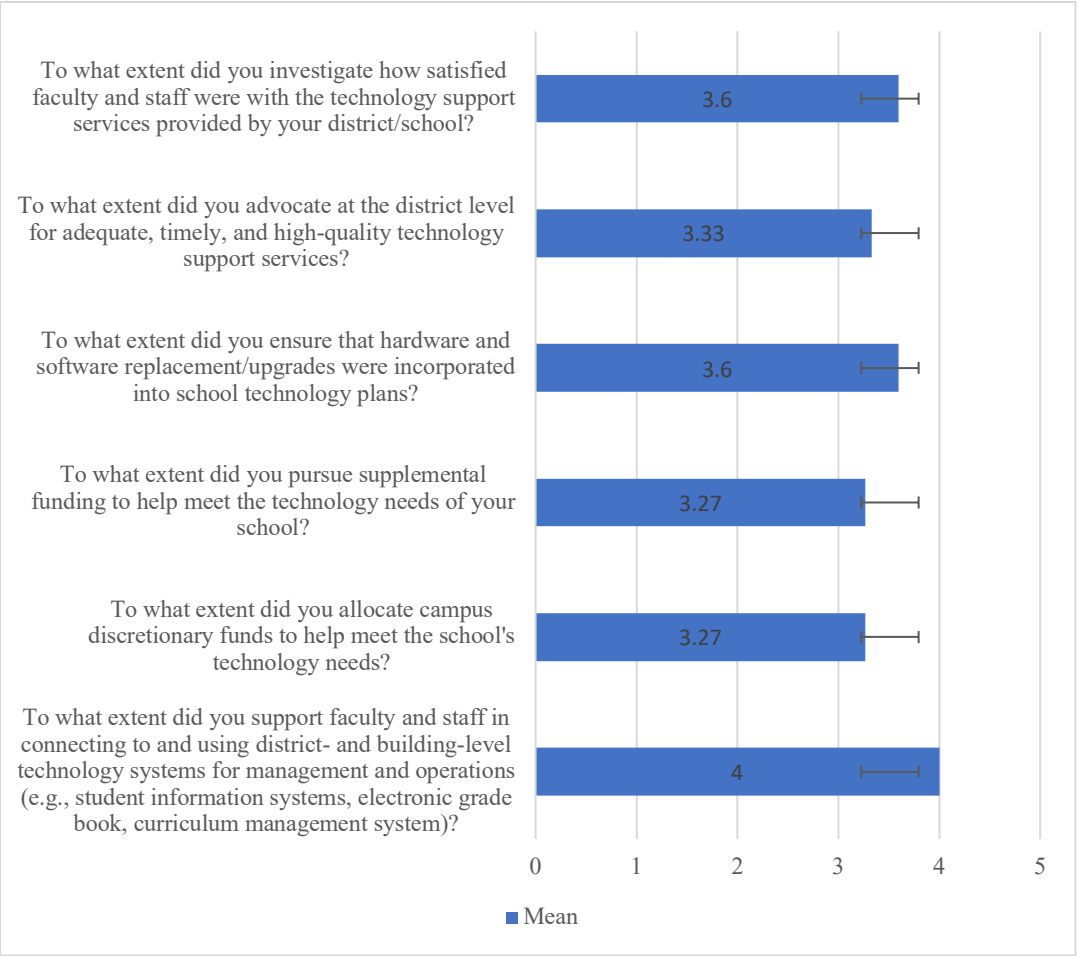


Figure 14

PTLA: Support, Management, & Operations

Assessment and evaluation.

The section related to Assessment & Evaluation consisted of 5 selected response questions (see Figure 15). Scores for this section ranged from 3.07 to 3.80. Leaders scored themselves highest in promoting or modeling technology-based systems to collect student assessment data ($M = 3.80$, $SD = 1.082$). Assessing and evaluating existing technology-based administrative and operations systems for modification or upgrade scored the lowest ($M = 3.07$, $SD = .730$).

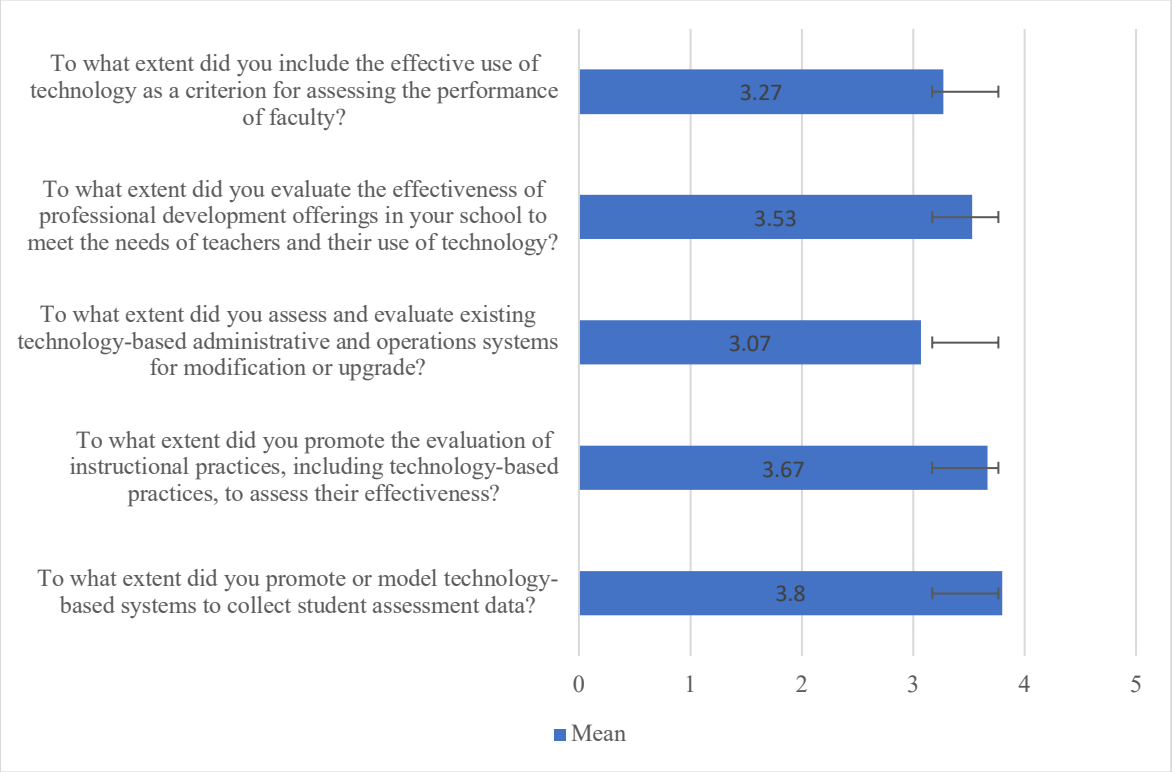


Figure 15

PTLA: Assessment & Evaluation

This section included an open response question asking school leaders to define "effective use of technology" in teaching and learning. The use of technology to support and enhance instruction was the general definition of "effective use of technology" provided by 40% of survey participants. Other participant definitions of the effective use of technology included:

- using technology as an instructional resource.

- the purposeful use of technology—not using technology for the sake of using technology.
- not merely a means of output (papers, presentations, etc).
- student self-navigation and exploration with the technology to become self-learners and take ownership of their learning.
- differentiated learning.
- supplement used for instruction or assessment.

Social, legal, and ethical issues.

In the section on Social, Legal, and Ethical issues, there were 7 selected response questions (see Figure 16) with a score range of 2.73 to 3.87. School leaders scored working to ensure equity of technology access and use in their school (M = 3.87, SD = .834) and supporting the use of technology to assist in the delivery of individualized education programs for all students (M = 3.87, SD = .915) highest. Disseminating information about health concerns related to technology and computer usage in classrooms and offices scored lowest (M = 2.73, SD = .704).

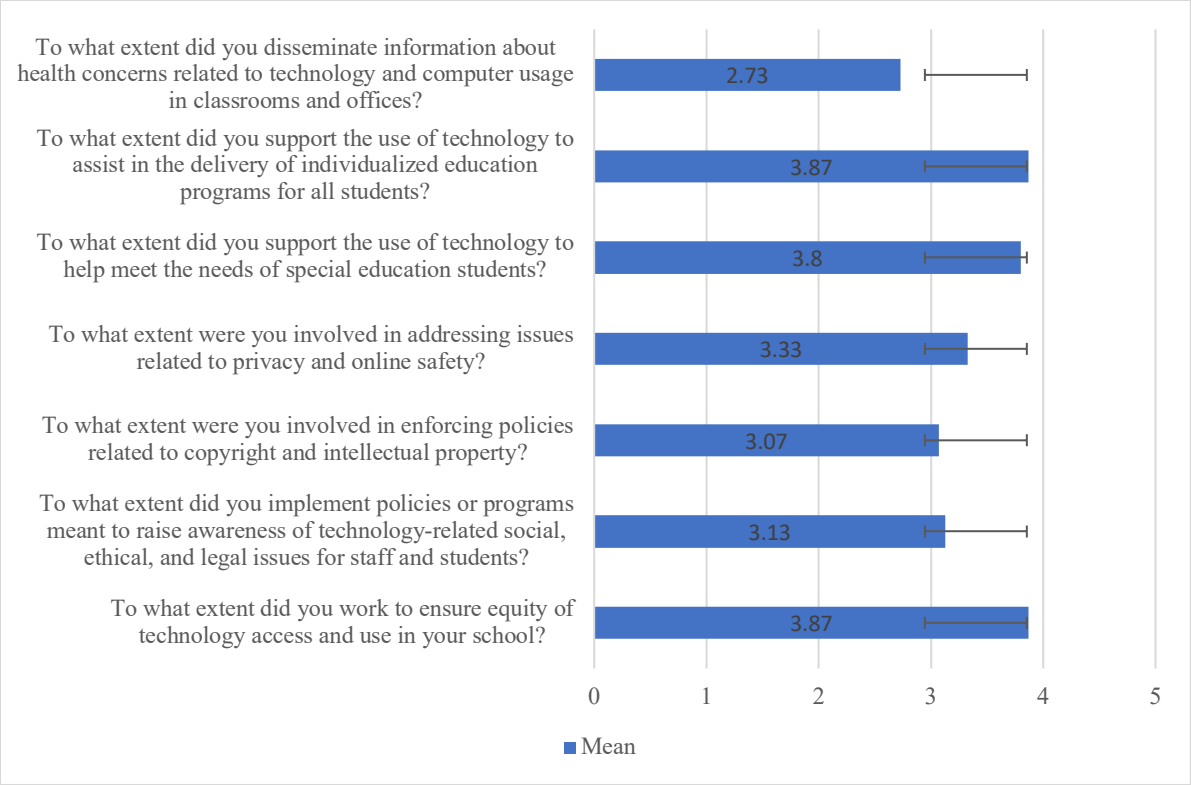


Figure 16

PTLA: Social, Legal, & Ethical Issues

Discussion

Based on the results of the PTLA, school leaders in this survey are most comfortable using technology in the area of productivity and professional practice. The leaders indicate they most often use technology to access student records and complete their day-to-day tasks. This supports the findings of research which found that principals primarily used technology in their day-to-day operation of schools, especially for communication (Waxman et al., 2013). Teachers value principals who demonstrate increased levels of technology fluency (Brown & Jacobsen, 2016). Leaders modeling the

effective use of technology assists in sending a consistent message to teachers regarding the importance of technology within the building (Waxman et al, 2013). Anderson and Dexter (2005) found that a principal's technology leadership practices and technology-oriented behaviors play a more important role in technology integration within the school than did the availability of cutting-edge technology tools.

Principals in this study were least comfortable with technology practices related to social, legal, and ethical issues. Principals indicated they provide little information about the health concerns related to technology and computer use. They also indicated they were only somewhat involved in enforcing policies related to copyright and the protection of intellectual property. Hutchinson and Reinking (2011) conducted a survey of literacy teachers and found the lack of understanding of copyright issues as one reason teachers gave for not using ICT tools within their classroom. The area of social, legal, and ethical issues may be an area of growth for both school leaders and teachers.

Identifying individuals for follow-up interviews.

In the sequential explanatory design, results from the quantitative phase are used to inform the design of the qualitative phase (Creswell & Creswell, 2018). The responses to open ended questions in the PTLA about the determination of professional development needs, school leader use of technology and the effective use of technology, and their alignment to current research and best practices in current research were the criteria used to identify the potential participants to request follow-up interviews.

Determination of professional development needs.

Guskey (2014) says professional development must be planned with consideration of teacher's desired knowledge and skills. Professional development aligned to teacher evaluation is recommended by Archibald et al. (2011) and Desimone et al. (2002).

School leader use of technology.

Waxman et al. (2013) found principals consider the use of technology for communication as an important tool in their leadership. The ISTE Standards for Education Leaders (2018) call for leaders to collaborate and communicate the vision and strategic plan with stakeholders. Leading by example and modeling the use of technology will support educators to use technology in the same manner (Anderson & Dexter, 2005; Berrett et al., 2012).

The effective use of technology.

Research about technology integration says school leaders must be consistent in their expectations about integrating learning technology in their school (Demsky, 2012). This expectation requires school leaders to have a clear definition of what the effective use of technology is and share that definition with others (Waxman et al, 2013). Kolb (2017) states that "technology integration is more complex than simply using a technology tool; pedagogical and instructional strategies around the tool are essential for successful learning outcomes" (p.10). The ISTE Standards for Education Leaders (2018) call for leaders to create a culture that empowers teachers and students to use technology in innovative ways. In addition, leaders must understand that students need to apply tools they are using outside of school within the classroom (Sheninger, 2014).

Survey respondents whose open-ended responses aligned with the school of thought of recent the research related to identifying professional development needs, leadership use of technology, and current understandings of the effective use of technology received an email requesting a follow-up interview. Emails were sent to 10 survey respondents. Chapter 5 will discuss the qualitative portion of this research study.

CHAPTER V: QUALITATIVE DATA ANALYSIS

Overview

School leaders in 3 districts in the southeastern United States were asked to participate in this research study to determine how school leaders in a 1:1 learning environment experience and enact recommended practices for technology integration. The Principals' Technology Leadership Assessment (PTLA) was sent to 34 school leaders who held the role of principal or assistant principal. Fifteen principals responded to the survey. Criterion sampling was used to identify potential interview candidates. Criterion sampling uses predetermined criteria of importance to identify and select cases for follow-up data collection (Palinkas et al, 2016).

Based on responses to open-ended questions included in the PTLA and how the responses aligned to current research, select school leaders were identified to receive an invitation to participate in a follow-up interview. Of the 15 respondents, emails were sent to 10 school leaders to request an interview. Seven leaders agreed to be interviewed for the study, of those 2 (Sarah and Rose) were from the same building. One school leader's interview was unable to be included in the data analysis due to the poor translation of the interview. Leaders from all 3 districts were included in the interviews. Table 4 includes descriptive information on each participant along with their definition of technology integration provided during the interview.

Table 4

Descriptive Information for Participants in the Qualitative Phase

Participant* (*Pseudonyms)	Years as Leader in 1:1 School	Current Role	Definition of Technology Integration	District
Rose	3	Principal	Incorporating technology in general instruction every day in some way	Creativity
Sarah	1	Assistant Principal	Teaching students how to use a device to further their learning and show their learning	Innovation
Lily	2	Assistant Principal	A planning and training process for both students and educators to unitize the available technology at its highest ability.	STEM
Ruth	2	Principal	Maximizing technology to accomplish something in a more meaningful or a more impactful way then you could otherwise	Innovation
William	1	Assistant Principal	Anything that makes life easier; teaching students to use the tool better and use it to their advantage	STEM
Chris	2	Principal	Enhancing and supporting instruction	Innovation

Patton (2015) cautions against quantizing qualitative data especially when there is a small number of participants. The practice of "keeping qualitative analysis first and foremost qualitative" (Patton, 2015, p. 558) assists in protecting the anonymity of interview participants. For this reason, numbers or percentages will not be ascribed to any of the qualitative findings in this study.

