THE IMPACT SYSTEMS DESIGN AND LEADERSHIP PRACTICES HAVE ON TECHNOLOGY INTEGRATION AND ADAPTATION AT THE K-12 SCHOOL LEVEL DURING A TIME OF CHANGE

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ABSTRACT

THE IMPACT SYSTEMS DESIGN AND LEADERSHIP PRACTICES HAVE ON TECHNOLOGY INTEGRATION AND ADAPTATION AT THE K-12 SCHOOL LEVEL DURING A TIME OF CHANGE

Gustavo M. Loor

The COVID-19 pandemic has compelled K-12 schools and districts across the United States to quickly pivot to distance learning. This disruption to traditional in-person instruction required shifts in district leadership and teacher pedagogy. Previous research has shown that teachers must be provided with learning and supportive environments that cultivate and enhance their instructional technology proficiency and capabilities, hence the importance of technology leadership among K-12 administrators (Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Hennessy et al., 2005; Hew & Brush, 2007). However, much of the research in the field of K-12 technology integration has relied on quantitative and mixed-methods approaches to reflect their findings. Several gaps in the existing literature have led to a need not only for an in-depth case study approach, but also the need to study the geographic region of New York in the research base.

This comparative case study was conducted in two suburban Long Island, New York school districts. The researcher will aim to triangulate findings by utilizing data from teacher focus groups, individual interviews from leaders, and a thorough document analysis of instructional technology plans, teacher contracts, and district websites. The

purpose of this comparative case study was to examine the organizational dynamics and leadership practices necessary for an effective K-12 technology integration environment during a time of change. As this study conveys, leadership practices and systems thinking matter. They have been found to have a prominent impact on technology implementation and adaptation within the fabric of K-12 schooling (Christensen, 2018; Raman et al, 2019; Dexter & Richardson, 2020). Given the sudden shift in teaching pedagogy and educational leadership due to a global pandemic, this study aims to stimulate a novel investigation and thorough analysis of its implications on K-12 schools and districts through the lens of key educational stakeholders (e.g., leaders and teachers). Ultimately, the study serves as both a resource and framework to assist the K-12 education community respond to a change process and provide a theoretical framework and research-based actionable steps for educational leaders to utilize as a guide while navigating through shifting teaching and learning landscapes during a time of change.

DEDICATION

I dedicate this accomplishment to those closest to me who have provided continuous support, encouragement, and love throughout this arduous journey. I have not made this journey alone. This document serves as a culmination of my previous academic and professional achievements.

My work and learning ethic can only be attributed to my immigrant parents and grandmother who sacrificed their lives and migrated from Ecuador to afford me the opportunity to excel in this country. I would not be the person I am today without recognizing where I came from and the people who paved the way. To my late grandmother, who as the patriarch of the family, set the foundation for our family growth and success in this country. I hope this accomplishment makes you proud. To my mother who worked tirelessly to provide for us; who raised me to be the man I am today; who modeled hard work and perseverance; and who has sacrificed more than anyone will ever know. To my father, who taught me the value of respect, family, legacy, and most importantly education.

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Lastly, to my future unborn child or children. You have not entered this world yet, but I'm hoping this accomplishment will plant the roots for a fruitful future for you. My legacy will live within you. My hope is to make you proud of our family name, to inspire you to accomplish anything that you put your heart and mind to, and to stay resilient to what the world will put forth on your path. Regardless of my accomplishment, nothing is as valuable as you will be.

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Finally, I would like to thank each of my doctoral cohort members. It has truly been an amazing journey and I am fortunate to have shared it with such dedicated professionals and scholars. #stay

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CHAPTER 1

Introduction

Nationwide, the COVID-19 pandemic has intensified technology integration efforts from teachers and leaders at the K-12 level. Consequently, remote teaching and learning has become the new instructional platform for teachers. As the 2017 National Technology Plan (U.S. Department of Education, 2017) foreshadows, it is a time of great possibility and progress for the use of technology to support learning in K-12 classrooms. From the vast instructional technology resources available to teachers to the current K-12 remote learning landscape that has stemmed from COVID, technology integration has become paramount within the K-12 educational arena. Now more than ever, K-12 teachers are expected to use technology in remote, interactive, and collaborative ways to meet the needs of the 21st-century learner amid a global pandemic. Hence, it has become essential to research and explore the leadership practices and systems that need to be set in place for effective technology integration at the K-12 level during a time of crisis and uncertainty. Ultimately, the systems set in place by educational leaders create the means and foundation for K-12 teachers to effectively integrate technology within their instruction. Moreover, as the literature review section of this study will reveals, the case study approach has been seldom utilized in past qualitative studies. A case study method will present a comprehensive outlook of the lived experiences of key educational stakeholders (e.g., leaders and teachers) regarding technology integration best practices and sustainable systems design during a time of change and upheaval.

Technology integration in classrooms has also been collectively referred to as instructional technology (National Science Board, 2018). As the report from the National

Science Board (2018) offers, instructional technology involves utilizing and creating "appropriate technological platforms and resources to facilitate teaching, engage students, and improve learning outcomes" (p. 86). Similarly, Liu et al. (2017) view technology integration as an approach that involves using technology in classrooms to support instructional methods and practices. Hence, technology integration and instructional technology may be used interchangeably. According to Inan & Lowther (2010), technology integration in schools may vary and can be grouped primarily into three broad categories: technology for instructional preparation (e.g., preparing instructional materials, locating digital resources), technology for instructional delivery (e.g., presentation tool), and technology as a learning tool (e.g., digital applications or platforms used to communicate, create, share, or solve). Ultimately, as Ertmer & Ottenbreit-Leftwich (2010) argue, "it is time to shift our mindsets away from the notion that technology only provides a supplemental teaching tool" (p. 256) and acknowledge that technology is currently transforming instruction (remote or in-person) and necessary for effective and engaged student learning.

Purpose of the Study

When governors and state superintendents decided to close K-12 school buildings in early March 2020 due to the COVID-19 pandemic, school districts across the country went into rapid-response mode and were compelled to execute remote learning continuity plans for students, with varying degrees of delivery and success (Alvarez, 2020). School districts are being required to spend resources on supplies and resources to ensure teachers and students are adequately prepared to teach and learn remotely, while at the same time possibly facing budget cuts for the upcoming 2020-2021 school year (Hanley,

2020). Thus, educational leaders nationwide have been challenged with circumstances beyond their control. Educational leaders have been inundated with the uncertainty and health risks of a global pandemic that has shifted pedagogical and leadership practices. As the Consortium for School Networking (CoSN, 2020) addressed in their guidelines for reopening schools amid COVID-19, educational leaders must consider the ambiguities and unanticipated issues that arise with rapid changes in education (e.g., remote learning). As the report indicates, leadership during a change process "requires thoughtful, intentional, and purposeful strategic planning (e.g. system dynamics) to support the learning community as it confronts current and future crises" (CoSN, 2020, p. 5). This is an unprecedented time in our history as a country and within the education profession. Nonetheless, educational leaders are responsible for establishing a system that allows students and teachers to maintain engagement and connection while sustaining meaningful education during a time of change (CoSN, 2020). Further, the ever-accelerating push for schools to adopt and incorporate new technologies into their instruction is unlikely to decrease in the foreseeable future (Warner et al., 2018). Accordingly, the purpose of this study is to explore and identify the leadership practices and system dynamics that are perceived as integral for a sustainable and effective K-12 technology integration environment during a time of change and disruption through the lens of teachers and leaders.

As the COVID pandemic ensues, K-12 teachers are in a midst of a technology evolution within their instruction. Teachers are now responsible for planning and implementing their instruction in a remote environment with varying degrees of resources and technological support (Hanley, 2020). Teachers are very much facing a shift in

pedagogy without a viable precedent to draw from. In spite of the crisis, teachers have responded in innovative ways by drawing on an array of resources available to meet the needs of their students (Hanley, 2020). One thing is certain amid the current turbulent times, meaningful and sustainable change requires that teachers continue learning and shifting their mindsets. Teachers have become crucial figures in the educational change process; thus, their perspectives are integral in understanding the dynamics involved with technology change efforts. As Hennessy et al. (2005) assert, "investigating pedagogic change requires an understanding of the key contextual factors in how technology is perceived and used by teachers" (p. 158). Further, Hennesy et al. indicate that since integrating new technologies may create challenges for teachers, it is integral to understand and engage in conversations with teachers about their experiences with their technology integration efforts, especially amid unprecedented circumstances. The predominant focus of previous research has been on the perspectives from educational leaders, thus making the teacher dimension sparse in the qualitative realm. This study strives to elicit teacher perspectives alongside the viewpoints from K-12 leaders. In doing so, the researcher will holistically recognize and identify the dynamics of the current shifting instructional landscape. Ultimately, amid the educational climate of change we are living today, examining technology integration systems and practices through the lens of teachers as agents of change adequately contributes to an evolving research field.

Although technology integration in K-12 settings is a dynamic process that requires a number of factors to work together in an integrated and interrelated manner (Gurfidan & Koc, 2016), studies have found that teachers play a significant role in the technology integration process (Ertmer, 2005; Ertmer et al., 1999; Ertmer et al. 2012; Liu

et al., 2017). In order to achieve the kinds of instructional technology effectiveness required for 21st-century teaching and learning, teachers need guidance (e.g., leadership) and a system of support (e.g., systems thinking) to be able to leverage technology to facilitate meaningful remote teaching and learning. As technology in education is evolving and transforming instructional pedagogy, research in the field must also be ongoing and progressing to keep up to date with evolving times (e.g., COVID-19 pandemic). Hence, this study presents a contemporary outlook that will supplement the current K-12 research base by identifying and providing a coherent leadership and system framework for educational leaders to apply during a change process.

In order to provide a comprehensive outlook and backdrop for this study, this section has been categorized into the following pertinent topics that will build a contextual understanding of the K-12 technology integration realm: Trends & Policies; and Educational Technology Standards.

Trends and Policies

To gain a holistic understanding of the evolving landscape that K-12 technology integration has undergone politically throughout the years, the researcher has branched trends and policies into national, state, and local levels.

National

As of August 2020, Congress was negotiating an educational relief bill to meet the growing technology needs in school communities across the nation amid COVID (Flannery, 2020). The proposed bill, known as S.3690: Emergency Educational Connections Act of 2020, establishes and provides funding for the Emergency Connectivity Fund, from which the Federal Communications Commission (FCC) is

responsible to support (Congress.gov, 2020). Specifically, the FCC must provide funding to selected elementary schools, secondary schools, or libraries to purchase telecommunications equipment or services (e.g., Wi-Fi hotspots, modems, and routers) for use by students and staff at locations other than the schools or libraries (e.g., homes), especially during remote learning initiatives caused by COVID (Congress.gov, 2021). The Emergency Educational Connections Act of 2020 was introduced into Congress on May 12, 2020 and, as of March 2021, is in the first stage of the legislative process. (Congress.gov, 2021). Moreover, this current technology initiative is supported at the policy level by the government's previous passage and funding of the E-Rate program (ISTE, 2016).

The schools and libraries universal service support program, commonly known as the E-rate program, helps schools and libraries obtain affordable broadband and internet access (Federal Communications Committee, n.d.). Results from a 2016 national survey suggest that increased bandwidth continues to be needed because schools expect dramatic increases in the number of students using multiple devices for classwork while at school (National Science Board, 2018). According to the Federal Communications Committee (n.d.), when E-rate was established in 1996, only 14 percent of the nation's K-12 classrooms had access to the Internet. On December 11, 2014, the Federal Communications Committee (FCC) decided to revise the E-rate program to meet the needs of 21st century digital learning, thus raising funding to enable more schools and libraries nationwide to purchase high-speed broadband and internet connectivity (Federal Communications Committee, n.d.). As of a result, today, virtually all schools and libraries nationwide have Internet access.

Prior to the COVID pandemic, the U.S. federal government recognized the potential value of technology and launched a series of initiatives urging school leaders and educators across the nation to adopt a 21st-century model of education that embraces technology (National Science Board, 2018). In 2013, the Obama administration announced the ConnectED initiative, designed to enrich K-12 education for every student in the U.S. by aiming to connect 99% of American students to broadband and high-speed wireless services in their schools and libraries by 2018 (Office of Educational Technology, n.d.). Accordingly, the country has made significant progress in reaching this goal, with the percentage of school districts with high-speed broadband increasing from 30% in 2013 to 88% in 2016 (Education Superhighway 2017). The integration of technology into the teaching and learning environment is also supported by the U.S. Department of Education.

According to the U.S. Department of Education's Office of Educational Technology (n.d.), the Future Ready pledge, launched in November 2014, serves as a key component of the ConnectED initiative. Importantly, district superintendents across the country that sign the Future Ready pledge commit to: (1) working collaboratively with district stakeholders to set a vision for digital learning, (2) commit to empower teachers through personalized professional learning, and (3) commit to mentor other district leaders in their own transition to digital learning (Office of Educational Technology, n.d.). Education Superhighway's (2017) report on the state of broadband connectivity in American public schools noted that forty governors in 2015 committed to providing their K-12 students with equal access to educational opportunity by ensuring that all of their classrooms were connected to high-speed broadband. As the report further states, during

2016, these governors took action and took advantage of the opportunity presented by the modernization of the Federal Communications Commission (FCC) E-rate program, to begin the process of delivering on this commitment (Education Superhighway, 2017). As a result of the efforts from state and district leaders across the country, "10.4 million more students and 700,000 additional teachers now have the connectivity they need to utilize and leverage technology to enhance teaching and learning in the classroom" (Education Superhighway, 2017, p. 3).

Moreover, the National Education Technology Plan (NETP), released in 2017, is the flagship educational technology policy document for the United States (U.S. Department of Education, 2017). The NETP lays out the vision of the U.S. Department of Education for the purpose and use of technology in American K-12 education (ISTE, 2016). As ISTE identified in their 2016 report, the NETP's main indicators align well with the 2016 ISTE Standards for Students, which supports and expands upon the NETP vision (ISTE, 2016). Importantly, the principles and examples provided in the NETP document align with the activities that support the effective use of technology as defined in Title IV, Part A, of the Every Student Succeeds Act (ESSA) as authorized by Congress in December 2015 (U.S. Department of Education, 2017).

Ultimately, at the national level, the United States government has spent billions of dollars for technology infrastructure (e.g., E-rate program; ConnectEd initiative) in K-12 schools, thus establishing and assuring systems for effective use of instructional technology. Nevertheless, federal support for K-12 technology integration initiatives continue today as evidenced by the current proposed federal relief bill, the Emergency Educational Connections Act of 2020, as a response to COVID.

State

On March 16, 2020, Governor Andrew Cuomo issued an Executive Order closing schools for two weeks due to the COVID-19 crisis. Moreover, as the COVID pandemic ensued, subsequent executive orders closed schools for the remainder of the school year, thus triggering fundamental changes to New York's education system. Recently, the New York State Education Department disseminated a reopening guidance report to districts and schools and across New York (NYSED, 2020, July 16). According to the state report, school districts must create and submit a comprehensive reopening plan for the 2020-21 school year that includes plans for in-person instruction, re-mote instruction, and a hybrid of both in-person and remote. In order to adhere to state and local health and safety guidelines and ensure social distancing practices, districts are collaborating with district stakeholders to consider various reopening plans and schedules that stagger or alternate their stu-dents' return to school. The proposed reopening plans from districts statewide were due by July 31, 2020. Most recently, a press release from New York State (NYS) Governor Andrew Cuomo on August 7, 2020 (Office of the Governor, 2020) announced that schools across NYS are permitted to open in Fall 2020. According to the New York State Office of the Governor (2020, August 7), determining how individual districts in New York will reopen (e.g., in-person; a hybrid model) will be made by local school districts under the strict guidelines of the Department of Health.