Interview Questions

The interview consisted of 16 questions which were developed by the researcher based on a review of current literature. To determine if the interview questions were appropriate to answer the research question, the questions were utilized in a small-scale pilot study during a previous course in the researcher's study. Following the pilot study, the questions were revised to better meet the needs of the research. Following the revision, a mock interview was conducted to confirm the questions would provide adequate information to answer the research question. Following the mock interview, the researcher and the mock interview participant discussed the questions to determine if they covered all pertinent areas of the 1:1 implementation. It was determined some of the questions needed to be reordered, but the necessary information could be obtained from the interview questions. The final interview questions (see appendix B) could be clustered into five areas: background information, vision, technology leadership, support, and instructional use of technology. A brief summary of the questions included in each category follows.

Findings from the qualitative portion of this study were triangulated with the results of the PTLA. Patton (2015) indicated that specific methods of incorporating

mixed data intentionally supports triangulation. The use of both closed- and open-ended questions on the survey assisted in the triangulation process.

The background questions included determining how long each interview participant had been a principal in a 1:1 school, how the implementation was initiated within the school, how the school leaders themselves developed their technology skills, and how they defined technology integration. Leaders were also asked to discuss the importance of technology in education.

The questions related to vision included what the school leaders vision for technology was and how it was created. Monitoring of progress toward achieving the vision was also discussed.

Technology leadership included questions about a technology leadership team—if there was one, who made up the team, how often they meet, and what role the team played in technology integration. Policies and procedures implemented to ensure the successful integration of technology within the school were discussed, along with how school leaders used technology.

Support is an area frequently identified in the research as being important to teachers. One question related to support focused on professional development needs of teachers. Leaders were also asked to identify what supports, for both teachers and students, they had put in place to assist with the 1:1 implementation. School leaders were also asked to discuss continuous learning regarding technology or the 1:1 initiative for themselves, teacher and staff.

The questions related to instructional use of technology included a question on the level of influence the school leader had over technology use in the classroom. Student use

of technology and the impact of that technology use was also discussed. School leaders were asked to identify and discuss the 21st century skills students within their school were developing as a result of the 1:1 implementation and technology integration.

The final question in the interview asked leaders to identify the success and challenges of the 1:1 program and what were the future plans for the program.

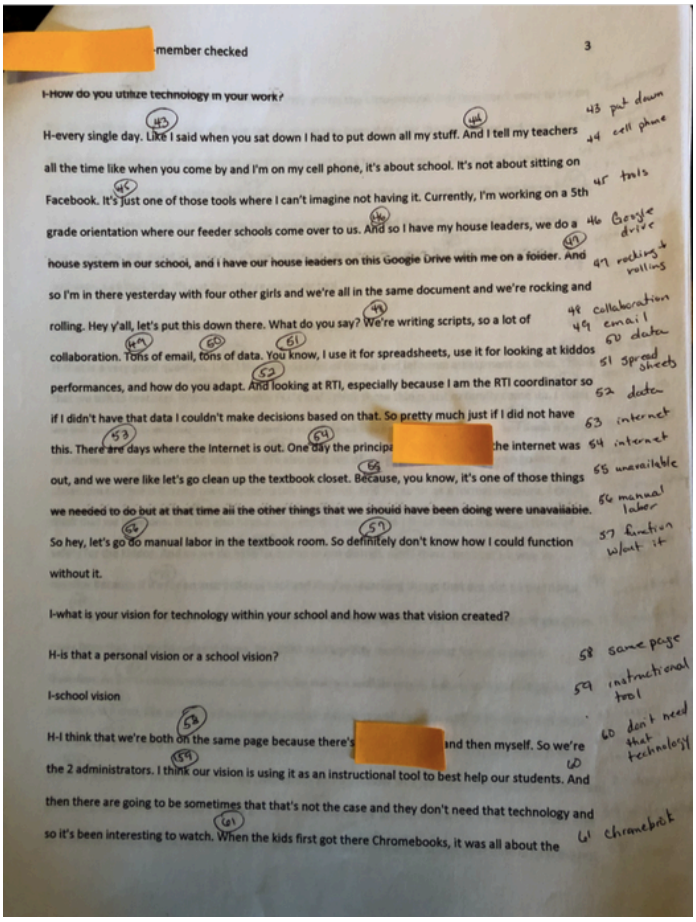
Interviews

Interviews were conducted at each participant's school, with one exception. One interview was held at the local public library. Each interview consisted of 16 questions. Six of the interviews were transcribed using Microsoft Office's speech-to-text tool. One interview was transcribed using Google's speech-to-text tool. The transcription using Google was poorly transcribed resulting in the elimination of that interview from the qualitative portion of the study.

Transcripts were sent to interviewees for member check prior to coding. None of the interviewees indicated that the transcriptions were erroneous or missing anything they thought was important.

Initial coding was completed using In Vivo coding. In Vivo coding refers to a word or short phrase taken directly from the language of the qualitative data record (Saldana, 2016). In Vivo coding is appropriate for most all qualitative studies, but particularly for beginning researchers who are learning how to code (Saldana, 2016). An example of the initial coding is provided in figure 17. Second round coding was completed using code mapping to identify themes and patterns within the data. Two overarching themes were identified: leadership practices and development of 21st century skills. I will briefly summarize each interview and identify *common codes and categories*

from each. Following the brief description, I will examine the themes resulting from the code mapping across all the interview data.



-member checked 3

I-How do you utilize technology in your work?

H-every single day. Like I said when you sat down I had to put down all my stuff. And I tell my teachers all the time like when you come by and I'm on my cell phone, it's about school. It's not about sitting on Facebook. It's just one of those tools where I can't imagine not having it. Currently, I'm working on a 5th grade orientation where our feeder schools come over to us. And so I have my house leaders, we do a house system in our school, and i have our house leaders on this Google Drive with me on a folder. And so I'm in there yesterday with four other girls and we're all in the same document and we're rocking and rolling. Hey y'all, let's put this down there. What do you say? We're writing scripts, so a lot of collaboration. Tons of email, tons of data. You know, I use it for spreadsheets, use it for looking at kiddos performances, and how do you adapt. And looking at RTI, especially because I am the RTI coordinator so if I didn't have that data I couldn't make decisions based on that. So pretty much just if I did not have this. There are days where the internet is out. One day the principa[redacted]he internet was out, and we were like let's go clean up the textbook closet. Because, you know, it's one of those things we needed to do but at that time all the other things that we should have been doing were unavailable. So hey, let's go do manual labor in the textbook room. So definitely don't know how I could function without it.

43 put down
44 cell phone
45 tools
46 Google drive
47 rocking & rolling
48 collaboration
49 email
50 data
51 spread sheets
52 data
53 internet
54 internet
55 unavailable
56 manual labor
57 function w/out it

I-what is your vision for technology within your school and how was that vision created?

H-is that a personal vision or a school vision?

I-school vision

H-I think that we're both on the same page because there's [redacted]nd then myself. So we're the 2 administrators. I think our vision is using it as an instructional tool to best help our students. And then there are going to be sometimes that that's not the case and they don't need that technology and so it's been interesting to watch. When the kids first got there Chromebooks, it was all about the

58 same page
59 instructional tool
60 don't need that technology
61 Chromebook

Figure 17

In Vivo Coded Interview Transcript

Individual interview summaries.

Lily.

Lily is a young and enthusiastic school leader who has a bubbly personality. She has been an assistant principal for approximately 7 years. Her school has been 1:1 for 2 years. Throughout the interview Lily spoke rapidly and animatedly. She is comfortable using technology and this is evident in her office. Her computer has 2 monitors, her cell phone is laying on her desk and there is a tablet, which she mentions using during the interview, on the table behind her.

Logistics was a common theme throughout this interview. She spoke at length about the challenges of having multiple device types, each with a different charger, and the lack of charging carts when they first started the 1:1 program. The use of technology in this building seems to be more to provide tools for the teachers and students rather than to transform the learning experience. The need to have a good *balance* in the use of technology tools and traditional classroom instruction was also frequently mentioned.

Rose.

Rose has been in education approximately 25 years and has been principal for about 8 years. Her school has been 1:1 for 3 years. This interview was completed in the local public library thus limiting observation of the interviewees school surroundings. During the interview Rose was pleasant but reserved. Her responses were thoughtful, but often short. She quickly gave the answer to the questions asked but didn't often elaborate on specifics within the school setting.

Rose thought technology was important in schools, but it should not replace good teaching. Technology should be used to "complement classroom instruction." Rose did

not discuss any specific ways that the availability of technology has transformed student learning. She mentioned her students *communication* skills had improved as a result of having access to the technology and felt the students were more engaged in their learning. She was concerned, with the increased availability of technology, we were losing some important aspects of traditional education, such as handwriting and penmanship.

Ruth.

Ruth has been in education for approximately 25 years. She has been a school leader for 9 years, but only worked in her present school as the principal for the past 2 years. Her school has been 1:1 for 2 years. Ruth was very energetic and peppy throughout the interview. The interview was conducted in her office which had many wall-hangings, books, and pictures. Notes from students and teachers decorated the door and bulletin board. The lighting was low which results in a very comfortable setting. She has a round table in the center of the room where the interview was completed. Her computer is on her desk and, a few times during the interview, she stepped over to it to address an immediate need. Her cell phone is on the table in front of her and she occasionally checked it for texts or updates from her staff. She is obviously comfortable with technology.

Her love and concern for her students was evident throughout the interview. She spoke frequently about wanting to meet their needs both now and in the future. Multiple times Ruth mentioned technology *empowering* her students by providing them access to information and connecting them with people and resources. She understands the role and impact technology will have in students' lives and thinks it is important to develop *21st century skills* in her students.

Sarah.

Sarah has also been in education for approximately 25 years. This was her first year as an assistant principal although listening to her speak you would think she had been in the position much longer. Sarah spoke confidently and with authority throughout the interview. Sarah and Ruth work in the same building. The school has been 1:1 for 2 years. The interview was conducted in Sarah's office which also has low-lighting. A round table was situated comfortably in the center of the room. This was where the interview took place. Her desk, with her laptop and monitor on it, was located in the corner of the room. A few wall-hangings decorate the office and some examples of student work are lying on the table in the center of the room.

Sarah also considered technology a tool to support instruction. She was pleased students in her building were getting the opportunity to learn both iPad and Chromebook technology. She indicated students in her building were learning *communication* skills and were becoming *globally connected*.

Chris.

Chris has been in education for approximately 15 years. He has been a school leader for about 10 years and has been in his present role as principal for 7 years. His school has been 1:1 for 2 years. The interview was conducted in Chris' office. His office is a very collaborative work space with a center table and 8 stools dominating the space. He had a small space in the corner for organization of various materials such as his computer monitor and printer. All this was, however, hidden from view because he had transformed his office to represent a McDonalds restaurant. All the walls in the room were covered in black paper and cut outs of the familiar golden arches decorated the

paper. He was preparing for an end of year celebration for his teachers in which they would be rewarded with treats from the local restaurant. He told me he wanted to model for his teachers how to use their classroom environment to further engage the students and celebrate success.

Chris' enthusiasm for technology was obvious throughout our conversation. He frequently discussed technologies that he has used or tried. He shared his use of social media to further his own education and to communicate happenings at his school. Chris had a strong *vision* for his schools technology and had developed a strategic plan with his *leadership team* to bring that vision to fruition.

William.

William is a young school leader. He has been in education for about 10 years, but this was his first year as an assistant principal. His school had been 1:1 for 2 years. His interview was conducted in his office which was a small, cozy office. His desk was covered with files and various books. In the center of his desk was his laptop, closed. The walls and tables were decorated with pictures of his family. Lamps were situated on side tables to provide alternative lighting for the office. As is the case with many novice assistant principals, his primary leadership function in the school was to handle the discipline issues. He was pursuing his doctoral degree through an on-line doctoral program.

He had a *vision* for his school to become more STEM focused. He wanted to see his students "*create* and do something different". He reported seeing his students furthering their own learning through the technology and referencing the teacher as a facilitator in their learning.

Themes

Leadership practices.

Through analysis of the results of the PTLA along with the interviews, several themes emerged as practices school leaders have implemented to ensure improved student learning and the success of their 1:1 program. These practices were evident in varying degrees in most of the principal interviews. They include distributive leadership, culture development, visionary planning, continuous learning, and a supportive environment. The themes identified will be discussed within this section. Chapter 6 will include a discussion of the quantitative data and the qualitative data.

Distributive leadership.

Effective technology leaders foster change by inspiring change through vision and motivation and through the use of distributed leadership, where the responsibilities of leadership are shared with faculty and staff (Levin & Schrum, 2013; Petersen, 2014). The ISTE Standards for Leaders (2018) call for leaders to empower educators to build professional agency and develop teacher leadership skills. School leaders interviewed indicated they leveraged previously created teams to address technology in the school. Lily stated that "we are a small school, and it's a blessing and a curse. We've got about 33 certified faculty and staff… so we have a leadership team and that leadership team is responsible for everything." The various "leadership teams" meet periodically throughout the year to address the needs of the school.

Ruth indicated she used her Project Based Learning (PBL) leadership team for technology leadership, as well. This school used student-led conferences for their parent teacher conferences. Students created a portfolio to share their learning with their parents.

The PBL leadership team was considering shifting to digital portfolios next year and they planned to include the collection of student artifacts in the portfolio. To do this, the PBL team was considering options to collect video data from students. One option they were considering was using the program See-Saw.

Chris used his leadership team to develop a 3-year strategic plan which included the full implementation of 1:1 in grades K-4. He, however, indicated that "probably 90% of his teachers are involved in some capacity [with technology leadership]."

School leadership teams were also used to address concerns that develop through the 1:1 implementation. In STEM district, middle school students didn't take their devices home with them. Therefore, leaders and their leadership teams had to develop a plan to effectively and efficiently collect and distribute the devices on a daily basis. William's school developed a plan to collect and distribute the devices from a designated location each day. Students knew they had to get to this location and pick up their device before reporting to their first class of the day.

Another issue addressed by the school leadership team in Lily's school was a plan to let students know if technology would be utilized in class on a specific day. Teachers were concerned because students would enter class, get on their device, and go directly to playing games before class started. The teachers then struggled to get students off the devices to start instruction. The leadership team meet several times and "had a lot of . . . discussion about what's our school approach to that" would be. They developed a red light system to let students know if they should get their devices out at the beginning of class. Lily stated, "so when the student walks in and the light is on green that means technologies a go, get your stuff out, let's rock and roll." Red meant the devices would

not be used that day and yellow meant the devices might be used in class. According to Lily, the implementation of this plan helped both teachers and students to effectively utilize classroom instructional time. Lily's school relies on the leadership team to develop consistent procedures within the building because students have 7 classes each day. "If you had 7 different procedures about technology, a middle school student's brain is not going to function that way."

By relying on a team approach to make decisions, school leaders ensured they had the voice of stakeholders included in decision-making and planning. The ISTE Standards for Education Leaders (2018) call for leaders to include stakeholders in the development and communication of the technology or strategic plan. Both Lily and Rose discussed communicating decisions of the leadership team back to faculty and staff through the members of the leadership team.

Culture development.

The implementation of a 1:1 program brings many challenges to schools. Developing the right culture is an important leadership responsibility. The ISTE Standards for Education Leaders (2018) include developing the skills needed to lead and navigate change, advance systems, and promote a mindset of continuous improvement for how technology can improve student learning. Leaders modeling the use of technology can assist teachers with the changes required to integrate technology into their daily practices and classroom instruction (Schrum, Galizio, & Ledesma, 2011). Ruth stated she "modeled through . . . the professional development" they have in her school. Chris shared that he "models good practice(s)" for teachers.