Comprehensively, New York State has established educational technology initiatives and funding to foster and support technology integration efforts from schools and districts. On July 30, 2020, New York State Governor Andrew Cuomo announced the approval of 148 Smart Schools Investment Plans aimed at improving school security and

reimagining teaching and learning for the 21st century (Office of the Governor, 2020, July 30). The approved plans total $94 million and are part of the $2 billion Smart Schools Bond Act. The Smart Schools Bond Act, approved by New York State voters in 2014, authorized the granting of $2 billion to finance educational technology initiatives and infrastructure to improve learning and opportunity for students throughout New York State schools (NYSED, Office of Educational Design and Technology). The Smart Schools Bond Act allows school districts to invest in technologies such as computer servers, interactive whiteboards, tablets, desktop and laptop computers, and high-speed broadband and wireless connectivity, which expands access to interactive curriculums and enhances communication between parents and teachers (Office of the Governor, 2020, July 30). Accordingly, during a recent press release amid COVID, NYS Governor Cuomo adamantly stated,

> As the ongoing public health crisis has shown, now more than ever we must do everything possible to help schools modernize their infrastructure and are equipped to keep students up with their studies even when they can't be in the classroom. With this funding, we are helping schools navigate the pandemic while expanding opportunities and providing students with the skills and technology they need to succeed in the 21st century economy (Office of the Governor, 2020, July 30).

Local (school districts)

Due to the unique dynamics of the current remote teaching and learning landscape, local educational leaders and teachers must come together and collaborate with colleagues and professional organizations for best practices and resources more so now than ever before. The Consortium for School Networking (CoSN) is a professional association for school system technology leaders that provides leadership resources, best practices, and advocacy tools to help educational leaders at the district level succeed in

the digital transformation of their schools or districts (CoSN, 2020). CoSN represents school districts nationwide and continues to grow as a powerful and influential voice in K-12 education. Recently, in collaboration with the American Association of School Administrators (AASA), the CoSN created a COVID-19 recovery task force, which presents guidelines for reopening schools recommended by superintendents throughout the country (CoSN, 2020). Schools and districts have also placed focus on ensuring students have access to one-to-one devices (laptop, tablet, or other mobile computing device) for instructional purposes (National Science Board, 2018). Moreover, substantial progress is being made with local school systems fully meeting the minimum internet bandwidth recommendations (100 Mbps per 1,000 students) from the Federal Communications Commission (CoSN, 2016; Education Superhighway, 2017). As the CoSN (2016) further reports, this progress has been equally seen across urban, rural and suburban districts.

School districts opened up schools in September 2020 with guidance from state and health officials and in accordance with their proposed reopening plans that were submitted on July 31, 2020. However, this data remains fluid as educational leaders are continuously and diligently planning for multiple scenarios for teaching and learning depending on the spread of COVID-19 and on federal or state health guidelines. Subsequently, school districts will need to ultimately adhere to the guidance and recommendations from the Centers for Disease Control and Prevention (CDC) and the New York State Department of Health (NYSDOH).

Educational Technology Standards

In an effort to better serve the needs of 21st century learning and to serve as a guiding role in enriching educational environments according to innovations of the digital age, the International Society for Technology in Education (ISTE) developed the National Education Technology Standards (NETS) for students in 1998 (Gurfidan & Koc, 2016). As Friedman et al. (2009) indicate, the NETS were developed with the guiding principle that "citizens must be able to use technology effectively to contribute to an increasingly technology-infused society" (p. 478). The NETS for Teachers presented standards for preservice teachers that were aligned with the National Council for the Accreditation of Teacher Education (NCATE) standards (Friedman et al., 2009). Moreover, the National Educational Technology Standards for Administrators (NETS-A) were initially called the Technology Standards for School Administrators (TSSA) and were released in 2001 (Anderson & Dexter, 2005). As Anderson & Dexter further indicate, in 2002, they were integrated into the ISTE NETS standards and widely promoted thereafter.

In 2013, ISTE changed the name of their standards from the National Education Technology Standards (NETS) to the ISTE standards. According to ISTE (n.d.), this change reflected the international reach of ISTE and of their standards, which are used by educators around the globe. As their mission states, ISTE is committed to supporting transformative education technology in the U.S. and around the world (ISTE, n.d.). The ISTE Standards are designed to serve the field for five to ten years as a blueprint for technology adoption and implementation. Further, since educational technology moves rather quickly, the ISTE Standards are refreshed periodically to reflect the current and

forthcoming state of education (ISTE, n.d.). As such, the ISTE standards have undergone revisions and name changes throughout the years. In 2017, ISTE updated and renamed the ISTE Standards for Teachers to the ISTE Standards for Educators. Moreover, the initial ISTE Standards for Administrators underwent a name change in 2018 to the ISTE Standards for Education Leaders to include revised leadership elements: visionary planner, empowering leader, equity and citizenship advocate, connected learner and systems designer (Christensen et al., 2018). Most recently, the Computer Science Educators Standards were unveiled at the ISTE Conference in 2019 and are currently named the Computational Thinking (CT) Competencies for Educators (ISTE, n.d.).

The International Society for Technology in Education (ISTE) consists of five sets of standards that provide a framework for amplifying and transforming digital age learning, teaching, and leading within the field of educational technology (ISTE, n.d.). According to ISTE (n.d.), the five sets of standards include: (1) ISTE Standards for Students; (2) ISTE Standards for Educators; (3) ISTE Standards for Education Leaders;(4) ISTE Standards for Coaches; and (5) Computational Thinking (CT) Competencies for Educators. Education stakeholders from all over the U.S. and countries around the world use the standards in a variety of ways. The ISTE student standards are meant to inform lesson and curriculum planning, and guide schools, districts, and states in creating technology plans, while also expanding on skills considered necessary for digital age work and life (ISTE, 2016). Additionally, the ISTE standards for teachers, leaders, coaches, and computer science educators are aimed at guiding the professional enhancement of educators with the current digital age (ISTE, n.d.).

During the past several decades, instructional technologies have influenced every aspect of our society, particularly education (Zhao & Frank 2003). Nevertheless, a global pandemic has further intensified the technology integration efforts of K-12 districts and schools. Accordingly, the ISTE standards have been established as the guiding framework that districts and schools need to not only further stimulate instructional practices, but to also stay abreast with the dynamic and evolving educational landscape amid COVID. Consequently, strong technology leadership is necessary for the advocacy, utilization, and leveraging of technology to transform K-12 learning (U.S. Department of Education, 2017). Notably, technology leadership has evolved and stemmed from earlier forms of educational leadership models.

Theoretical Framework

The basis of this study integrates the theoretical lens of systems thinking and professional capital. Specifically, Peter Senge's disciplines of a learning organization will be linked with Andy Hargreaves and Michael Fullan's view of professional capital to provide a comprehensive theoretical lens that cultivates a system of collaboration, growth, and sustainability during the current shift of technology integration in K-12 schools. The challenging work that lies ahead for technology leaders must incorporate leaders' ability to cope with complex change and organizational capacity for continuous learning (Senge et. al, 2000). As Anderson & Dexter (2005) suggest, focusing on "theories of learning organizations would help to theoretically address how to incorporate culture and community into conceptions of technology leadership" (p. 73).