Communication.

Communication within any school is important to developing a supportive culture. Communication must be effective between all facets of the stakeholders—leaders and teachers, leaders and parents, leaders and students, teachers and parents, as well as, teachers and students. Ruth attended a training where a teacher from another district shared the use of e-vites to invite parents to various school events. Her response to this strategy was "why don't we use e-vite? I meant that just makes sense. We have access to all our parents through e-mail. It's just another tool to welcome families into our school." She connected her teachers with the teacher in the other district who had shared the idea and encouraged her teachers to use e-vites within the school. In addition, Ruth encouraged her students to use technology for communication by encouraging them to email her. She saw this as a way to connect with students and build a relationship with them.

Leadership use of technology.

Chris stated he used technology for "collaborative work, as far as team minutes, setting SMART goals, collecting data for SMART goals, we can do that through things like Google Docs or OneNote." Sarah stated her school was "very digitally driven." They maintained all school files on a shared Google drive to ensure all teachers could access the information. She and the teachers in her school use this file to pull data for data team meetings, post minutes to meetings and many other things. Sarah also used technology "to push out assessments to them [teachers], and then to look at the results of the assessments." Lily used technology to communicate and collaborate with her teachers. For example, she was collaborating with 4 teachers throughout her building on a shared

Google document to plan and organize a 5th grade orientation for the school's incoming 5th grade students. She stated "I have our house leaders on the Google Drive with me on a folder. And, so I'm in there yesterday with four other girls and we're all in the same document and we're rocking and rolling." William stated he relied heavily on his Google calendar to help him manage his time and stay organized. He stated "it [Google calendar] has really become my friend." He also used the Remind App to communicate with teachers regarding student discipline, faculty meetings, and various other things. The transformation to a technology-rich environment requires time and leadership support (Byrom & Bingham, 2001). By modeling the use of technology, school leaders can begin to develop a technology culture and mindset with their teachers.

Trust.

Another crucial component of culture development is creating a trusting relationship with faculty, staff and students. Brown and Jacobsen (2016) identified trust as an important aspect of leadership to promote school improvement. Ruth identified teacher trust as a measure of many things. She commented on teacher trust and teacher willingness to try "new things and not being worried about failing or making a mistake." Teachers in Ruth's school knew the leadership would support them through the trial and error phase of implementation. In addition, William discussed the importance of principals trusting teachers to do what they were supposed to be doing, as well.

Risk.

Developing a risk-ready environment is another important aspect of culture development in a 1:1 program (Levin & Schrum, 2013; Peled, Kali, & Dori, 2011). Couros (2015) indicates that taking chances, such as trying new technology tools or new

teaching strategies, seems less risky when there is a trusting relationship between teachers and leaders. To encourage and support teachers in taking risk, principals can model taking risk themselves. In a study conducted by Pautz & Sadera (2017), principals acknowledged and celebrated risk, even when it involved failure. Chris modeled risk-taking for his teachers through the introduction of 3-D technology within his school. To encourage teachers to take the risk of incorporating this technology into their classrooms, he learned to use the technology himself. He commented "I think that it's kind of a part servant leadership, that kind of coming in beside them. They see me playing with the technology, learning the technology and then it kind of gets them excited about things." Once he mastered the use of the printers, Chris created a school-wide contest for students in each grade level to develop a design that would meet an existing need within the school. Once the design was approved, the grade level would receive their 3-D printer. For example, students felt there needed to be an award created to celebrate teachers. They collaborated with their teachers to create and design the Eternal Flame Award. Chris stated this award could be presented to individuals who demonstrated "an on-going passion for the teaching profession." At the final school board meeting of the school year, Chris presented this award to several of his teachers. In addition to modeling risk taking, this principal modeled celebrating the success of teachers and students. The ISTE standards appeal to leaders to celebrate success (ISTE, 2018).

Visionary planning.

The ISTE Standards also call for leaders to be visionary planners who engage in establishing a vision, strategic plan and on-going evaluation cycle for the implementation of technology to transform learning (ISTE, 2018). Research indicates to effectively

integrate technology into student learning, a school leader must be able to develop and articulate a vision for technology (Brown & Jacobsen, 2012; Yee, 2000).

Ruth had been principal in her school for approximately two years. She said she developed her vision for the school based on her initial impressions of teachers and classroom instruction at the time she was named principal. She acknowledged there were some logistical reasons for her vision. A desire to move away from paper and pencil tasks to reduce waste was a big component of the vision. However, her biggest desire was to empower students to understand their passion and purpose in life. She wanted to connect students with the world in a way that was relevant to them. She envisioned students as being equal to adults in the digital world and assisting students to understand how to manage that world. She also envisioned providing students with the tools they needed to complete any task they wanted. She stated " I would love it, you know, if I had a laser cutter and my students can say they had access to a myriad of tools" to accomplish any task or project they were working on.

William's vision for his school was to see students use the technology to begin to "create and do things differently." He wanted to see students go deeper into the content. He also had a vision to see the school develop a large STEM focus. The school is located in an area where industrial maintenance and engineering are a significant employer demand. He would like to see his students graduate and be on their way to a career. His school was assisting students in accomplishing this goal by focusing more intentionally on providing guidance about Career and Technical Education (CTE) programs that would lead to either a university or technical school following graduation. This articulation between the middle school, high school and university or technical school would assist

students in obtaining the 21st century skills needed to meet the demands of the job market in their community. William's schools guidance effort is supported by recent research which indicated school leaders need to develop partnerships among schools and researchers in order to prepare students for a more globalized and technical world (Brown and Jacobsen, 2016).

Lily, Rose, and Sarah each envisioned the technology being used as a tool to support instruction. They stressed the need for balance in the use of technology and traditional instructional materials. Sarah pointed out that the technology should be used "not [as] direct instruction as much as …supported instruction." Rose's school vision was for the technology to compliment instruction and further student knowledge of the technology.

To explain the balance he expected, Chris used an analogy of a teeter totter or a seesaw, "helping teachers understand the assessed content in one seat and technologies in the other seat. We don't necessarily want one to outweigh the other, but there's never going to be a perfect balance." Balance was a term used by several of the interviewees with regard to classroom instruction and technology integration. To support teachers in ensuring they aren't relying too heavily on the technology, Lily taught her teachers to "chunk" their instruction. By this she meant to use one instructional tool, possibly technology based, for about 20 minutes, then shift and use a different instructional tool which is not technology based for about 20 minutes. Kolb (2019) states that students can quickly get off-task when using technology tools. She stresses the importance of teachers not assuming that "engagement in using a device or application is the same as engagement in the learning goal" (Kolb, 2019, p. 23).

Interviewees said they included stakeholders in the technology planning process; however, in most instances, the only stakeholders involved in the development of the vision were teachers. Current research indicates school leaders need a collaborative effort of all stakeholders—students, parents, teachers, community members, and business leaders in the development of the vision (U. S. Department of Education, 2017). Inclusion of stakeholder perceptions and values will assist in gaining broader support for bringing the vision to fruition (Berrett et al., 2012; Rabah, 2015).

The alignment of school visions with district visions can ensure all parties are working to accomplish the same goals. Culatta (2019) says "schools and districts can seize opportunities to rethink and refocus technology strategies by clarifying priorities and building staff knowledge around them" (p. 29). During interviews only 2 school leaders indicated they had taken the district vision or strategic plan, or the school's strategic plan, into consideration when developing their school's vision for technology. Rose indicated the leadership team had aligned the school vision with the district mission and vision. Chris stated his leadership team developed the vision following the new superintendent sharing the broad vision for the district to become 1:1.

The ISTE standards call for school leaders to have an on-going evaluation cycle to transform learning with technology, most principals in this study discussed only informal methods for monitoring technology integration (ISTE 2018). Chris, however, in collaboration with his leadership team, had developed a 3-year strategic plan to move his school toward full 1:1 implementation in grades K-4. Rabah (2015) indicated the need for long-term, carefully developed plans for the successful integration of technology. Over the past three years, Chris' school had frequently revisited the strategic plan in order to

make decisions and monitor progress toward accomplishing its goals. Modifications and adjustments to the plan were made as needed. The team will develop a new 3-year plan in the upcoming school year with a future vision of the school becoming a STEM accredited school. Other leaders monitored the vision through formal classroom observations, informal walk-throughs, and conversations with teachers and students. Lily and Sarah discussed the use of diagnostic instructional tools to also monitor the time students were using various programs and the progress they were making in their learning. Monitoring the time of usage allowed them to monitor the balance of instructional strategies being utilized within the classroom.

Ruth openly acknowledged that she did not monitor progress toward the technology vision. She commented "I am so stuck in trying to figure out how to get achievement where it needs to be that that [technology vision] isn't something I monitor." She did, however, observe and monitor teacher willingness to try new things and innovate.

Continuous learning.

Effective school leaders support the integration of technology to enhance student learning by modeling continuous learning for themselves and encouraging it in others (ISTE, 2018). Opportunities for school leaders to model best practices in learning to stay abreast of current approaches and best practices include the use of various resources to include conferences, books, journals, and social media (Sheninger, 2014; Yee, 2000). Ruth discussed reading professional journals as a means of continuous learning. Lily stated she attended state conferences and brought technology resources back to her teachers. For example, she stated she went to a conference where she "learned about

Flipgrid, which is where the kiddos can make their own videos and they can share them." She was able to share this resource with teachers during a PLC meeting to meet a specific need of a teacher.

Chris discussed the use of his personal learning network (PLN) to keep him abreast of current research and strategies regarding technology integration. This effort to do so is just the sort of practice Sheninger (2014) discusses as a means through which leaders can meet their professional learning needs. Chris stated, "I read a lot and a lot comes through Twitter." A PLN and other social media sites can be used to nurture professional dialogue and provide time for reflection regarding technology-rich teaching and learning (Curous, 2015; Sheninger, 2014). Chris' PLN consists of fellow educators and education leaders across the country. He stated he relied on Twitter and other social media networks to stay abreast of current happenings and communicate with experts in the field of instructional technology.

To promote the learning of his faculty, Chris conducted a book study on digital leadership with his leadership team and then invited the author to present on a professional development day. Chris shared that "it was a really good professional learning and the learning was centered more on good pedagogical strategies and not necessarily good technology strategies." Kolb (2017) indicates that technology integration requires the use of pedagogical and instructional strategies not simply using a technology tool. Following the training in Chris' school, the school devised a plan for how they could implement those instructional and pedagogical practices within their teaching. Providing professional growth opportunities was found to be an important

characteristic of information communication technology (ICT) principals in a study completed by Yee (2000).

Rabah (2015) reported that teachers identified the need for additional professional development to support their integration of technology. Principals interviewed agreed with this and discussed the importance of providing technology professional development to their teachers. Many stated they relied on the district to provide trainings. Sarah and Rose indicated the use of monthly district level professional development opportunities to support the continuous learning of the teachers in their building. Other principals stated they provided in-house professional development for teachers. Some principals provided professional development through specific technology training, while others incorporated technology into routine professional learning such as faculty meetings and PLC meetings. Ruth shared that she and her building level coaches modeled the use of various technology tools when meeting with teachers at faculty meetings and PLCs. She referred to this as "leading as learners" and stated all her coaches knew, during any type of professional learning within the building, they should be modeling strategies that were transferrable to the classroom. Rose stated she has "a mini PD at most all of our faculty meetings, so there is some kind of assistance or offering of instruction. Most of that is generally around the technology."

Obtaining continuous learning for themselves and providing learning opportunities for their teachers was considered extremely important by all leaders surveyed and interviewed. On-going professional learning empowers teachers as leaders and ensures principals and assistant principals develop into being connected learners as called for by the ISTE standards (ISTE, 2018).

Supportive environment.

Teachers have to know that school leaders support the use of technology within the school. Peled et al. (2011) stated that a school leader who is supportive of technology can inspire even the most reluctant teacher to integrate technology, but an unsupportive school leader can cause even early adopters to lose their passion for using the technology. Providing support and encouragement to teachers is an important component of developing the culture. The ISTE Standards for Leaders call for leaders to "inspire a culture of innovation and collaboration that allows the time and space to explore and experiment with digital tools" (ISTE, 2018, p. 1). Integrating technology into instruction is a slow process which school leaders can support by providing time for teachers to collaborate (Byrom & Bingham, 2001; Greaves et al., 2010).

Modeling the use of various technologies encourages teachers to try the technology within their own classroom. Teachers know their school leaders will support their attempts at integrating technology when they see their leaders modeling the tools themselves (Pautz & Sadera, 2017). Ruth shared that she often modeled the use of different technologies for her teachers. She stated, "if we are going to do some kind of staff development, uhm, we use Google Slides… or Google Draw. Different apps that are available because those are things that we encourage the teachers to kind of transfer into their classroom."

Encourage and support are also important for developing a culture that embraces technology integration. Sheninger (2014) indicated that change comes from "supporting professionals to invest in studying, connecting, communicating, and learning together" (p. 30). William stated that he encourages his teachers' technology use through the

instructional coaching he does during the observation process. He stated that he had a teacher who was "really trying to integrate the technology but…really kind of surface level. So, after some examples and encouragement, he's moving on and looking at doing a flipped classroom . . . next year." Another principal encouraged the use of technology to complement rather than replace traditional teaching practices. Lily stated she supported her teachers through the use of reflection. She cautions her teachers not to simply use a technology tool "because it is provided." She encouraged her teachers to reflect on their lessons to ensure they were using the best instructional tool and making the best decision for students by reflecting on the data provided through various instructional software. Lily further stated if you use the software but "never utilized the results from the Study Island [instructional software], how is that helping your child educationally?" The ISTE standards support leaders using technology to regularly reflect on practices that support personal and professional growth (ISTE, 2018).

Chris supported teachers in pursuing their personal interests in technology by providing collaboration time for teachers to learn specific technology tools of interest to them. He shared that his teachers collaboratively develop a list of technology tools they want to learn about and then "one Monday a month . . . they meet with the other people that want to learn that technology." Sarah stated her school provided opportunities for her teachers to attend technology conferences to learn about new programming. Upon their return to school, they share new learning and resources with the rest of the staff.

In addition to supporting teachers to integrate technology through modeling and encouragement, school leaders also provide support by budgeting and funding technology purchases and repairs. Anderson and Dexter (2005) indicated that school leaders

providing funding and training for technology increased technology integration and student use of the technology. Device breakage was frequently mentioned as one of the biggest challenges the schools face in their 1:1 programs. School leaders indicated budgeting funds to repair the devices was important to teachers because the students needed the devices for their learning. Ruth had spent approximately $1,000 repairing student devices. Students not having access to their device was a concern mentioned by several school leaders. Lily was worried if a student didn't have a device or access to the internet "that the kid is not getting the same learning experience [as other students]."

School leaders indicated they are willing to request or obtain additional financial support for technology within their schools. Ruth stated that she was willing to purchase, or pilot, programs and resources teachers were interested in trying or needed. Chris supported his teachers in creating Donors Choose pages to obtain donations for additional technology. Approximately 90% of his teachers had created such a page.

Supporting teachers to effectively use data to support student learning was another area frequently mentioned by school leaders. Several of the school leaders mentioned using technology-based curriculum tools to improve student achievement. Working with teachers to learn how to use the data from those programs to drive instruction was an area of support mentioned. Lily discussed the challenge of getting teachers to use the data to drive instruction to improve student learning. She questioned "if you [classroom teacher] never utilized the results … how is that helping your child educationally?" Sarah discussed the need to use the data to monitor time on programs to ensure students were getting enough exposure, but not so much that teachers were using it as a crutch.