As the researcher will conceptualize, Fullan's professional capital theory enhances the impact that Senge's five disciplines of learning organizations have on K-12

educational environments. Fullan's professional capital theory focuses on the growth and enhancement of the individual and collective capacity of educators (teachers and leaders), which involves ongoing collaboration and learning (Hargreaves & Fullan, 2012). Consequently, Fullan's professional capital model accentuates the human element within Senge's learning organization framework. As the researcher will further discuss in Chapter 2, Senge's five disciplines of learning organizations emphasize a systems thinking approach that will be substantiated with the enhancement of human and social capital (Senge, 2006). Essentially, the investment in the progression of people matters (Fullan's model) and can only be attained within a system that cultivates the process (Senge's model). Conclusively, educational leaders nationwide will benefit from the fusion of both Senge's and Fullan's theoretical frameworks as they attempt to establish a system and culture of learning and collaboration among teachers during the COVID-19 pandemic. Ultimately, a school or district's ability to work systematically and learn cohesively about significant and enduring solutions may make the difference between thriving or struggling during changing times in education.

Significance of the Study

This study has significance for research, policy, and practice related to K-12 technology integration efforts during a time of change and upheaval. Since COVID-19 is in its early stages of influence on K-12 education, this study provides a novel exploration in the current field. Research needs to be mobilized in response to a current pandemic that has shifted instructional pedagogy, system dynamics, and leadership within the K-12 educational realm. Presently, the COVID-19 global pandemic has generated significant changes in the way districts and schools are educating and delivering instructional

services to students and families. Subsequently, educational leaders have been compelled to shift their practices to be able to navigate through unprecedented times and evolving technological processes (e.g. remote learning). Studies have found that alongside leadership, systems must also be set in place for successful technology integration at the K-12 school level (Anderson & Dexter, 2005; Bleakley & Mangin, 2013; ISTE, n.d.; Liu et al., 2017; Tucker, 2019). Both leadership and systems infrastructure work in tandem for effective K-12 technology implementation and adaptation (Anderson & Dexter, 2005; Gurfidan & Koc; 2016). Hence, the realm of technology leadership within K-12 education has become a relevant area of study.

As the literature review will reflect, quantitative studies in the field of K-12 technology integration are bountiful. However, the field has few qualitative studies that explore perspectives from technology leaders and teachers. Further, a case study methodology has been seldom utilized in the current research base, thus prompting the need to thoroughly explore the lived experiences of key educational stakeholders (e.g., leaders and teachers) during a time of change and uncertainty. Their voices in the field will offer relevant viewpoints and experiences that cannot be quantified. Since a global pandemic has further intensified the technology integration efforts of K-12 districts and schools, educators must attempt to remain afloat amid the changing and evolving educational landscape. Educational priorities and resources have shifted as political, economic, and health concerns continue to develop and emanate from the uncertainty of the COVID-19 pandemic. Now more than ever, technology leadership is at the forefront of districts and schools. Subsequently, educational leaders today must be able to effectively anticipate and prepare for change during uncertain times by establishing a

system of continuous improvement and strategic planning. According to the COVID-19 recovery task force report (CoSN, 2020), educational leaders are currently collaborating and coordinating technology initiatives to figure out how they can best meet education policy expectations, while providing adequate support for all students.

Large investment in educational technology at the federal and state levels have stimulated considerable research and interest related to technology integration (Liu et al., 2017; Department of Education, 2017; U.S. Department of Education, 2018). Moreover, under today's COVID circumstances, research is needed that further explores and identifies effective K-12 educational leadership practices and system designs during a crisis or a change process. As education goes digital, technology leaders face many challenges in planning for their technology network or infrastructure, especially around factors of affordability, network speed and capacity, and network reliability (CoSN, 2016). As the 2017 National Technology Plan (U.S. Department of Education, 2017) maintains, learning, teaching, and assessment enabled by technology requires a robust system infrastructure. This implies the necessity for educational leaders to recognize and understand the system dynamics necessary for effective K-12 technology implementation plans. Hence, the significance of this study lies in the exploration and analysis of these dynamics to offer a fundamental framework for success with K-12 technology integration during a change process.

Research on K-12 classroom technology integration should remain an ongoing process that needs several sources of data to inform the literature base (Liu et al., 2017). Accordingly, this study explores educational leadership practices and systems infrastructure necessary for effective K-12 technology integration from the perspectives

of both leaders and teachers. The researcher will seek to conceptualize the findings from a leadership and systems thinking approach. As Tucker (2019) argues, K-12 technology leaders will find it much easier to introduce a new technology initiative if they build a sustainable professional learning infrastructure to support that change. Thus, by equipping current and future technology leaders with a knowledge base of effective practices and system dynamics, districts and schools nationwide may be better prepared to both initiate and sustain effective technology integration practices during shifting and changing times.

Research Questions

The study's purpose is driven by the following research questions:

1. What leadership practices and approaches influence technology implementation and adaptation efforts at the K-12 level?
2. What elements within a system infrastructure are necessary to effectively support and sustain technology integration initiatives at the K-12 level?
3. What are teacher perceptions regarding leadership practices and systems and structures that influence their technology integration experiences?

Definition of Terms

- *COVID-19* - an infectious disease caused by a new strain of coronavirus that has turned into a global pandemic, resulting in nationwide school closures (World Health Organization, n.d.).
- *Technology integration* - a combination of technology resources (hardware or software), network-based communication systems, tools, and other technology-

based practices that have been integrated into daily routines and student activities in the classroom (Gurfidan & Koc, 2016).

- *Instructional technology* - involves utilizing and creating technological platforms and resources to facilitate teaching, engage students, and improve learning outcomes. (National Science Board, 2018)
- *Technology leadership* - methods that leaders utilize to encourage, support, and sustain a district or school's instructional technology use (Ertmer et al., 2002).
- *Remote (or distance) learning* - refers to educational teaching and learning that take place online. It provides an opportunity for students and teachers to remain connected and engaged with instructional content while working from their homes due to emergency situations that pose a threat to student health or safety - e.g., COVID-19 pandemic (Ray, 2020).
- *International Society for Technology in Education (ISTE)* - a national organization that provides a framework for educators in the use of technology in the classroom and is committed to supporting transformative education technology in the U.S. and around the world. Formerly known as the National Education Technology Standards, or NETS (ISTE, n.d.).
- *National Education Technology Standards (NETS)* - ISTE developed the National Education Technology Standards (NETS) for students, teachers, and leaders with the guiding principle that citizens must be able to use technology effectively to contribute to an increasingly technology-infused society. In 2013, ISTE changed the name of their standards from the NETS to the ISTE standards (ISTE, n.d.).

- *Substitution, Augmentation, Modification, Redefinition (SAMR) model* - Created by Ruben Puentedura, the SAMR model is a technology integration assessment tool that can provide a rating framework for technology integration (Chang, 2012).
- *Technological Pedagogical Content Knowledge (TPACK) model*: a consolidated framework designed to bring together elements of content, pedagogy, and technology in a manner meant to assist teachers in delivering effective technology-infused instruction (Hilton, 2015).
- *Consortium for School Networking (CoSN)* - a professional association for school technology leaders with the mission of empowering educational leaders to leverage technology to realize engaging learning environments (CoSN, 2016).
- *Emergency Educational Connections Act of 2020* - establishes and provides funding for the Emergency Connectivity Fund, from which the Federal Communications Commission (FCC) must provide support for qualifying schools and libraries to purchase Wi-Fi hotspots, modems, routers and other connected devices for students during the COVID-19 pandemic. As of August 2020, it was on the first stage of the legislative process (Congress.gov, 2020).
- *E-rate program* - The E-rate program is administered by the Universal Service Administrative Company under the direction of the FCC. The program helps schools and libraries to obtain affordable broadband and internet access (Federal Communications Committee, n.d.).
- *Federal Communications Commission (FCC)* - An independent U.S. government agency overseen by Congress, the FCC is the federal agency responsible for

implementing and enforcing America's communications law and regulations (Federal Communications Committee, n.d.).

- *The National Education Technology Plan (NETP)* - released at the end of 2015, is the flagship educational technology policy document for the United States (U.S. Department of Education, 2017).
- *ConnectED initiative* - established in 2013 by the Obama administration, it is designed to enrich K-12 education for every student in the U.S. by aiming to connect 99% of American students to broadband and high-speed wireless services in their schools and libraries by 2018 (Office of Educational Technology, n.d.).
- *Future Ready pledge* - serves as a key component of the ConnectED initiative. District Superintendents that sign the Future Ready District Pledge commit to foster and lead a culture of digital learning in their district and to share what they have learned with other districts (Office of Educational Technology, n.d.).
- *Every Student Succeeds Act (ESSA)* - As a successor to No child Left Behind (NLCB), ESSA was signed into law by the Obama administration in 2015 with the purpose of closing educational achievement gaps by providing all students the opportunity to receive a fair, equitable, and high-quality education (https://www.ed.gov/ESSA).

CHAPTER 2

Introduction

This chapter will discuss the findings from the existing research literature base regarding K-12 technology integration. The research reviewed in this section comes from prominent literature in education theory, peer-reviewed journals, and national and state reports and websites. This chapter begins with discussion of two theoretical frameworks relevant to the study. The researcher will also discuss the combination and merging of both frameworks and their implications on K-12 technology integration efforts during a time of change. Further, to elaborate on key aspects in the field, the findings from the literature base have been organized into the following subsections: (1) Technology Leadership; (2) Teachers as Change Agents; and (3)Technology Integration Accountability. This chapter concludes with a brief discussion of the gaps in the existing research literature, which the subsequent methodology chapter of the study further addresses.

Theoretical Frameworks

As the COVID pandemic amplified K-12 technology integration efforts, educational leadership has evolved, thus prompting the research field to revisit the way leaders should lead. Today's educational leaders must be able to establish a sustainable system conducive to technology integration efforts, all the while leading in a culture of change (e.g., remote/hybrid schooling). Therefore, the researcher chose to review the research base through the combined theoretical lens of systems thinking and professional capital. Peter Senge's (2006) five disciplines of a learning organization will spotlight the systems thinking approach that requires collective thinking and learning and is necessary

for effective technology leadership amid COVID. Hargreaves & Fullan's (2012) professional capital model will capture the change element caused by COVID and the response to that change. Through Senge's theoretical lens, school systems can find ways to get teachers to collaborate and create an environment where teachers can continually reflect on what they are doing and learn to collaborate in order to bring about systems thinking (Senge, 2006). Notably, Hargreaves & Fullan's view of professional capital (2012) contends that professional capital is the key to transitioning educational change efforts from individuals to groups. As Fullan (2016) asserts, when establishing change strategies to solve educational problems, we need to capitalize on the power of the group, which professional capital takes into account. Subsequently, Hargreaves & Fullan's professional capital model will be examined in the context of Senge's systems thinking approach to establish a basis for effective technology implementation and adaptation at the K-12 school level.

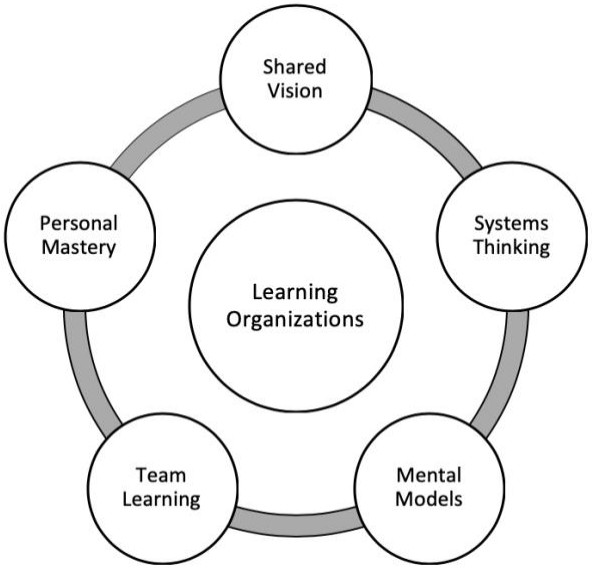
Peter Senge's Five Disciplines of Learning Organizations

According to Senge (2006), a learning organization discovers how to tap people's commitment and capacity to learn at all levels. In essence, the basic meaning of a learning organization is one that is continually expanding its capacity to adapt and generate learning, especially amidst changes within the landscape of education. Senge emphasizes the notion of "disciplines" within learning organizations, which he defines as commitment, focus, and practice (Senge, 2006, p. 12). Accordingly, Peter Senge has identified five disciplines of a learning organization: Systems Thinking, Shared Vision, Mental Models, Personal Mastery, and Team Learning (see Figure 1). Though developed separately, each discipline "provides a vital dimension in establishing organizations that

can truly learn and that can continually enhance their capacity to realize their highest aspirations" (Senge, 2006, p. 10).

Figure 1

Senge's Five Disciplines of Learning Organizations



Note: Adapted from Zeeman, A. (2017). Senge's five disciplines of learning organizations. https://www.toolshero.com/management/five-disciplines-learning-organizations/

Systems Thinking

Systems thinking is knowledge that provides a comprehensive outlook on how parts of a learning organization coincide and influence each other. It is about understanding and acknowledging the connectedness and interaction among the disciplines of learning organizations (Senge, 2006). Identified as the fifth discipline, systems thinking is the discipline that integrates the other four disciplines (Shared Vision; Mental Models; Personal Mastery; Team Learning) and fuses them into a coherent body of theory and practice (Senge, 2006). Subsequently, it is vital that the five disciplines develop as a whole to realize its potential. Building a shared vision fosters a commitment

to the long term. Mental models focus on the self-reflection needed to current reveal notions or assumptions that affect actions. Team learning develops skills and knowledge by learning from each other. Personal mastery fosters the personal motivation to continually learn and grow in our craft. Lastly, systems thinking allows us to recognize the interrelationships of the disciplines and how each one is needed to foster the growth of a learning organization. As Senge (2006) contends, by enhancing each of the other disciplines, it continually reminds us that the whole is greater than the sum of its parts. The cohesiveness of the disciplines together produces better results than utilizing each discipline separately. In times of turmoil and drastic change, systems thinking within schools and districts becomes ever more essential.

Shared Vision

A shared vision paints the picture of what we want to create. As Senge (2006) posits, a shared vision is vital for the learning organization because it provides the focus and energy for learning. Taking time early in the change process to have conversations needed to shape a shared vision is crucial to building common understandings and commitments. In effect, by planting the seed of a technology shared vision (e.g., technology initiatives and goals) via communication and dialogue (e.g., technology committees), leaders are able to establish purpose and ignite coherent commitment and effort from teachers. According to Senge (2006), the practice of shared vision involves revealing shared "pictures of the future that foster genuine commitment and enrollment rather than compliance" (p. 11). Essentially, when teachers share a vision (e.g., technology initiatives) they are connected and bound together by a common goal (i.e., technology integration). However, in order to effectively transition and transcend

instruction through technology use in the classroom, communicating and collaborating to create a shared vision is vital. Senge (2006) contents that visions effectively spread by increasing clarity, communication, and commitment. As communication increases, the vision grows clearer, thus enthusiasm for its benefits can begin to build (Senge, 2006).