Providing additional technology support staff is cited as a needed support to teachers (Brown & Jacobsen, 2016). Providing additional staff to assist with technology integration is one means of meeting the technology needs within a school. Coaching has been identified as an effective professional development support strategy (Archibald et al., 2011). This could be people whose sole responsibility is technology, or it could be teacher leaders in the building who provide additional support. Sarah stated her school had an "in-house tech coach who is fabulous as far as just being able to do quick fixes for our teachers." Rose had a blended learning coach, her school librarian, who supported teachers in integrating technology and content. The coach also provided professional development as needs arose within the building.

Through the use of leadership practices such as distributive leadership, culture development, visionary planning, continuous learning and creating a supportive environment, school leaders can influence technology integration in order to impact student learning. In addition, through the use of technology, leaders and teachers can develop 21st century skills within their students.

Development of 21st century skills.

The second theme identified through the coding of the interviews was the development of 21st century skills within students. Through the use of technology, school leaders identified development of student skills in the areas of communication, innovation and creativity, critical thinking and problem-solving, and collaboration.

Communication.

Improved communication skills was the 21st century skill most frequently cited by school leaders as being developed in students. Principals saw evidence of improved

development of communication skills through the use of school video announcements, filming, public speaking, representing information, and writing. Brown and Jacobsen (2012) indicated the use of student-led audio-visual broadcasts was a shift from adult-led intercom audial messages.

Rose stated that her students "were able to communicate in a more productive way." Sarah said her students were improving their communication skills by using the computers to respond to one another's work, often through the use of videos. Lily said her students were learning to use different tools, such as Venn Diagrams, PowerPoints, or Flipgrid to present information. Students were also connecting and communicating outside the classroom and globally. Teachers at Chris' school were Skyping with the author of the story they were reading in class. William reported that written communication had improved in his school as a result of improved organizational skills.

Innovation and creativity.

School leaders discussed how technology use had led to greater innovation and creativity for their students. Students in Ruth's school completed a coding project in art class in which they had to maneuver a robot through a maze. Students in both Ruth and Chris' schools were creating daily video announcements using green screen technology. Ruth stated, "we have video announcements now on YouTube and, I think, they learn from each other, you know, it seems that leadership in the building." This type of announcement represents creativity in both the school leader and the students (Brown & Jacobsen, 2012). Students also used video technology to present their research using SeeSaw or other programs. Students in William's school were programming robots and

working to figure things out on their own, relying on the teacher as a facilitator rather than the instructor.

Critical thinking and problem-solving.

Critical thinking and problem-solving were skills leaders identified as developing within students. Ruth said her students were "becoming more willing to problem solve with one another, and I'm speaking SEL [social emotional learning] type stuff, but those are 21st century skills. They're learning how to talk to each other and solve problems with each other, instead of telling me and then me talking to that student."

Students studying world geography in Chris' school identified a problem of falling tourism in Europe resulting in a declining economy. The students were to develop ways to encourage people to visit Europe. They created brochures and created a board game which taught about tourist sites in Europe. They then filmed commercials to advertise their game and country. This one activity not only taught students creativity, critical thinking and problem-solving, but also geography, English/language arts, public speaking, and technology.

Students in Ruth's school were using "Wedos", STEM tools used to build, and she commented that it "opens their mind in a different way to ideas. [It] helps them kind of learn that resilience and problem solving in working together as a team because they can't just do it by themselves." She referred to this type of learning as social emotional collaborative learning.

Students were also learning research skills. Technology makes research much easier, but students have to be taught how to find reputable sources. William discussed the need to teach students to "weed out the bad stuff" when using the Google search

engine. Chris discussed the need to teach good research practices even at the elementary level. Ruth said her students were "investigating" rather than turning to an adult for the answer all the time.

Collaboration.

Students were learning to collaborate with one another through many of the activities they were doing with technology. Students worked together to write scripts for the announcement broadcasts in Chris and Ruth's schools. Students in Ruth's school were also collaborating to record videos of one another presenting their learning. Students collaborated as they gave one another feedback on their assignments and writing. Students in Sarah's school were collaborating with students in Nova Scotia to learn about the similarities and differences in schools in the two locations.

Summary

This chapter contains the findings from the qualitative portion of the study. Quantitative data provide contextual information for the discussion in chapter 4. The qualitative results indicate that several leadership practices are an important consideration in how school leaders impact student learning. The use of distributive leadership, development of a vision, and continuous learning were all important factors in leaderships impact on student learning. The inclusion of teachers in the decision-making and planning processes were discussed by school leaders as factors having an impact on learning. The development of 21st century skills such as communication, innovation and creativity, critical thinking and problem-solving, and collaboration, in conjunction with improved academic achievement, were identified as important skills for school leaders to

develop within their students. Creating the right conditions for teachers and students to be successful was also identified as an important aspect of school leadership. Chapter 6 will discuss the conclusions and recommendations of the study.

CHAPTER VI: DISCUSSION AND FINDINGS

Overview

Schools and school districts across the world are spending billions of dollars to provide students with 1:1 access to computers and technology in hopes of improving student learning (Herold, 2015; Schiller, 2008). Recent research has indicated that leadership has a major impact on student learning (Briggs, Davis, & Cheny, 2012; DuFour & Marzano, 2011; Leithwood & Louis, 2012; Marzano & Waters, 2009). In addition, leadership has been identified as "the most important catalyst" (p. 3) for realizing the integration of technology into schools and classrooms (Rabah, 2015). The purpose of this study was to answer the following research question:

> *How do administrators in a 1:1 environment experience and enact recommended practices for technology integration?*

Through examining the quantitative and qualitative results of this study, it appears that certain school leadership practices may impact student learning in a 1:1 technology infused learning environment. This chapter discusses the findings from this study. Implications for theory and practice are also discussed. The limitations of the study and the recommendations for future research end the chapter.

Summary of Results and Findings

The purpose of this study was to determine how school leaders in a 1:1 learning environment experience and enact recommended practices for technology integration. Using contextual information from the Principals' Technology Leadership Assessment (PTLA) and the findings from interviews with school leaders, the results will be discussed.

Quantitative.

The Principals' Technology Leadership Assessment (PTLA) was designed to provide information on principals' inclinations and activities over a specific period of time (CASTLE, n.d.a). The survey was administered to school leaders in 3 school districts in the southeast United States. Only principals in schools with full 1:1 implementation were asked to participate in the survey. The results of the survey were used to provide contextual evidence for the qualitative portion of the study and to provide the criteria for participant selection for the qualitative portion of the study. Survey respondents answers to open ended questions, which were added to the survey (see PTLA, appendix A), in light of current research on technology integration were used to select participants for the interview. Based on the results of the PTLA, 10 principals were invited to participate in the interview portion of the study. Seven of the 10 agreed to be interviewed. The following section will discuss the results of the survey portion of the study.

PTLA.

The PTLA consists of 35 Likert type questions (1 = not at all; 5 = fully) divided into 6 categories of questions: leadership and vision; learning and teaching; productivity

and professional practice; support, management, and operations; assessment and evaluation; and social, legal, and ethical issues. The average scores across categories along with the range of scores are provided in table 5.

Table 5

Average PTLA Scores

Category	Mean Score	Score Range
Leadership & Vision	3.56	3.40 - 3.67
Learning & Teaching	3.78	3.47 – 4.20
Productivity & Professional Practice	4.01	3.40 – 4.53
Support, Management, & Operations	3.51	3.27 – 4.00
Assessment & Evaluation	3.47	3.07 – 3.80
Social, Legal, & Ethical Issues	3.40	2.73 – 3.87

The category of Productivity and Professional Practice was scored highest (M = 4.01) by the school leaders. Overall, leaders survey responses indicated they used technology to carry out their day-to-day tasks, to include budgeting, communicating, and accessing student and personnel records. Interview responses aligned with this survey question. Dexter (2011) reported that a principal's involvement with technology

responsibilities to include budgeting, personal use of technology, and technology planning had more positive impact on classroom technology use than did infrastructure or spending. In addition, leadership communication with stakeholders through appropriate media and technology tools provides opportunities for feedback to flow from leaders to stakeholders and vis versa (U.S. Department of Education, 2017).The survey question related to using a technology-based management system to access student records scored highest, *M* = 4.53. Whereas, the question regarding the extent to which school leaders participated in professional development activities meant to improve or expand their use of technology scored lowest in this category, *M* = 3.40. The ISTE Standards for Education Leaders (2018) call for leaders to model and promote professional learning for themselves and others.

School leaders scored the survey category of Teaching and Learning the second highest (M = 3.78). Questions related to assisting teachers in using student assessment data scored highest. Leaders indicated they provided or made available assistance to teachers to use technology for interpreting and analyzing student assessment data highest (*M* = 4.20) and providing or making available assistance to teachers for using student assessment data to modify instruction a close second (*M* = 4.13) in this category. School leaders surveyed indicated they disseminated or modeled best practices in learning and teaching with technology to faculty and staff (*M* = 3.73). The questions in this category related to professional development scored lowest (*M* = 3.47): to what extent did you organize or conduct assessments of staff needs related to professional development on the use of technology and to what extent did you facilitate or ensure the delivery of professional development on the use of technology to faculty and staff. These responses

appear to correlate with the question in Productivity and Professional practice regarding school leaders participation in professional development themselves (*M* = 3.40).

Leadership and vision received a mean score of 3.56. Leaders indicated they communicated information about their school's technology plan and implementation efforts to stakeholders (*M* = 3.67). They also indicated they engaged in activities to identify best practices in the use of technology (*M* = 3.67) and advocated for the inclusion of research-based technology practices in their school improvement plan (*M* = 3.60). Based on the responses to questions related to participating in the technology planning process themselves (*M* = 3.47), promoting participation of stakeholders in the technology planning process (*M* = 3.53), and aligning their school technology plan with other plans in the district and school (M = 3.40), school leaders appear to be less involved. Brown and Jacobsen (2012) identify the need for school leaders to foster a culture conducive to realizing the technology vision. Participation in the technology planning process and including stakeholders in the process play an important part in developing a culture supportive of technology integration (Pautz & Sadera, 2017).

In the category of Support, Management, and Operations (*M* = 3.51), school leaders indicated they support faculty and staff in the use of district- and building-level technology systems for management and operation (*M* = 4.00). This question referred to the use of such systems as student information systems, electronic gradebooks, and curriculum management systems. Planning for the replacement and upgrade of hardware and software through the school technology plan received a score of *M* = 3.60. This was a challenge and concern mentioned by several school leaders during the interviews. Allocating school discretionary funds and pursuing supplemental funding to help meet

the school's technology needs scored the lowest in this category (*M* = 3.27). Levin and Schrum (2013) indicated leaders have to be entrepreneurial with regard to finding funds to sustain technology initiatives. The use of partnerships was one strategy suggested by school leaders in the Levin and Schrum (2013) study. There appears to be little research available on the avenues for continuous funding for technology replacements and upgrades.

Assessment and evaluation scored the next to the lowest overall average (*M* = 3.47). School leaders indicated they promoted and modeled the use of technology-based systems to collect student assessment data (*M* = 3.80). During the interviews some school leaders mentioned the use of technology-based diagnostic assessments to monitor student academic growth. The use of technology to administer and evaluate formative and summative assessments to determine needs and differentiate instruction was a practice used by award-winning secondary school leaders (Levin & Schrum, 2013). On the survey leaders also indicated they promoted the evaluation of instructional practices, including technology-based practices, to assess their effectiveness (*M* = 3.67) and that they evaluated the effectiveness of the professional development offerings in their school to meet the needs of teachers and their use of technology (*M* = 3.53). However, in the interviews, school leaders indicated they primarily use formal and informal observations to monitor the effectiveness of technology use within their building and did not mention monitoring the effectiveness of professional development. Lawless and Pellegrino (2007) indicate a better measure of the effects of professional development, and thus instructional practices, would be the change in pedagogical practice within the classroom. The scores indicated school leaders were less involved in assessing and evaluating

existing technology-based administrative and operations systems for modification or upgrade (*M* = 3.07). This may be due to decisions related to these systems often being made at the district level.

The category Social, Legal, & Ethical Issues was scored lowest by school leaders (*M* = 3.40). The questions to what extent did you work to ensure equity of technology access and use in your school and to what extent did you support the use of technology to assist in the delivery of individualized education programs for all students scored highest in this category, *M* = 3.87. To what extent did you disseminate information about health concerns related to technology and computer usage in classrooms and offices scored the lowest (*M* = 2.73). This appears to be an area in which school leaders have the most opportunity for growth.

Qualitative.

How do school leaders in a 1:1 learning environment experience and enact recommendations for technology integration? This was the question this quan-QUAL study sought to answer.

The qualitative phase of this study was conducted using a structured interview protocol. The interviews provided an opportunity to define technology integration and identify leadership practices that have led to the integration of technology within their schools. Themes were identified using In Vivo coding and code mapping. Two overarching themes were identified: leadership practices and 21st century skills.

Technology integration defined.

Technology integration is defined by Lawless and Pellegrino (2007) as the incorporation of technology resources and technology-based practices into the daily

routines, work, and management of schools. School leaders in this study defined technology in a variety of ways. Rose defined technology integration as "incorporating technology in general instruction every day, in some way." Chris' definition was similar in that technology integration was to enhance and support instruction. Ruth defined technology integration as "maximizing technology in order to accomplish something in a more meaningful way or a more impactful way then you could otherwise." Lily considered the ever changing nature of technology integration in her definition. She saw technology integration as "a planning and training process for both students and educators to unitize the available technology at its highest ability." Whereas both William and Sarah, first year school leaders, defined technology integration through the function of technology—to use a device to further learning, show learning, or make life simpler by using technology tools to the student's advantage. I will now consider how a school leaders definition of technology integration relates to the research question.

How do administrators in a 1:1 environment experience and enact recommended practices for technology integration?

The ISTE Standards for Education leaders call for leaders to be visionary planners, empowering leaders, systems designers, and connected learners (ISTE, 2018). Leadership practices set the stage for how leaders are impacting student learning in a 1:1 environment. Throughout the interviews vision, balance, and a clear definition of technology integration were themes identified as demonstrating how school leaders are experiencing and enacting technology integration within their schools.

Vision.

Interview participants in this study indicated they had a vision for their 1:1 computer initiative and technology integration within their school and that they involved teachers in the decision-making processes regarding technology. This aligns with the results from the PTLA in which school leaders said they participated in the technology planning process, communicated information about the technology plan and implementation efforts to their stakeholders, and promoted stakeholder involvement in the planning process. Anderson and Dexter (2005) found that schools whose vision had a more instructional focus saw better results than did schools that were simply trying to provide computer access to students.

The ISTE Standards for Education Leaders (2018) call for school leaders to engage stakeholders in the process to develop and adopt a vision to use technology to improve student learning. In addition, current research supports the inclusion of stakeholders, to include parents, community members, and business leaders, in the vision setting process (Berrett et al., 2012; Pautz & Sadera, 2017; Rabah, 2015; U.S. Department of Education, 2017). Ruth stated that her vision for technology was created with teachers within her school and the vision was

> "somewhat logistics, logistically related, like minimizing . . . pencil paper tasks and waste, you know. But it's more so providing access to information that empowers students to understand their passion and their, their purpose in life. To help them to connect with the world in a way that is relevant to them so that they feel like, number one, it's accessible, but number two, their role in it and that they have an important role to play."

Other interview participants vision included that the technology should be used to enhance or support classroom instruction. This vision also aligned with school leaders definition of technology integration. Leaders thought technology should not replace regular classroom instruction. Sarah stated that her vision, created collaboratively with teachers, was "that the technology be a tool for the students. Not the instructional method, but a tool that teachers can use to access different kinds of instruction for the students." Rose's vision for the 1:1 initiative and technology was for it "to compliment instruction and further students' knowledge of technology." She stated her vision was developed through her leadership team and that it corresponded with the county and district plans.