Mental Models

According to Senge (2006), mental models are perceived beliefs, values, mindsets or assumptions that influence how we understand the world and how we take action. These notions may determine and dictate the way people think and act about certain things. The discipline of mental models starts with turning the mirror inward and learning to unravel our internal notions of the world and how things work (Senge, 2006). In relation to technology integration in classrooms, mental models may include how educators perceive the usefulness and comfortability of integrating technology to enhance their instruction. Their assumptions and experience with technology may dictate how they approach technology integration. Teachers may not even know that they are holding on to firmly held beliefs regarding technology. Essentially, firmly held beliefs can make teachers inflexible with transitioning their mindset in the midst of educational change. Ultimately, mental models are active— they shape how we act. As such teachers need to add flexibility within their mental models to be able to adapt to educational change, especially with technology. Moreover, Senge (2006) asserts that it is crucial to surface and recognize mental models within people in an organization in order to get in touch with and understand the thinking related to change in the workplace. Accordingly, challenging or clarifying assumptions and encouraging people to reframe their mental models is essential and key to success within a culture of change. Similarly, leaders must

learn to reflect on their current mental models in order to lead by example. As Senge (2006) argues, failure to appreciate mental models has undermined many efforts to foster systems thinking.

Personal Mastery

Personal mastery is the discipline of personal growth and learning (Senge, 2006). It is the discipline of being a life-long learner. Learning in this context does not mean acquiring more information, rather expanding or enhancing one's craft or reaching a certain level of proficiency. People with high levels of personal mastery are on a continual learning mode, are aware of their growth areas, and view educational change as a natural progression and outgrowth of learning, not a detriment (Senge, 2006). As Senge asserts, people with high levels of personal mastery have learned how to work with and learn from forces of change rather than resist them. Subsequently, as technology has grown and evolved within society and education, it has become imperative for teachers to adapt their instruction with technology, which involves them seeking their own personal growth with instructional technology. The practice of improving one's teaching craft amidst sudden change comprises personal mastery. Subsequently, personal mastery is an organization's commitment to and capacity for learning. In relation to the other disciplines, if people in a learning organization do not share a common vision, and do not share common "mental models" about the reality within which they operate their craft, people will not feel motivated to seek personal mastery (Senge, 2006). Importantly, leaders should commit themselves to their own personal mastery. Discussing personal mastery may broaden people's minds, however, in order to motivate others to seek

personal mastery, there's nothing more powerful than modeling your own personal mastery by being serious in your own quest (Senge, 2006).

Team Learning

The discipline of team learning involves learning with and from each other and mastering the practices of dialogue and discussion. As Senge (2006) describes, engaging in dialogue refers to the capacity of members of a team to think collaboratively to explore a variety of issues. Conversely, individual learning is irrelevant for organizational learning. Through team or group learning, insights shared, and skills developed may extend to other individuals and to other teams (Senge, 2006). The team's accomplishments can set the tone and establish a standard for learning together for the larger organization. Moreover, the discipline of team learning can only occur if learning and collaborative environments are established, similar to professional learning communities (PLC's) within school systems. Accordingly, leaders need to create an environment where teachers can continually learn from each other (O'Neill, 1995). As it relates to instructional technology, technology committees are examples of team learning. Technology committees provide a bridge for building and district level teachers and leaders to engage in discussing technology goals, accomplishments, needs, issues, and action steps. The dialogue and discussions within technology committees establishes a team learning environment. As Senge (2006) posits, "when teams are truly learning, not only are they producing extraordinary results, but the individual members are growing more rapidly than could have occurred otherwise" (p. 12).

The key to applying the five disciplines of learning organizations is to acknowledge and understand the interrelationship among the disciplines. Each discipline

cannot stand independently. The interconnectedness of all the disciplines is what systems thinking emphasizes. Conclusively, the implementation of the five disciplines will lead to a sustainable and effective learning organization that is able to make key decisions based on shared understandings, with systems thinking at its core.

Andy Hargreaves & Michael Fullan's Professional Capital Framework

Michael Fullan (2016) views professional capital as the key to transitioning change efforts from individuals to schools and districts. The knowledge, experience, and skills of educators are more beneficial when it's utilized in a collaborative and coherent way. Hargreaves & Fullan (2012) express professional capital in a formula (see Figure 2), where PC is professional capital, HC is human capital, SC is social capital, and DC is decisional capital. Effective learning and teaching for the whole profession are a product of these three kinds of capital amplifying each other (Hargreaves & Fullan, 2012).

Figure 2

Professional Capital Formula

PC = f (HC, SC, DC)

PC = Professional Capital
f = function of
HC = Human Capital
SC = Social Capital
DC = Decisional Capital

Note: Adapted from Hargreaves, A. & Fullan, M. (2012). Professional capital: Transforming teaching in every school. New York, NY: Teachers College Press.

Human Capital

The concept of human capital refers to the knowledge, experience, and skills that are developed in individuals through education and training. Human capital is about

individual talent. Human capital refers to the quality of teachers in the school, or their basic teaching skills and knowledge (Fullan, 2016). Regarding instructional technology, human capital relates to the teacher level of technology proficiency and usage in the classroom. However, as much as it is important to improve the craft of individual teachers and educators, you can't get much growth in schools or districts by just focusing on the capital of individuals. Human capital should not be thought of as the main force for developing a school. Instead, it should be circulated and shared. Effective instructional technology practices occurring in the classroom should be shared and highlighted with other teachers to be able to learn from them. As Hargreaves & Fullan (2012) assert, "groups, teams, and communities are far more powerful than individuals when it comes to developing human capital" (p. 3). As Fullan (2016) posits, social capital (the group) improves individuals more readily than individuals improve the group.

Social Capital

According to Hargreaves & Fullan (2012), social capital refers to how the quality of interactions and social relationships among people in a workplace affects their access to knowledge and information. Social capital increases knowledge—it provides access to other people's human capital. Fundamentally, social capital expands a person's networks of influence and opportunity (Hargreaves & Fullan, 2012). Fullan (2016) indicates that social capital in schools influence teachers' commitment to work together for a common cause. Subsequently, we cannot increase human capital just by focusing on it in isolation - collaboration is key. Social capital enables teachers to learn from each other, within and across schools. It allows schools to build cultures and networks of communication, learning, trust, and collaboration. The degree of social capital in the culture of a school

may determine the success it has with any innovation or initiative. Accordingly, in order to accomplish technology initiatives within a school or district, leaders need to establish the environment for social capital to flourish. Fullan (2016) asserts that schools that take the time and effort to invest in the interaction among human and social capital build the resources required for schoolwide success, resulting in deeper results. Ultimately, the social capital process ensures that collaborative learning opportunities are ongoing elements in schools.

Decisional Capital

Decisional capital refers to resources of knowledge, intelligence, and energy that are required to make decisions by putting human and social capital to effective use (Fullan, 2016). Decisional capital is what is required for making good decisions. As Fullan & Hargreaves (2012) determine, decisional capital is enhanced and sharpened by utilizing insights and experiences of colleagues in forming judgments. Accordingly, social capital is an integral part of decisional capital. As engagement with social capital increases, decisions get better. In school systems, decisional capital is about cultivating human and social capital over time and making decisions that identify and spread the instructional practices that are deemed most effective for the learning goals of the school (Fullan, 2016). Importantly, expertise and judgment become critical in time of innovation. In time of technology innovation (e.g., 1:1 devices), uncertainty (e.g., COVID-19 pandemic), or educational change (e.g., remote learning), leaders and teachers need a high degree of decisional capital to make effective and informed instructional and pedagogical decisions. According to Hargreaves & Fullan (2012), the capacity to judge well depends on the ability to “make decisions in situations of unavoidable uncertainty

when the evidence or the rules aren't categorically clear" (p. 93). Ultimately, when human and social capital merge over time, their professional judgment becomes more powerful (Fullan, 2016).