The balanced use of technology along with classroom instruction was important to several interview participants. Chris shared his concern with connecting the technology with the assessed content and stated, "I like the analogy of a teeter totter, a seesaw, … but really helping teachers understand the assessed content [is] in one seat and technology's in the other." Sarah pointed out that "while students have access to technology during the day, they are not constantly with a device in their hands during the day. So, it's not direct instruction as much as it is supported instruction." Rose shared her desire that "as far as technology is concerned, we want it to compliment and not replace instruction." Ruth stated

> there's a lot of renaissance learning to be had by students that isn't happening because of technology. So, you have to watch that too, so it's kind of a careful balance. I have one teacher I have had to have a conversation with twice…about manipulatives

because the teacher commented “it’s so much easier to put them on I-Ready [computer-based instructional software].”

The ISTE Standards for Education Leaders (2018) also call for school leaders to build on the shared vision by collaboratively developing a strategic plan that articulates how the technology will enhance learning and to regularly evaluate that plan to make course corrections and measure the impact the use of technology is having on transforming learning. Levin and Schrum (2013) found it was necessary to have a “clearly articulated vision and mission statement along with a strategic plan that is tightly coupled to the vision/mission and transparent to all stakeholders” (p. 45). Only one school leader had taken his vision to the next level and developed a strategic plan for technology integration. Chris and his leadership team had the vision for the entire school to be 1:1, kindergarten through 4th grade. The district had initially planned for the 1:1 initiative to include only grades 3-12. Chris shared that with his leadership team he did a book study “that really kind of turned the paradigm.” They developed a strategic plan for their school which included adding 1:1 devices to one grade level each year until they were fully 1:1. They would begin in 4th grade and work backwards until all students, grades K-4, had a 1:1 device. The team meet at least twice a year to monitor progress toward accomplishing the goals within the strategic plan. Chris said they ask “have we met them [goals]? Where are we at? … We check in to see how we are progressing towards those goals.” Rabah (2015) stressed the importance of a school leader who could clearly articulate his vision. The vision and strategic plan help to ensure the school community understands what function technology will play in supporting student learning (Leithwood, Harris, & Hopkins, 2008; Richardson, McLeod, & Sauers, 2015;

U.S. Department of Education, 2017). Based on the findings from interviews in this study, the absence of a strategic plan can result in limited or fragmented technology implementation with teachers simply incorporating various programs or apps without a clear understanding of what they were trying to accomplish through the technology integration. For instance, some interview participants appeared to lack an understanding of the 21st century skills they were trying to develop within their students. On-going professional learning is important for school leaders to ensure they can provide adequate support and guidance within their schools and ensure the vision successfully comes to fruition (Berrett et al, 2012). Leaders have to plan comprehensively for technology integration, to include professional learning, to ensure alignment of all technology investments so there is a cohesive connection to classroom use rather than a series of unrelated initiatives (Rabah, 2015). Educators must buy in to the pedagogical value of the technology integration, otherwise the technology will remain "just fashionable add-ons in [the] curricula" (Rabah, 2015, p. 5).

Why do administrators in a 1:1 environment experience and enact recommended practices for technology integration?

School leaders identified improved academic achievement and the development of 21st century skills within their students as why they thought it was important to integrate technology within their buildings. State standardized tests are commonly used to measure student academic achievement in 1:1 learning environments. However, researchers question if those assessments are the best source of data to determine the impact of technology on student learning (McNabb, Hawkes, & Rouk, 1999; Russell, 2000; Silvernail, 2005). With regard to 21st century skills, Kay (2010) recognized the

need for a model for education that would prepare students for the demands of the current century. The Partnership for 21st Century Skills (Kay, 2010) and other researchers have developed frameworks and models to support the development of these skills in students.

Academic achievement.

Scores on state assessment for students in the participating schools are lower than the state average scores, but leaders did express concern about improving academic achievement within their schools. They discussed the use of curriculum software to support student academic growth. Ruth stated the technology

> gives them [students] access to I-Ready … which is helping them make incredible gains that we knew could happen but weren't sure exactly how they were going to happen. So, it gives them [students] access to tools that actually help them grow.

She further shared her wish to not have to rely so heavily on the technology for curriculum instruction. She stated,

> I wish that we had more access to that [social emotional collaborative piece] than the need for the I-Ready [instructional software] because I would love to not have to have that. I do believe, right now, we do need those tools to get where we need to be [academically]. I wish we weren't where we are, but we are.

Lily shared that her school was focusing on using the technology as an instructional tool also. She stated that in addition to using the I-Ready program for diagnostic assessments, they had "implemented 45 minutes of math and 45 minutes of reading" weekly using the programs on-line platform. This on-line usage provided leaders and teachers an additional opportunity to monitor student learning. The school reported tremendous growth through

the use of these curriculum programs, 150% school-wide in reading/language arts and 200% in math.

21st century skills.

Equipping students with the skills they needed to be successful after graduation was important to school leaders. Communication was the most frequently mentioned 21st century skill being developed within students. Lily said her students were learning how to properly communicate through writing. With regard to communicating via email, her school is teaching students to use correct spelling and grammar. For example, she explained how they were teaching students to "appropriately e-mail a boss, not in text format. How do you put *are* instead of *R*, you know. So, it's kind of like you have to unteach them bad habits with technology." This practice in Lily's school is contrary to the findings of Hutchison and Reinking (2011) who found that literacy teachers believe teaching new literacy skills, such as sending e-mail, locating and evaluating information online, etc, is important, yet they rarely incorporate those literacy skills into their instruction. Students in Sarah's school are learning to give effective feedback by providing one another feedback on student work using technology-either written through collaborative word processing tools, or orally through video feedback.

Students were also learning innovation and creativity, critical thinking and problem-solving, and collaboration. Entrepreneurs, technology and innovation were identified by Abdullah and Osman (2010) as things that would power the economy of the 21st century. Developing these skills in students was important to school leaders. Students in William's school were learning career building skills such as programming in robotics. He shared how his students are "using that, that outlet or that, that tool as an outlet for not

only their creative and artistic desire or ability, but, you know, to kind of fuse that [with class work] and get a grade for it too." Ruth shared how her students are developing resiliency through the use of STEM tools and learning to "problem-solve in working together as a team" because oftentimes, with the STEM tools, students can not complete the work alone. Ruth did express concern that her students weren't collaborating enough, however. She stated she would like to see

> students using the tool more so to engage one another [in] conversation and problem-solving versus in isolation. I think we're still in a stage where the students are engaging with the device predominantly independently, and so I think that's definitely an area of progress for us.

Sarah was pleased to see students learning to use the technology to best demonstrate their learning. She shared students take a "project they've got on paper and they choose to go to an iPad or they choose to go to a Chromebook because they know that's what will help them show their learning."

Students improving their academic learning through the use of technology-based curriculum software and developing their 21st century skills through the various uses of the technology are the "*why*" behind school leaders experiencing and enacting recommended practices for technology integration. However, to be able to do this, the conditions must be right within the school to support the use of the technology.

Under what conditions do administrators in a 1:1 environment experience and enact recommended practices for technology integration?

The conditions under which school leaders impact student learning in a 1:1 environment include the culture created by the school leader. A culture of trust and risk-

taking along with a supportive environment in which school leaders model the use of technology is important to ensure teachers and teaching practices are impacting student learning.

Trust and risk-taking.

To support the integration of technology in their schools, school leaders developed a culture of trust and risk-taking. Brown and Jacobsen (2016) found that trust was an important aspect of principal leadership in promoting school improvement. Ruth shared how her teachers were "willing to try new things and to innovate. And I measure… you know, their trust of us [in] their readership in trying new things and not being worried about failing or making a mistake." Teachers in Chris' school were willing to take the risk of incorporating tools such as Ozobots and 3-D printers into their instruction when they weren't quite sure how the technology tools would impact student learning. They trusted their leader would support them through the learning to integrate process. In a study conducted by Pautz & Sadera (2017), principals recognized they had to support teachers who were willing to take risks, yet still focus on student outcomes.

School leaders in this study modeled the use of technology in their day-to-day work practices and modeled risk-taking in their learning of technology. Chris shared several instances of modeling the use of technology, such as learning to use the 3-D printer and learning to do the producing and editing of the school news video broadcast when a teacher was out. Teachers are more confident to take risks and try new technologies when they see their leader taking risks and know the leadership will support them to take risk (Pautz & Sadera, 2017). In addition, leaders modeled the use of

technology during professional development, PLCs, and faculty meetings. Ruth and Lily modeled the use of technology for teachers during faculty meetings and PLCs.

Supportive environment.

Leaders in this study provided support to their teachers through encouragement, reflection, funding, training, and additional support staff. The ISTE Standards for School Leaders (2018) call for leaders to model and promote continuous professional learning for both themselves and others. In addition, they call for leaders to create a culture that empowers teachers and learners to use technology innovatively to enrich teaching and learning. Berrett et al (2012) found that the culture of the school dramatically impacted the success or failure of technology initiatives. Purposeful attention to the culture and climate of the school must occur throughout the process of integrating technology (Levin & Schrum, 2013).

Leaders identified the use of personal learning networks, reading, and conferences as avenues to continue their professional learning. Brown and Jacobsen (2016) identified technology fluency—the knowledge and ability to understand, use and assess technology, as a requirement for school leaders who were involved in a school improvement initiative that involved technology. Brown and Jacobsen (2016), however, indicate the use of social and technological networks for leadership support and professional learning was an area of growth for leaders in their study. Chris shared the use of his personal learning network (PLN) to expand his knowledge base, whereas Ruth shared her use of professional journals to continue her learning. Lily took a different approach to professional learning and attended conferences.

School leaders in this study also supported teachers continuous learning by providing opportunities for their teachers to learn about technology integration. Leaders identified various resources their teachers used to increase and enhance their learning about and integration of technology (see table 6). In addition, leaders provided support and training for teachers to use the data from curriculum software to guide instruction.

Table 6

Continuous Learning Opportunities for Teachers

Book studies
Regularly scheduled technology collaboration sessions
Technology training during faculty and PLC meetings
Conferences
Guest speakers

School leaders further created a supportive environment for technology integration by funding technology repairs and initiatives. Ruth used available school funds and school personnel to repair student devices. Rose had a line item in her budget to support the repair of technology tools. Chris supported his teachers in creating Donor's Choose pages to obtain funding for technology. Although they provided financial resources and supported teachers seeking donations, funding for repairs and purchase of new or additional devices was a concern for school leaders. Levin and Schrum (2013)

reported school leaders in their study "getting out of the hardware business as soon as possible and allowing students to use their own personal computing devices" (p. 46). Approximately half of the participants in the Levin and Schrum (2013) study found funding technology devices for every student was unsustainable.

Discussion

The results of the Principals' Technology Leadership Assessment (PTLA) and the findings from the interviews support one another in some respects. On the PTLA school leaders indicated they participated in and encouraged the participation of stakeholders in the development of a vision for technology within their school ($M = 3.47$). Participant responses during the interviews frequently mentioned the collaborative development of a school vision through the use of their leadership team or another pre-existing team within the school. However, interview participants only included teachers in their definition of stakeholder and only included teachers on their leadership teams. The ISTE Standards for Leaders (2018) and current research include parents, community members and business leaders as stakeholders in the vision setting process (Berrett et al., 2012; Pautz & Sadera, 2017; Rabah, 2015; U.S. Department of Education, 2017). Levin and Schrum (2013) recommend involving parents in the technology planning process because most parents did not learn with technology when they were in school. Participation in the technology planning process and frequent communication with parents is important for them to understand the change in their child's education (Levin & Schrum, 2013).

It also appears the vision most often focused on getting technology into the hands of students and ensuring a balanced use of the technology tools along with regular

classroom instruction rather than a true integration of technology. Lawless and Pellegrino (2007) define technology integration as "the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools." On the PTLA, school leaders indicated they included research-based technology practices in their school improvement plans ($M = 3.60$) and that they engaged in activities to identify best practices in the use of technology ($M = 3.67$) yet there is little evidence of these practices from the interviews. There were few specific mentions of ways in which the technology or technology-based practices were integrated into daily student routines and learning or into teacher planning. Rose stated that at her school they "encourage teachers to use it [technology] weekly, maybe not daily so that it doesn't replace the instruction." Leaders seem to think teachers will naturally know how to effectively integrate technology into their instruction rather than provide training or resources to ensure they know how to integrate technology. In reference to teacher training to prepare them for the 1:1 initiative, Ruth stated

> …there was no training at all. I guess I feel kind of bad that I didn't do that, but it just never occurred to me because they [teachers] had so many [devices] and they [teachers] were doing a great job with them as it was. I had observed the students using them, they used them responsibly, very respectful of the device.

Providing teachers with training and tools to assist them in regularly selecting the appropriate technology tool to meet the demands of the curriculum and student needs would assist teachers in effectively integrating technology into their instruction. Teachers should first identify the desired learning outcomes of a lesson or project, then determine the needs of the students before selecting the technology to be used (Campbell, 2012).

Teachers are more likely to develop a technology-supported pedagogy when they can see the connection between the content area they teach and technology tools (Hutchison & Reinking, 2011). Too often the technology tool is selected first, and it is then forced into the lesson structure regardless of whether it is an appropriate tool for the desired learning or not.

Research indicates that teachers often use technology to enhance teacher practice rather than put the technology into the hands of the students through the development of more student-centered, problem-solving learning opportunities (Herold, 2015; Michael, 2006). These types of lessons require teacher training on effectively integrating technology, rather than training to simply use a technology tool. Teachers must have pedagogical beliefs that support the change to a more student-centered, constructivist environment (Weaver & Mims, 2011). These pedagogical beliefs can be supported by technology but should not be based on the presence of technology (Weaver & Mims, 2011).

Some examples of the 21st century skills leaders identified as being developed in students included collaboration, communication, problem-solving and creativity. Ruth shared that her students collaborate to give one another feedback which provides an opportunity for students to develop communication skills. William provided an example of the robotics class in which students were learning problem-solving through programming. In addition, there were incidents of use of the technology outside of classroom learning which provided opportunities for students to develop 21st century skills such as creativity through the school news broadcasts and the development of the school award with the 3-D printer.

Lily and Ruth discussed the use of curriculum-based software to support student learning of academic standards but didn't discuss opportunities for students to construct new learning through the use of technology or for teachers to incorporate development of 21st century skills through authentic learning. Keengwe & Onchwari (2009) discussed the need for teachers to develop a greater understanding of different strategies for using technology tools to support learners constructing their own knowledge through the use of frequent creative activities which enhance meaningful learning. Chris shared one instance of professional learning which focused on strong pedagogical practices with technology rather than the technology itself; however, he did not follow up with examples of how those practices were implemented or monitored within his building.

With regard to the Teaching and Learning portion of the PTLA, school leaders stated that they provided or made available assistance to teachers to use technology for interpreting and analyzing student assessment data ($M = 4.20$). Lily specifically mentioned that she provided training to her teachers on how to use student assessment data. She also discussed her concern for teachers not utilizing the available data to support student learning by modifying instruction. She stated, with regard to Study Island, an on-line curriculum resource, some of her teachers will use the resource because it is provided by the district or school but "never utilized the results from the Study Island" to support student learning. Sarah and Chris mentioned using the technology to access data but didn't discuss teachers using the technology to analyze student data.

School leaders indicated on the PTLA that they disseminated or modeled best practices in learning and teaching with technology to faculty and staff ($M = 3.73$) and that they provided supports such as release time and funding to teachers who were attempting

to share information about technology practices, issues, and concerns ($M = 3.67$). During the interviews several school leaders mentioned modeling the use of various technology tools for their teachers (see table 7); however, this was often a technology tool rather than best practices in learning and teaching with technology.

Table 7

Commonly Used Technology Tools

Flipgrid
Google Slides
Google Docs
Skype
e-Mail

Most school leaders did indicate through the interviews that they provided opportunities for professional growth for their teachers through trainings, conferences, and book studies. This aligns to the survey question related to facilitating or ensuring the delivery of professional development on the use of technology ($M = 3.47$).

School leaders indicated they used technology in their day-to-day work. This aligned with the survey question to what extent do you use technology to complete day-to-day tasks ($M = 4.40$). Lily stated she did not "know how I would function without it." Rose said she "used technology for everything." School leaders also indicated they used technology to communicate with stakeholders. On the PTLA, respondents indicated

strongly (M = 4.13) that they encouraged or used technology as a means of communication. William shared that he used the Remind app to communicate with teachers regarding student discipline and logistical information. Others shared they used email to communicate with teachers and parents.

Developing a consistent funding stream to support the technology is important. School leaders in some schools, both on the PTLA (M = 3.27) and in the interviews, indicated they used discretionary funds to help meet the school's technology needs. Leaders surveyed on the PTLA indicated (M = 3.60) that they ensured hardware and software replacement/upgrades were incorporated into the school's technology plan. Funding and replacement of devices was, however, an area of concern for leaders interviewed. Limited funds often resulted in students not having access to devices or devices simply sitting on a shelf waiting to be repaired. Ruth stated she had

> $600, $600 in damages right now, just waiting on expired warranties and Chromebooks that are just getting old. So that's going to affect my 1:1 because I don't have any money to buy new devices, so I don't know what is going to happen.

Lily shared her frustration with the replacement and repair of devices when a "parent won't sign the waiver" because they aren't willing to pay for repairs if their student damages the device. Levin and Schrum (2013) discussed the importance of clear communication when families were asked to pay a portion of the cost of a device, which could include insurance or rent.

How do school leaders in a 1:1 learning environment experience and enact recommended practices for technology integration?

School leaders impact student learning through the development of a vision that supports the integration of technology into teaching and learning. However, along with the vision, school leaders need to develop a strategic plan to ensure the success of their vision along with a plan to monitor the implementation and success of the plan (ISTE, 2018). The strategic plan should be collaboratively developed and include all stakeholders—parents, teachers, community members, business leaders, and students. Ensuring the values of all stakeholders are represented in the vision can assist in gaining support for the vision (Berrett et al., 2012; Rabah, 2015). The strategic plan should include regular assessment of teachers and staff with regard to their technology integration needs (Brown & Jacobsen, 2012). Professional development should be planned in accordance with the results of the teacher input (Brown & Jacobsen, 2012).

School leaders also use distributive leadership practices to impact student learning in a 1:1 environment. Distributive leadership is defined as "a system of practice comprised of a collection of interacting components: leaders, followers, and situation" (Levin & Schrum, 2013, p.31). Including teachers in the decision making process assists in ensuring the success of the initiative.

Why do school leaders in a 1:1 learning environment experience and enact recommended practices for technology integration?

School leaders are concerned about student academic achievement along with the development of 21st century skills. They want to ensure students will have the knowledge and skills they need to be successful following graduation.

Under what conditions do school leaders in a 1:1 learning environment experience and enact recommended practices for technology integration?

School leaders develop a culture to support the integration of technology in a 1:1 learning environment. They work to establish trust among their faculty and staff so that teachers know they are supported in taking risks with the integration of technology. Teachers have to know their leaders will support them if they try something and it fails. They also support their teachers by modeling the use of technology and providing training with regard to technology integration.

Reflections

School leaders in this study strived diligently to support the integration of technology within their 1:1 learning environment. The challenges some of the leaders face with this task appear to be related to a lack of knowledge on their part. Most school leaders did not have formal training on the use of technology, so they have taught themselves or learned through attending conferences or reading books. School leaders with limited technology knowledge may find it difficult to lead in today's technologically complex environments (Brown & Jacobsen, 2016). This, in turn, leads to how they provide training to their teachers. Therefore, in many instances, leaders and teachers have had one-shot opportunities for learning how to use a specific tool or device rather than the on-going, job-embedded, reflective training that is actually needed to support the integration of technology (Weaver & Mims, 2011). Technology workshops that focus solely on software or hardware skills fail to help teachers understand how technology connects with specific pedagogies or content (Koehler & Mishra, 2005). Providing

specific training on technology integration to assist teachers in selecting appropriate technology resources should be a focus of school leaders. Training on technology integration should provide teachers with a framework for integrating technology to include the following (Campbell, 2012):

1. Focus first on identifying the desired learner outcomes.
2. Analyze student needs.
3. Identify available technology resources appropriate for the learning.

In addition, research supports on-going, job-embedded support and training with regard to technology integration (Guskey, 2000). Follow-up and reflection on the integration of technology will assist teachers in analyzing the results of their choices and guide future practice.

Several of the school leaders interviewed did not seem to have an understanding of the 21st century skills they should be working to develop within their students. To some of them, 21st century skills include typing and using traditional production tools such as spreadsheets rather than the skills identified by researchers as what students need to be successful in the 21st century (Kay, 2010; Robinson & Aronica, 2015; Wagner, 2014; Wagner, 2012). School leaders also need to be provided with on-going training with regard to technology integration and the desired outcomes of their initiatives.

Implications For Practice

As schools and school districts plan for the implementation of a 1:1 learning environment, a collaborative vision and strategic plan need to be developed to support the initiative. All stakeholders, including students, parents, teachers, community members

and business leaders, need to be involved in the development of the vision and strategic plan. The plan should include funding for the initiative, a training plan for the leaders and teachers within the district or school, and a plan to monitor the implementation and effectiveness of the 1:1 initiative. This collaborative effort will ensure both financial support for the 1:1 initiative and community support for the success of the initiative.

Based on the results and findings of this research study, it is apparent that there needs to be a common vocabulary used by all stakeholders in the vision and strategic planning process. This is crucial for organizing plans to systematically implement a 1:1 program that is aligned with best practices. For example, some of the interviewees in this study had definitions that did not align with what current research identifies as technology integration. Some leaders confused "learning with technology" and "learning technology." Lawless and Pellegrino (2007) defined technology integration as the incorporation of technology resources and technology-based practices into daily routines, work, and management of schools, whereas school leaders interviewed often focused on a balanced use of technology tools with regular classroom instruction.

Both leaders and teachers need to be trained on how to effectively integrate technology into instruction rather than simply use technology tools. There must be a focus on changing teacher pedagogical practices to effectively incorporate technology, pedagogy and content through authentic, student-centered learning to support the development of 21st century skills within students. The use of a framework or tool will assist teachers in selecting the appropriate technology with regard to the desired learner outcomes. In addition to learning about integrating technology, school leaders and teachers need to have an understanding of what 21st century skills employers are

demanding of graduates. To be most effective training about effective technology integraton needs to take place prior to implementing the 1:1 initiative and continue throughout the initiative.

Finally, when planning to implement a 1:1 technology initiative, schools and districts need to consider best practices. Best practices are best practices. Reviewing the essentials of high quality professional development, school improvement practices, Professional Learning Communities, etc. will assist schools in their implementation. For example, Desimone et al. (2002) and Guskey (2000) indicate best practices in high quality professional development include training that is long-term, on-going and job-embedded.

Implications For Policy

Based on the results and findings of this research study, school and district leaders may want to consider establishing a policy related to technology planning, to include funding for the initiative, training for leaders and teachers, an implementation monitoring plan, and a plan for monitoring effectiveness of the program.

In addition, schools and districts may want to consider developing a policy to address damages. This policy would need to include how and by whom the damages would be paid.

The final policy that may need to be considered would relate to employee and student discipline related to improper use, damage, or theft of the devices.

Recommendations For Future Research

Future research on the impacts of leadership on student learning in a 1:1 environment should focus on the changes in pedagogical practice through the use of frameworks or guides for teachers. In addition, studies that focused on schools that have been in their implementation for 5 or more years with consistent leadership could provide more clarity on how leadership is impacting student learning and following research recommendations. Inclusion of student and teacher voice on leadership practices regarding technology integration would also provide insight into how school leaders experience and enact recommended practices for technology integration.

Limitations

Limitations to this study include the relatively small number of participants due to the need for the schools to have a 1:1 initiative that has been in place for more than one year. Also, the limited geographical range of the study participants could impact results. Generalizability of the study findings may be limited by both the population size and proximity of participants.

A leaders tendency toward or away from technology could also impact the results of this study. Leaders who have an affinity for technology may have been more willing to participate in the study.

An additional limitation of this study could be participant inclusion in the qualitative portion. The researcher analyzed responses to open-ended questions and compared those to current research. There is a possibility of bias based on previous knowledge levels of the researcher.

The use of a semi-structured interview format may have been a limitation. This possibly resulted in a lack of follow-up questions which could have assisted in gaining greater clarity and understanding during the interviews. Perhaps the use of a less structured interview protocol would have provided more opportunity to expand on leader responses to interviewer questions.

Summary

This study built upon recommendations made by Harper and Milman (2016) to explore how, why, and under what conditions school leadership impacted student learning in a 1:1 learning environment. The specific research question addressed in this study was how do school leaders in a 1:1 environment experience and enact recommended practices for technology integration.

The study supports findings from previous research in which Levin & Schrum (2013) found that leaders in successful schools involved in a technology-based school improvement initiative focused on and attended to the following characteristics: vision, leadership, school culture, technology planning and support, professional development, curriculum and instructional practices, funding, and partnerships. Brown and Jacobsen (2016) also found that school leaders in Canada ranked themselves highest to lowest in the following areas for cultivating teaching and learning improvements in integrating technology: fostering effective relationships, leading a learning community, developing and facilitating leadership, managing school operations, visionary leadership, larger societal context, providing instructional leadership, and social and technological networks.

REFERENCES

Abdullah, M., & Osman, K. (2010). Inventive thinking skills in science: A comparative study between students in Malaysia and Brunei. *The International Journal of Learning, 17*(9), 227-236.

Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2008). School leadership and information communication technology. *The Turkish Online Journal of Educational Technology, 7*(4), 82-91.

Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*(1), 49-82. doi: 10.1177/0013161X04269517

Archibald, S., Coggshall, J. G., Croft, A., Goe, L. (2011). *High-quality professional development for all teachers: Effectively allocating resources*. Washington, DC: National Comprehensive Center for Teacher Quality.

Banilower, E. R., Boyd, S. E., Pasley, J. D., & Weiss, I. R. (2006). *Lessons from a decade of mathematics and science reform: Capstone report for the local systemic change through teacher enhancement initiative*. Chapel Hill, NC: Horizon Research, Inc.

Banoglu, K. (2011). School principals' technology leadership competency and technology coordinatorship. *Educational Sciences: Theory & Practice, 11*(1), 208-213.

Barab, S. A., MaKinster, J. G., Scheckler, R. (2003). Designing system dualities: Characterizing a web-supported professional development community. *The Information Society, 19*, 237-256. doi: 10.1080/01972240390210064

Bebell, D., & Kay, R. (2010). One to one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. [Special issue]. *The Journal of Technology, Learning and Assessment, 9*(2), 1-59.

Berrett, B., Murphy, J., & Sullivan, J. (2012). Administrator insights and reflections: Technology integration in schools. *The Qualitative Report, 17*(1), 200-2.

Berry, R. M. (2005). Web-based survey research: Lessons from the University of Akron study. *International Journal of Public Administration, 28*(1-2), 57-72. doi: 10.1081/PAD-200044562

Björkvall, A., & Engblom, C. (2010). Young children's exploration of semiotic resources during unofficial computer activities in the classroom. *Journal of Early Childhood Literacy, 10*(3), 271-293. doi: 10.1177/1468798410372159

Briggs, K., Davis, J., & Cheny, G.R. (2012). *The promise of a strong principal*. EdWeek.org. Retrieved from https://www.edweek.org/ew/articles/2012/05/09/30briggs_ep.h31.html?qs=the+promise+of+a+strong+principal

Brown, B. & Jacobsen, M. (2012). A mixed method case study: How principals cultivate technology integration and use social networks for professional growth. In M. Simonson (Ed.), *2012 Annual Proceedings of the Annual Convention of the AECT*. Retrieved from: https://members.aect.org/pdf/Proceedings/proceedings12/2012/12_04.pdf. 41-50.

Brown, B., & Jacobsen, M. (2016). Principals' technology leadership: How a conceptual framework shaped a mixed methods study. *Journal of School Leadership, 26(*5), 811-836.

Burden, K., Hopkins, P., Male, T., Martin, S., & Trala, C. (2012). *iPad Scotland evaluation report*. Hull, England: University of Hull, Technology Enhanced Learning Group.

Byrom, E., & Bingham, M. (2001). Factors influencing the effective use of technology for teaching and learning: Lessons learned from the SEIR-TEC Intensive site schools, 2nd Edition. *SERVE*. Retrieved from ERIC.

Campbell, J. (2012). *Determining the usefulness of classroom technologies, part 1*. Retrieved from evolllution.com/opinions/determining-the-usefulness-of-classroom-technologies-part-1.

Couros, G. (2015). *The innovator's mindset: Empower learning, unleash talent, and lead a culture of creativity*. Dave Burgess Consulting: San Diego, CA.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. 5th Ed. Thousand Oaks, CA: Sage Publications, Inc.

Cuban, L. (1992, November). Computers meet classroom; Classroom wins. *Education Week*. Retrieved from https://www.edweek.org/ew/articles/1992/11/11/10cuban.h.12.html?print=1

Cuban, L. (2006). The laptop revolution has no clothes. *Education Week, 26*(8), 29.

Cullota, R. (2019). Creating a shared vision: How one district reworked a failed ed-tech strategy to transform learning. *Education Leadership, 76*(5), 26-29.

Demsky, J. (2012). The seven habits of highly effective tech-leading principals. *THE Journal, 39*(5), 48-55.

Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birman, B. F. (2002). Effects of professional development on teachers' instruction: Results from a three-year long longitudinal study. *Educational Evaluation and Policy Analysis, 24*(2), 81-112.

Duncan, J. A. (2011). *An assessment of principals' technology leadership: A statewide survey*. (Doctoral dissertation). Retrieved from ProQuest LLC. (UMI 3490700)

DuFour, R., DuFour, R., Eaker, R., Many, T. M., & Mattos, M. (2016). *Learning by Doing: A handbook for Professional Learning Communities at Work*. 3rd Ed. Bloomington, IN: Solution Tree Press.

DuFour, R., & Marzano, R. J. (2011). *Leaders of learning: How district, school and classroom leaders improve student achievement*. Bloomington, IN: Solution Tree Press.

Dunleavy, M., & Heinecke, W. F. (2007). The impact of 1:1 laptop use on middle school math and science standardized test scores. *Computers in the Schools, 24*(3/4), 7-22.

Epslin, N. L. (2017). *Utah elementary school principals' preparation as technology leaders*. (Doctoral dissertation). Retrieved from ProQuest. (ProQuest 10264426)

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47-61. Retrieved from http://eds.b.ebscohost.com.ezproxy.mtsu.edu/eds/pdfviewer/pdfviewer?vid=2&sid=d5e58746-6490-49fa-9e7d-8eedd4414a9d%40pdc-v-sessmgr02

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research & Development, 53*(4), 25-39.

Farrace, B. (2011). A national vision. *Principal Leadership, 12*(1), 52-54.

Fischer, K. (2013). Employers wish degrees meant more. *The Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/the-employment-mismatch/137625#id=overview

Florida Center for Instructional Technology. (2011). *Technology Integration Matrix*. Retrieved from https://fcit.usf.edu/matrix/wp-content/uploads/2016/11/TIM_Summary_Descriptors.pdf

Fullan, M. (2014). *The principal: Three keys to maximizing impact*. San Francisco, CA: Josey-Bass.