Fullan (2016) maintains that professional capital is essential in the most challenging educational circumstances. Subsequently, amidst times of uncertainty and change, professional capital is vital for the future of the teaching profession and educational technology.

Merging Theoretical Frameworks

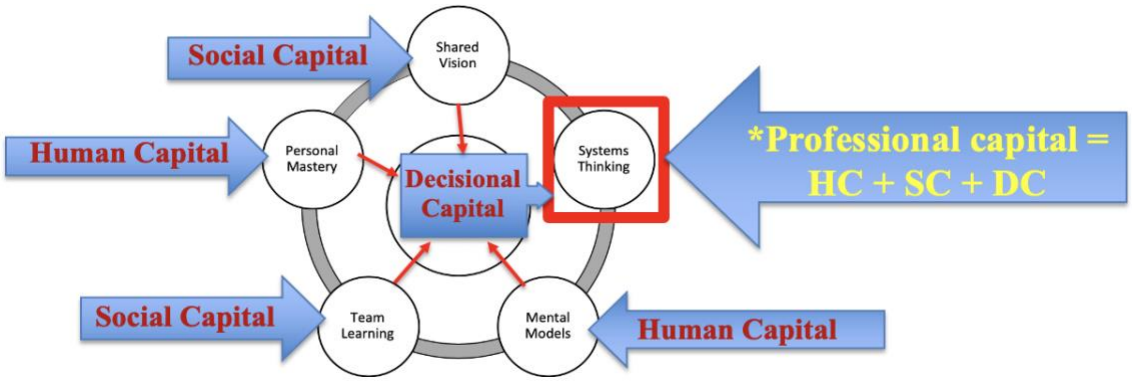
To organize the theoretical concepts in a coherent way, the researcher integrated both frameworks and constructed the Systems and Capacity Model (see Figure 3) as a comprehensive framework intended to guide educational leaders during change efforts. Although two separate constructs, professional capital can effectively be applied within the five disciplines of learning organizations. As seen in Figure 3, three effective interconnections can be made by coupling and integrating both constructs: (a) Human capital corresponds to individuals attaining personal mastery and shifting mental models; (b) Social capital aligns to the disciplines of team learning and shared vision within a learning organization; and (c) Decisions made with a high level of decisional capital can help establish and sustain systems thinking. Ideally, professional capital is already being established as the disciplines of personal mastery, team learning, and systems thinking are continuously being practiced and refined within a learning organization.

Systems thinking that includes the development of professional capital establishes an efficient framework for effective technology leadership during an evolving instructional technology realm. Prevalently, a global pandemic (i.e., COVID) has

heightened the need for leaders to increase their technology leadership proficiency and adapt to sudden changes. As a result, educational leaders must be able to establish and provide teachers with a system design that generates knowledge and accelerates innovation within their instruction. Subsequently, systems thinking that includes the development of professional capital may assist schools and districts in attaining an effective instructional technology plan during a culture of change. As Fullan et al. (2005) argue, the change process is about establishing the condition (e.g., systems thinking) for continuous improvement in order to persist and overcome barriers to reform. Ultimately, building professional capital within the context of Senge's five disciplines establishes an efficient framework for a sustainable and strong learning organization, amidst an evolving instructional technology realm.

Figure 3

Systems and Capacity Model



Literature Review

This section will provide theoretical and research-based insights on the impact that leadership practices and systems design have on technology integration practices and initiatives. The ERIC (EBSCO) research database was utilized to conduct a comprehensive review of literature covering technology leadership factors and system dynamics that affect the implementation and adaptation of technology within K-12 instruction. Additionally, studies that discussed the system dynamics that must be in place to be able to have success with K-12 technology integration efforts were also examined. Over eighty studies and prominent literature in the field of instructional technology integration and technology leadership, the majority of which are peer-reviewed articles, were reviewed and synthesized. The researcher also included international studies, government websites, and think tanks to offer an extensive and thorough analysis of the evolving and expanding K-12 technology integration landscape. Among the wealth of empirical studies that emerged within the instructional technology realm, technology leadership, teachers as key change agents, and systems infrastructure were found to be the most commonly referenced factors integral to K-12 technology integration efforts.

Notably, as the literature review will reveal, most peer-reviewed studies have identified that technology leadership and a sustainable and supportive system framework are integral components of technology integration efforts (Chang, 2012; Christensen, 2018; Gurfidan & Koc, 2016; Inan & Lowther, 2010; Liu et al., 2017; Machado & Chung, 2015; Raman et al, 2019). To further synthesize and organize the robust literature, technology leadership was sub-categorized into five essential aspects: (1)

establishing vision; (2) empowering and collaboration; (3) systems designer; (4) model & advocacy; and (5) connected learner. Moreover, prominent peer-reviewed studies conducted by Peggy Ertmer (Ertmer, 1999; Ertmer, 2005; Ertmer, et al.,1999; Ertmer et al., 2002; Ertmer & Ottenbreit-Leftwich, 2010) have continuously found that integral to technology integration efforts is a continuous system of support and growth for teachers. Subsequently, as teachers are learning to adapt and implement instructional technology amid sudden changes in the educational field, they have become pivotal agents of school change. Cohesively, technology leadership, teachers as key agents of school change, and systems designs have been found to be interrelated factors that systemically impact technology integration initiatives. Lastly, as the literature will convey (Chang, 2012; Christensen et al., 2018; Hilton, 2015; Karlin et al., 2018; Kihoza et al., 2016), there is a vast need for accountability and evaluative practices in K-12 settings with regards to technology integration, with the goal of enhancing and supporting the growth and proficiency of technology integration within the fabric of K-12 instruction.

Technology Leadership

Much empirically reviewed research focuses on the literature base covering technology leadership and technology integration within the K-12 realm (Dexter et al., 2017; Dexter & Richardson, 2020; Hitt & Tucker, 2016; Mcleod & Richardson, 2011; Richardson et al., 2012). The influential study of Mcleod & Richardson (2011) analyzed educational leadership journals and leadership conferences to portray how school technology leadership has been researched and written about in the most often-cited peer-reviewed journals in the fields of educational leadership from 1997 to 2009. Mcleod & Richardson's study spearheaded future similar studies to expand the research base.

Richardson et al. (2012) followed up by presenting a content analysis and review of the literature of articles published from 1997 through 2010 covering school technology leadership. Similarly, Dexter et al. (2017) contributed by conducting an analysis of the empirical research within the PreK-12 school technology leadership literature published in peer-reviewed journals between 1998 and 2015. More recently, Dexter & Richardson (2020) utilized Hitt &Tucker's (2016) Unified Model of Effective Leader Practices as conceptual framework to base their review of literature on, which focused on the empirical research conducted on K-12 technology integration between 1998 and 2018. Hitt & Tucker's (2016) framework of effective educational leader practices was formulated from a systematic review of the literature that unified the research base covering leadership practices, both in terms of studies and frameworks.

Most recently, the COVID-19 pandemic caused K-12 schools nationwide to suddenly close and compelled educational leaders and teachers to rapidly and urgently adapt to remote teaching and learning. Therefore, school leaders and teachers must be prepared to face the advances in instructional technology (e.g., remote learning) and the challenges that come along with it. Subsequently, leaders are tasked with transforming and developing educational organizations (Raman et al., 2019) amid a technology boom that rapidly digitized teaching and learning. In today's educational landscape, leaders must move beyond a management approach and toward the role of being a change agent for technology adaptation (Fullan, 2014). Christensen et al. (2018) argue that to lead successfully in the twenty-first century, leaders must consider the evolving nature of technology and establish ways to ensure its effective integration within instruction.