Gray, L., Thomas, N., Lewis, L., & Tice, P. (2010). *Educational technology in U.S. public schools: Fall 2008 first look*. U.S. Department of Education, National Center for Education Statistics (NCES 2010-034). Retrieved from https://nces.ed.gov/pubs2010/2010034.pdf

Greaves, T. W., Hayes, J., Wilson, L., Gielniak, M., & Peterson, E. L. (2012). *Revolutionizing education through technology: The Project RED roadmap for transformation*. Eugene, OR: International Society for Technology in Education.

Gregory, K. L. (2015). *Elementary principals' perceptions of visionary leadership, self-efficacy, and professional development in technology*. (Unpublished doctoral dissertation). Bowie State University, Bowie, Maryland.

Guskey, T. R. (2000). *Evaluating professional development.* Thousands Oaks, CA: Corwin Press, Inc.

Guskey, T. R. (2003). What makes professional development effective? *The Phi Delta Kappan, 84*(10), 748-750.

Guskey, T. R. (2014). Planning Professional Learning. *Educational Leadership, 71*(8), 10-16.

Handford, V., & Leithwood, K. (2013). Why teachers trust school leaders. *Journal of Educational Administration, 51*(2), 194-212. doi: 10.1108/09578231311304706

Harper, B. & Milman, N. (2016). One-to-one technology in K-12 classrooms: A review of the literature from 2004 through 2014. *Journal of Research on Technology in Education, 48*(2), 129-142. doi: 10.1080/15391523.2016.1146564

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393-416.

Herold, B. (2015). Why ed tech is not transforming how teachers teach: Student-centered, technology-driven instruction remains elusive for most. *Education Week, 35*. Retrieved from https://ezprozy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edsgao&AN=edsgcl.418872032&site=eds-live&scope=site

Hew, K. F., & Tan, C. Y. (2016). Predictors of information technology integration in secondary schools: Evidence from a large scale study of more than 30,000 students. *PLoS ONE, 11*(12), 1-20. doi:10.1371/journal.pone.0168547

Hilton, M. L. (2008). *Research on future skill demands: A workshop summary.* National Research Council. Washington, DC: National Academies Press.

Hixon, E., & Buckenmeyer, J. (2009). Revisiting technology integration in schools: Implications for professional development. *Computers in the Schools, 26*(2), 130-146.

Hutchison, A. & Reinking, D. (2011). Teachers' perceptions of integrating information and communication technologies into literacy instruction: A national survey in the United States. *Reading Research Quarterly, 46*(4), 312-333. doi: 10.1002/RRQ.002

International Reading Association. (2009). *New literacies and 21st-century technologies: A position statement of the International Reading Association*. Retrieved from https://www.literacyworldwide.org/docs/default-source/where-we-stand/new-literacies-21st-century-position-statement.pdf?sfvrsn=6

International Society for Technology in Education. (2016). *ISTE standards for students*. Retrieved from www.iste.org/standards/for-students

International Society for Technology in Education. (2017). *ISTE standards for educators*. Retrieved from tps://www.iste.org/standards

International Society for Technology in Education. (2018). *ISTE standards for education leaders*. Retrieved from https://www.iste.org/standards

Kay, K. (2010). 21st century skills: Why they matter, what they are, and how we get there. In Bellanca, J. & Brandt, R. (Eds.), *21st century skills: Rethinking how students learn* (pp.xiii-xxxi). Bloomington, IN: Solution Tree Press.

Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Journal of Early Childhood Education, 37*(3), 209-218. doi: 10.1007/s10643-009-0341-0

Kelley, T. & Kelly, D. (2013). *Creative confidence: Unleashing the creative potential within us all*. Crown Business: New York.

Knowles, M. S., Holton, E. F., & Swanson, R. A. (2011). *The adult learner: The definitive classic in adult education and human resource development.* Amsterdam: Butterworth-Heinenmann.

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131-152.

Kolb. L. (2017). *Learning first, technology second: The educator's guide to designing authentic lessons*. Portland, OR: International Society for Technology Education.

Kolb, L. (2019). Smart classroom-tech integration. *Educational Leadership, 76*(5), 20-26.

Lawless, K. A. & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614. doi: 10.3102/0034654307309921

Leading Education by Advancing Digital (LEAD) Commission. (2013). *Paving a path forward for digital learning in the United States*. Retrieved from www.leadcommission.org

Leithwood, K., Harris, A., & Hopkins, D. (2008). Seven strong claims about successful school leadership. *School Leadership and Management, 28*(1), 27-42. doi: 10.1080/13632430701800060

Leithwood, K., & Louis, K. S. (2012). *Linking leadership to student learning*. San Francisco, CA: Jossey-Bass.

Lencioni, P. (2002). *The five dysfunctions of a team: A leadership fable*. San Francisco, CA: Jossey-Bass.

Levin, B.B., & Schrum, L. (2013). Using systems thinking to leverage technology for school improvement: Lessons learned from award-winning secondary schools/districts. *Journal of Research on Technology in Education, 46*(1), 29-51.

Liu, S. (2013). Teacher professional development for technology integration in a primary school learning community. *Technology, Pedagogy and Education, 22*(1), 37-54. doi: 10.1080/1475939X.2012.719398

MacDonald, R. J. (2008). Professional development for information communication technology integration: Identifying and supporting a community of practice through design-based research. *Journal of Research on Technology in Education, 40*(4), 429-445.

Machado, L. J., & Chung, C. (2015). Integrating technology: The principals' role and effect. *International Education Studies, 8*(5), 43-53. doi: 10.5539/ies.v8n5p43

Marzano, R. J., & Waters, T. (2009). *District leadership that works*. Bloomington, IN: Solution Tree.

Matsumura, L. C., Sartoris, M., Bickel, D. D., & Garnier, H. E. (2009). Leadership for literacy coaching: The principal's role in launching a new coaching program. *Educational Administration Quarterly, 45*(5), 655-693.

McLeod, S., & Richardson, J. W. (2011). The dearth of technology leadership coverage. *Journal of School Leadership, 21*, 216-240.

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Technology in a digital age: How educators use technology to improve student learning. *Journal of Research on Technology in Education, 48*(3), 194-211. doi: 10.1080/15391523.2016.1175856

McNabb, M., Hawkes, M., & Rouk, U. (1999). Critical issues in evaluating the effectiveness of technology. *The Secretary's Conference on Educational Technology*. Retrieved from https://eric.ed.gov/?q=critical+issues+in+evaluating+the+effectiveness+of+technology&id=ED452827

Mehta, V., & Hull, D. M. (2013). Structural validity of the professional development profile for the LoTi digital-age survey. *Journal of Psychoeducational Assessment, 31*(1), 61-71. doi: 10.1177/0734282912454992

Melton, K. A. (2015). *Examining principal self-efficacy and technology behaviors*. (Doctoral dissertation). Retrieved from ProQuest. (ProQuest 3723884)

Metcalf, W. B. (2012). *K-12 principals' perceptions of their technology leadership preparedness*. (Unpublished doctoral dissertation). Georgia Southern University, Statesboro, GA.

Michael, J. (2006). Where's the evidence that active learning works? *Advance Physiological Education, 30*, 159-167. doi: 10.1152/advan.00053.2006

Muhammad, A. (2015). *Overcoming the achievement gap: Liberating mindsets to effect change.* Bloomington, IN: Solution Tree.

Office of Educational Technology. https://tech.ed.gov/connectivity/

Overbaugh, R., & Ruiling, L. (2008). The impact of a federally funded grant on a professional development program: Teachers' stages of concern toward technology integration. *Journal of Computing in Teacher Education, 25*(2), 45-55.

Page-Jones, A. B. (2008). *Leadership behavior and technology activities: The relationship between principals and technology use in schools*. (Doctoral dissertation). Retrieved from ProQuest. (UMI 3377828)

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533-544. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4012002/

Partnership for 21st Century Learning. (2009). P21 framework definitions. Retrieved from https://files.eric.ed.gov/fulltext/ED519462.pdf

Patton, M. Q. (2015). *Qualitative research & evaluation methods.* 4th ed. [Kindle edition]. Retrieved from https://smile.amazon.com/Qualitative-Research-Evaluation-Methods-Integrating-ebook

Pautz, S. & Sadera, W. A. (2017). Leadership practice in a one-to-one computing initiative: Principals' experiences in a technology driven, second order change. *Computers in the Schools, 34*(1-2), 45-59. doi: 10.1080/073880569.2017.1296314

Peled, Y., Kali, Y., & Dori, Y. J. (2011). Schools principals' influence on science teachers' technology implementation: A retrospective analysis. *International Journal of Leadership in Education, 14*(2), 229-245. doi: 10.1080/13603124.2010.524249

Penuel. W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Peterson, A-L. (2014). Teachers' perceptions of principals' ICT leadership. C*ontemporary Educational Technology, 51*(4), 302-315.

Polly, D., & Hannafin, M. J. (2010). Reexamining technology's role in learner-centered professional development. *Education Technology Research and Development, 58*(5), 557-571.

Potter, S. L., & Rockinson-Szapkiw, A. J. (2012). Technology integration for instructional improvement: The impact of professional development. *Performance Improvement, 51*(2), 22-27. doi:10.1002/pfi.21246

Rabah, J. (2015). Benefits and challenges of information and communication technologies (ICT) integration in Quebec English Schools. *The Turkish Online Journal of Educational Technology, 14*(2). Downloaded from https://files.eric.ed.gov/fulltext/EJ1057526.pdf

Reigeluth, C. M. & Duffy, F. M. (2008). The AECT futureminds initiative: Transforming America's school systems. *Educational Technology, 48*(3), 45-49.

Reigeluth, C. M. & Karnopp, J. R. (2013). *Reinventing schools: It's time to break the mold*. Lanham, Maryland: Rowman & Littlefield Education.

Ribble, M. (2012). Digital citizenship for educational change. *Kappa Delta Pi Record, 48*, 148-151. doi: 10.1080/00228958.2012.734015

Richardson, J. W., McLeod, S., Sauers, N. (2015). Technology leadership is just good leadership: Dispositions of tech savvy superintendents. *AASA Journal of Scholarship & Practice, 12*(1), 11-30.

Robinson, K. & Aronica, L. (2015). *Creative schools: The grassroots revolution that's transforming education*. New York, NY: Penguin Books.

Rosen, Y., & Manny-Ikan, E. (2011). The social promise of the time to know program. *Journal of Interactive Online Learning, 10*(3).

Russell, M. (2000). It's time to upgrade: Tests and administration procedures for the new millennium. *The Secretary's Conference on Education Technology*. Retrieved from https://eric.ed.gov/?q=it%27s+time+to+upgrade%3a+tests+and+administration+procedures+for+the+new+millennium&id=ED452833

Russell, M., Bebell, D., & Higgins, J. (2004). Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent 1:1 laptops. *Journal of Educational Computing Research, 30*(4), 313-330.

Saldana, J. (2016). T*he coding manual for qualitative researchers.* 3rd ed. [Kindle edition]. Retrieved from https://smile.amazon.com

Sauers, N. J. (2012). *1:1 laptop implications and district policy considerations* (Doctoral dissertation). Retrieved from UMI. (UMI number 3511653)

Sauers, N. J., & McLeod, S. (2018). Teachers' technology competency and technology integration in 1:1 schools. *Journal of Education Computing Research, 56*(6), 892-910. doi: 10.1177/0735633117713021

Schrum, L., Galizio, L. M., Ledesma, P. (2011). Educational leadership in technology integration: An investigation into preparation, experiences, and roles. *Journal of School Leadership, 21*, 241-261.

Schiller, J. (2003). W*orking with ICT: Perceptions of Australian principals. Journal of Educational Administration, 41*(2), 171-185. doi: 10.1108/09578230310464675

Schunk, D. (2016). *Learning theories: An educational perspective*, 7th ed. Greensboro, NC: Pearson.

Shapley, K., Sheehan, D., Maloney, C., Caranikas-Walker, F. (2011). Effects of technology immersion on middle school students' learning opportunities and achievement. *The Journal of Educational Research, 104*, 299-315. doi:10.1080/00220671003767615

Shapley, K. S., Sheehan, D., Maloney, C., & Carnakias-Walker, F. (2010). Evaluating the implementation fidelity of technology immersion and its relationship with student achievement. [Special issue]. *The Journal of Technology, Learning, and Assessment, 9*(4), 4-68.

Sheninger, E. (2014). *Digital leadership: Changing paradigms for changing times*. Thousand Oaks, CA: Corwin Press.

Silvernail, D. L. (2005). *Does Maine's middle school laptop program improve learning? A review of evidence to date*. (Occasional Brief). Retrieved from https://files.eric.ed.gov/fulltext/ED509480.pdf

Silvernail, D. L., & Gritter, A. K. (2007). *Maine's middle school laptop program: Creating better writers.* (Research Brief). Retrieved from https://www.maineflu.gov/mlti/resources/Impact_on_Student_Writing_Brief.pdf

Soby, M. (2015). Finnish education system. *Nordic Journal of Digital Literacy, 10*(2-2015), 64-68.

Stansbury, S., & Case, S. (2011). *Do laptop computers lead to more learning?* Retrieved from https://members.aect.org/pdf/Proceedings/proceedings11/2011/11_30.pdf

Stronge, J. H. (2018). *Qualities of effective teachers*, (3rd ed.). Alexandria, VA: ASCD.

Suh, S. M. A. (2014). *Mobile technology and applications for enhancing achievement in k-12 science classrooms: A literature review*. Retrieved from https://members.aect.org/pdf/Proceedings/proceedings14?2014i/14_28.pdf

Suhr, K. A., Hernandez, D. A., Grimes, D., & Warschauer, M. (2010). Laptops and fourth-grade literacy: Assisting the jump over the fourth-grade slump. [Special edition]. *The Journal of Technology, Learning and Assessment, 9*(5), 4-45. Retrieved from https://ejournals.bc.edu/ojs/index.php/jtla/article/download/1610/1459

Tarling, I., & Ng'ambi, D. (2016). Teachers pedagogical change framework: a diagnostic tool for changing teachers' uses of emerging technologies. *British Journal of Educational Technology, 47*(3), 554-572. doi: 10.1111/bjet.12454

Thannimalai, R., & Raman, A. (2018). The influence of principals' technology leadership and professional development on teachers' technology integration in secondary schools. *Malaysian Journal of Learning and Instruction, 15*(1), 203-228.

UCEA Center for the Advanced Study of Technology Leadership in Education (CASTLE). (n.d.a). *Principals technology leadership assessment: Dissemination and licensing*. Retrieved from http://dangerouslyirrelevant.org/wp-content/uploads/2017/04/PTLA-Packet.pdf

UCEA Center for the Advanced Study of Technology Leadership in Education (CASTLE). (n.d.b). *Principals technology leadership assessment: Interpreting the results*. Retrieved from dangerouslyirrelevant.org/wp-content/uploads,2017/04/PTLA-packet.pdf

UCEA Center for the Advanced Study of Technology Leadership in Education (CASTLE). (n.d.c). *Principals technology leadership assessment: Development of the instrument*. Retrieved from: dangerouslyirrelevant.org/wp.content/uploads/2017/04/PTLA.packet.pdf

U.S. Department of Education, Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 National Education Technology plan update*. Retrieved from https://tech.ed.gov/files/2017/01/NETP17.pdf

Wagner, T. (2012). *Creating innovators: The making of young people who will change the world*. Scribner: New York, NY.

Wagner, T. (2014). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need—and what we can do about it*. Persus Books: New York, NY.

Warschauer, M. (2006). *Laptops and literacy: Learning in the wireless classroom.* New York: Teachers College Press.

Waxman, H. C., Boriack, A. W., Lee, Y, & MacNeil, A. (2013). Principals' perceptions of the importance of technology in schools. *Contemporary Educational Leadership, 4*(3), 187-196.

Wenglinsky, H. (2006). Technology and achievement: The bottom line. *Association for Supervision and Curriculum Development, 63*(4), 29-32.

Wiliam, D. (2011). *Embedded formative assessment.* Bloomington, IN: Solution Tree Press.

Williams, N. L., & Larwin, K. H. (2016). One-to-one computing and student achievement in Ohio high schools. *Journal of Research on Technology in Education, 48*(3), 143-158. doi:10.1080/15391523.2016.1175857

Wilson, L., Gielniak, M., & Greaves, T. W. (2017a). *Project Red: Revolutionizing education-Leadership brief*. Retrieved from https://one-to-oneinstitute.org/pr-briefs

Wilson, L., Gielniak, M., & Greaves, T. W. (2017b). *Project Red: Revolutionizing education-Professional learning brief*. Retrieved from https://one-to-oneinstitute.org/pr-briefs

Wright, V. H. (2010). Professional development and the master technology teacher: The evolution of one partnership. *Education, 131*(1), 139-146.

Yee, D. L. (2000). Images of school principals' information and communications technology leadership. *Journal of Information Technology for Teacher Education, 9*(3), 287-302. doi: 10.1080/14759390000200097

Zheng, B., Warschauer, M., Lin, S., & Chang, C. (2016). Learning in one-to-one laptop environments: A meta-analysis and research synthesis. *Review of Educational Research, 86*(4), 1052-1084. doi: 10.3102/003465316628645

Zucker, A. (2004). Developing a research agenda for ubiquitous computing in schools. *Journal of Educational Computing Research, 30*(4), 371-386.

APPENDICES

Appendix A

Principals' Technology Leadership Assessment

CASTLE

INSTRUCTIONS
Principals Technology Leadership Assessment

You are being given this technology leadership assessment at the request of your school or district, which will use the results to guide its leadership training and professional development programming. Assessment items are based on the International Society for Technology in Education's (ISTE) National Educational Technology Standards for Administrators (NETS-A). The purpose of the assessment is to provide building-level administrators with detailed and comparative information about their technology leadership.

The individual items in the assessment ask you about the extent to which you have engaged in certain behaviors that relate to K-12 school technology leadership. Answer as many of the questions as possible. If a specific question is not applicable, leave it blank. For example, if a question asks about technology planning activities in your district, and your district has not engaged in any such activities, leave the item blank. Note that leaving multiple items blank may limit the usefulness of the assessment results.

As you answer the questions, think of your actual behavior over the course of the last school year (or some other fixed period of time). Do not take into account planned or intended behavior. As you select the appropriate response to each question, it may be helpful to keep in mind the performance of other principals that you know. ***Please note that the accuracy and usefulness of this assessment is largely dependent upon your candor.*** If done with care, the results can provide you with valuable information as you seek to extend or improve your leadership skills.

When assessing behaviors and performance, individuals have a tendency to make several types of errors. You should familiarize yourself with the following errors:

Leniency error. This occurs when an individual gives himself an assessment higher than he deserves. This could occur for several reasons: the individual has relatively low performance standards for himself; the individual assumes that other individuals also inflate their ratings; or, for social or political reasons, the individual judges that it would be better not to give a poor assessment. As you assess yourself, you should understand that accurate feedback will provide you with the best information from which to base further improvement.

Halo error. This occurs when an individual assesses herself based on a general impression of her performance or behavior, and the general impression is allowed to unduly influence all the assessments given. An example of halo error would be an individual who rates herself highly on every single assessment item. It is rare that individuals perform at exactly the same level on every dimension of leadership. It is more likely that an individual performs better in some areas than on others.

Recency error. This occurs when an individual bases an assessment on his most recent behavior, as opposed to his entire behavior over some fixed period of time (e.g., the last year). This assessment should be based on your behavior over the entire year (or other fixed period of time).

The following terms appear throughout the assessment. Keep these definitions in mind as you read the items and make your response.

Technology. Generally refers to personal computers, networking devices and other computing devices (e.g., electronic whiteboards and personal digital assistants (PDAs)); also includes software, digital media, and communications tools such as the Internet, e-mail, CD-ROMs, and video conferencing.

Technology planning. Any process by which multiple stakeholder groups (e.g., district administration, school administration, faculty, and parents) convene to develop a strategy for the use or expanded use of technology in instruction and operations. Technology planning need not be separate from other planning efforts, but should be a recurring theme if integrated within a more comprehensive planning process.

Research-based. A practice that employs systematic, empirical methods that draw on observation or experiment to provide reliable data. Research-based work uses research designs and methods appropriate to the research question posed and are presented in sufficient detail for replication. The strongest research-based practices typically obtain acceptance through peer-reviewed journals or expert panels.

Assessment. A method of measurement used to evaluate progress. Student assessment typically refers to a method of evaluating student performance and attainment to determine whether or not a student is achieving the expected outcome(s).

Average time to complete the assessment is about 15 minutes. To take the assessment, log on to

I. Leadership & Vision

1. To what extent did you participate in your district's or school's most recent technology planning process?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you communicate information about your district's or school's technology planning and implementation efforts to your school's stakeholders?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you promote participation of your school's stakeholders in the technology planning process of your school or district?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you compare and align your district or school technology plan with other plans, including district strategic plans, your school improvement plan, or other instructional plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you advocate for inclusion of research-based technology practices in your school improvement plan?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you engage in activities to identify best practices in the use of technology (e.g. reviews of literature, attendance at relevant conferences, or meetings of professional organizations)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

II. Learning and Teaching

1. To what extent did you provide or make available assistance to teachers to use technology for interpreting and analyzing student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you provide or make available assistance to teachers for using student assessment data to modify instruction?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you disseminate or model best practices in learning and teaching with technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you provide support (e.g., release time, budget allowance) to teachers or staff who were attempting to share information about technology practices, issues, and concerns?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you organize or conduct assessments of staff needs related to professional development on the use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you facilitate or ensure the delivery of professional development on the use of technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

III. Productivity & Professional Practice

1. To what extent did you participate in professional development activities meant to improve or expand your use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you use technology to help complete your day-to-day tasks (e.g., developing budgets, communicating with others, gathering information)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you use technology-based management systems to access staff/faculty personnel records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you use technology-based management systems to access student records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you encourage and use technology (e.g., e-mail, blogs, videoconferences) as a means of communicating with education stakeholders, including peers, experts, students, parents/guardians, and the community?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

IV. Support, Management, & Operations

1. Support faculty and staff in connecting to and using district- and building-level technology systems for management and operations (e.g., student information system, electronic grade book, curriculum management system)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you allocate campus discretionary funds to help meet the school's technology needs?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you pursue supplemental funding to help meet the technology needs of your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you ensure that hardware and software replacement/upgrades were incorporated into school technology plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you advocate at the district level for adequate, timely, and high-quality technology support services?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you investigate how satisfied faculty and staff were with the technology support services provided by your district/school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

V. Assessment & Evaluation

1. To what extent did you promote or model technology-based systems to collect student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you promote the evaluation of instructional practices, including technology-based practices, to assess their effectiveness?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you assess and evaluate existing technology-based administrative and operations systems for modification or upgrade?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you evaluate the effectiveness of professional development offerings in your school to meet the needs of teachers and their use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you include the effective use of technology as a criterion for assessing the performance of faculty?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

VI. Social, Legal, & Ethical Issues

1. To what extent did you work to ensure equity of technology access and use in your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you implement policies or programs meant to raise awareness of technology-related social, ethical, and legal issues for staff and students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent were you in involved in enforcing policies related to copyright and intellectual property?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent were you involved in addressing issues related to privacy and online safety?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you support the use of technology to help meet the needs of special education students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you support the use of technology to assist in the delivery of individualized education programs for all students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

7. To what extent did you disseminate information about health concerns related to technology and computer usage in classrooms and offices?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

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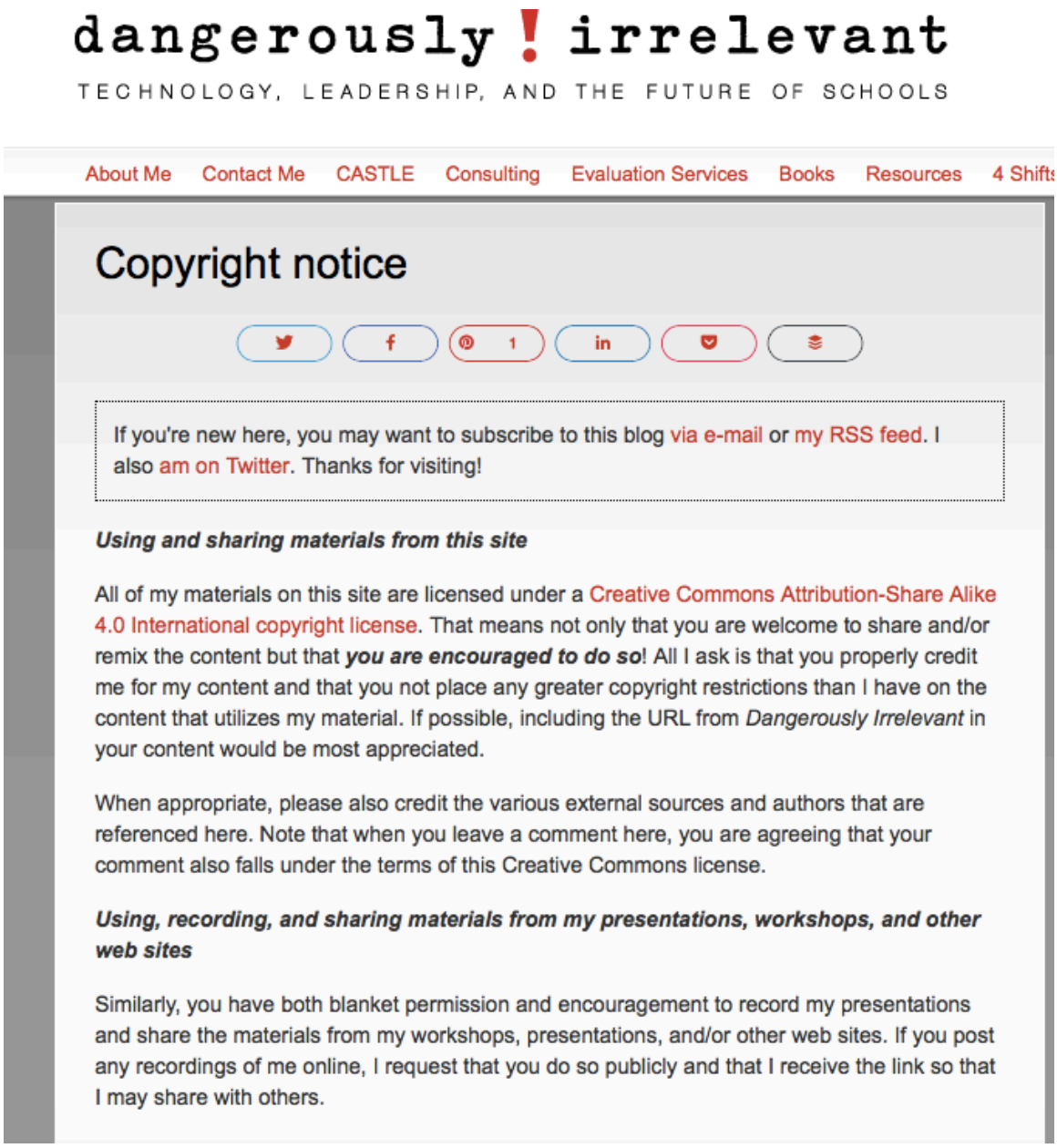

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Appendix B

Interview Questions

1. How long has your school been 1:1? Have you been principal for that entire time?
2. How was 1:1 implemented in your building?
3. How did you learn to use technology? For example, did you have course work in your undergraduate or graduate program related to technology?
4. How do you utilize technology in your work?
5. What is your vision for technology within your school and how was that vision created?
6. How do you monitor progress toward accomplishing your vision?
7. Discuss the role of the technology leadership team in your building—who, what, when?
8. What policies/procedures have you put in place to ensure the successful integration of technology in your school?
9. How do you define technology integration? Do you think it is important in education (Machado & Chung, 2015?
10. What supports do you provide your teachers and students with regard to 1:1?
11. What professional development have you provided for your teachers with regard to 1:1 and technology integration?
12. How do you support continuous learning of yourself/teachers/staff with regard to 1:1?
13. How much influence do you (principal) have over classroom practice, specifically technology use in the classroom (Machado & Chung, 2015)?

14. Explain how students in your building use technology in their learning and the impact of technology on their learning.
15. Discuss the skills students in your school are developing as a result of technology integration. (21st century)
16. What are the current successes and challenges of your 1:1 program? What are your future hopes/plans for the program?

APPENDIX C

IRB Approval Letter

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Thursday, April 04, 2019

Principal Investigator	**Beverly Miller** (Student)
Faculty Advisor	Kevin Krahenbuhl
Co-Investigators	NONE
Investigator Email(s)	*bjm5v@mtmail.mtsu.edu; kevin.krahenbuhl@mtsu.edu*
Department	Education Leadership
Protocol Title	***Leadership's impact on student learning in 1:1 computer environment***
Protocol ID	**19-1219**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category *(1) Educational Settings & Instructional Strategiesnd medical devices* A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	**EXEMPT from furhter IRB review*** **	Date	**4/4/19**
Date of Expiration	NOT APPLICABLE		
Sample Size	100 (ONE HUNDRED)		
Participant Pool	**Adults (18 or older) - Principals/Assistant Principals**		
Exceptions	Multi-mode data collection (online, verbal and telephone methods) permitted with appropriate mode of informed consent		
Mandatory Restrictions	1. Participants must be 18 years or older 2. Informed consent must be obtained from the participants 3. Identifying information must not be collected		
Restrictions	**1. All restrictions for exemption apply.** **2. No audio/video recording of the interviews/telephone conversations or other interactions is permitted.**		
Comments	NONE		

***This exemption determination only allows above defined protocol from further IRB review such as continuing review. However, the following post-approval requirements still apply:

- Addition/removal of subject population should not be implemented without IRB approval
- Change in investigators must be notified and approved
- Modifications to procedures must be clearly articulated in an addendum request and the proposed changes must not be incorporated without an approval

- Be advised that the proposed change must comply within the requirements for exemption
- Changes to the research location must be approved – appropriate permission letter(s) from external institutions must accompany the addendum request form
- Changes to funding source must be notified via email (irb_submissions@mtsu.edu)
- The exemption does not expire as long as the protocol is in good standing
- Project completion must be reported via email (irb_submissions@mtsu.edu)
- Research-related injuries to the participants and other events must be reported within 48 hours of such events to compliance@mtsu.edu

Post-approval Protocol Amendments:

The current MTSU IRB policies allow the investigators to make the following types of changes to this protocol without the need to report to the Office of Compliance, as long as the proposed changes do not result in the cancellation of the protocols eligibility for exemption:

- Editorial and minor administrative revisions to the consent form or other study documents
- Increasing/decreasing the participant size

Only THREE procedural amendment requests will be entertained per year. This amendment restriction does not apply to minor changes such as language usage and addition/removal of research personnel.

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

The investigator(s) indicated in this notification should read and abide by all applicable post-approval conditions imposed with this approval. Refer to the post-approval guidelines posted in the MTSU IRB's website. Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident.

All of the research-related records, which include signed consent forms, current & past investigator information, training certificates, survey instruments and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:
Click here for a detailed list of the post-approval responsibilities.
More information on exempt procedures can be found here.