Consequently, technology leadership has emerged as a necessary and integral component for effective technology integration in K-12 schools.

There are various descriptions and interpretations of technology leadership throughout the literature (Anderson & Dexter; 2005; Ertmer et al., 2002; Hsieh et al., 2014; ISTE, 2018; Karlin et al., 2018). In a mixed-methods study with eight leaders conducted by Ertmer et al. (2002), the researchers defined technology leadership as methods that leaders utilize to encourage and support teachers' technology use. More recently, in a mixed-study with over 150 K-12 technology leaders, Karlin et al. (2018) found that technology leaders fulfill diverse responsibilities that include, providing technical support, allocating technology budgets, making purchasing decision, researching and learning current technology trends, and planning and implementing technology professional development opportunities for teachers and other leaders. Hsieh et al. (2014) conducted a quantitative survey study with Taiwanese elementary teachers and utilized a structural equation model (SEM) to empirically investigate the relationships between principals' technology leadership and teachers' instructional technology usage. The authors concluded that technology leaders must understand how technology enhances teaching and learning, develop environments that help teachers integrate technology into their instruction, and establish a technology team and support system that continuously sustains an organization's use of new technology.

Hsieh et al (2014) further contend that technology leaders must also encourage teachers and faculty to continuously seek training and professional enhancement opportunities to improve their technology proficiency, and establish a communal, supportive, and learning school environment. Similarly, Anderson & Dexter (2015) assert

that technology leadership involves motivating, supporting, and guiding teachers for efficient and effective use of technology in schools or organizations. Adequately, ISTE (2018) categorizes technology leadership into five dimensions: (1) Equity and Citizenship Advocate; (2) Visionary Planner; (3) Empowering Leader; (4) Systems Designer; and (5) Connected Learner. The ISTE standards for education leaders (2018) target the knowledge and behaviors required for technology leaders and provide a clear blueprint to help districts envision, implement, and lead a transformative culture of technology integration. Overall, regardless of the various descriptions and interpretation of technology leadership in K-12 settings, educational leaders today, more than ever, are undertaking imminent shifts in their roles that require them to become technology leaders that can facilitate change within a digital era (Raman et al., 2019).

In a quantitative study that surveyed principals, technology coordinators, and teachers from a national sample of schools, Anderson & Dexter (2005) found that technology leadership had the largest correlation with technology outcomes (e.g., net use, technology integration, and student tool use). Interestingly, technology leadership had a higher correlation with desired outcomes than did technology infrastructure in the study. Anderson & Dexter's (2005) findings also reinforced the importance and usefulness of the ISTE standards as guidelines for successful practice. In a quantitative survey study that gathered teacher perspectives also using a structural equation model, Chang et al. (2008) identified four constructs that comprise technology leadership: (1) vision, (2) staff development, (3) infrastructure support, and (4) evaluation and research. The study concluded that a leader's technology leadership involves the ability to develop and articulate a vision of how technology can produce change, encouraging and facilitating

teacher development with technology, providing technological support, ensuring that facilities for technology use are adequate, and evaluating school and district technology plans (Chang et al., 2008). As Christensen et al. (2018) concur in their review of technology leader characteristics and responsibilities, technology leaders are expected to lead with transformative approaches in schools, rather than serving in a strictly administrative function. Chang's (2012) subsequent quantitative study investigated the relationships among principals' technological leadership, teachers' technological literacy (technology-implementation abilities), and teaching effectiveness by also utilizing a structural equation model. The study's results showed that through the mediated effects of teachers' technological literacy, the principals' technological leadership can explain sixty-four percent of the variance in teaching effectiveness.

Leader attitudes, practices, and actions can also make a difference in influencing teacher use of instructional technology. Afshari et al. (2012) contend that effective technology leaders must be good communicators and active listeners. In a quantitative survey study that gathered teacher perspectives, Chang et al. (2008) indicated that the ability to interact and communicate effectively (interpersonal skills) allow technology leaders to build positive working relationships and communicate change and initiatives more clearly and purposefully. Leaders must be able to get along with teachers and staff members as they begin to integrate new learning technologies. As Chang et al. maintain, "without interpersonal and communication skills, principals cannot be effective technology leaders" (p. 233). Interpersonal skills allow technology leaders to build positive working relationships and communicate change and new ideas more clearly and purposefully. Similarly, leaders must also support teachers through social and emotional

aspects of the technology integration process (Dexter & Richardson, 2020). The process involves teachers possibly changing mindsets and pedagogy, especially if they feel since some teachers might be resistant to instructional technology due to either fear of the unknown or lack of confidence with technology (Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010). Kafyaulilo et al. (2016) interviewed school leaders and found that their perspectives on educational technology greatly influenced how much they encouraged teachers' technology integration efforts. Moreover, it has been found that leaders who have positive attitudes toward technology are often supportive in introducing new technologies into the classroom (Afshari et al., 2010)

Webster (2017) took a qualitative approach by using a grounded theory method to examine the philosophy of technology assumptions that are present in the thinking of K-12 leaders and how these assumptions may influence their decision-making. Webster's research identified two dominant philosophical approaches important for educational technology leadership and decision making: (1) Educational goals and curriculum should drive technology (technology should not drive the curriculum), and (2) Technological change is inevitable (acknowledge and embrace the change). As Webster concluded, philosophy of technology assumptions or beliefs do matter, and these beliefs do shape leaders' approaches with technology decision making. Accordingly, Hew & Brush (2007) contend that technology leaders must be risk-takers, forward thinking, problem solvers, and confident in their pedagogical understandings (i.e., technology beliefs or assumptions).

Conclusively, a leader's proficiency with technology leadership is essential to the current needs and technological changes within the K-12 educational arena. Chang

(2012) asserts that educational leaders who can embrace their evolving roles and become technological leaders are those who can effectively lead and prepare their schools and districts for decades to come. In accordance with previous literature and the ISTE standard for educational leaders, technology leadership in this study is further broken up into the following five essential elements that it encompasses: (1) establishing vision; (2) empowering and collaboration; (3) systems designer; (4) model & advocacy; and (5) connected learner.

Establishing Vision

Creating a shared technology vision during a change process enables leaders to communicate and collaborate with key stakeholders (e.g., teachers, parents, students, community leaders, community partners), and facilitate conversations regarding technology initiatives or implementation plans (Dexter, 2011; Schrum et al., 2011; Tucker, 2019). Dexter (2011) maintained that a technology vision reflects a leader's ideas about how technology can support learning and influences the structures, routines, and tools they put into place. As Dexter explains, a shared vision provides the means for leaders to establish a sense of purpose for teachers; a sense of commitment; a sense of direction; and a sense of understanding the big picture. Without taking the time to establish the purpose of technology initiatives, educational leaders are simply directing or managing technology initiatives as opposed to facilitating the change process (Dexter, 2011). Similarly, Tucker (2019) asserts school wide initiatives impact all stakeholders, thus the entire school community needs to understand the purpose to gather their support and interest. A quantitative survey study done by Kurland et al. (2010) found that a

school's vision has a significant effect on organizational learning. This was especially true when concerning technology.

Creating a vision for technology integration has been found to improve teacher pedagogical processes (Chang, 2012; Christensen et al., 2018). As Christensen et al. (2018) contend, "developing a shared vision and shared responsibility for technology integration requires shifts in ways of thinking and beliefs amongst all stakeholders for beneficial outcomes" (p. 463). Chang's (2012) aforementioned quantitative study indicated that in building and sustaining a positive school culture, technological leaders must develop and implement vision and technology plans. All leader participants from Schrum et al.'s study (2011) stressed that the vision of the leader is essential in helping "establish a culture that values risk taking, promotes exploration, and celebrates innovation" (p. 254). A quantitative survey study done by Kurland et al. (2010) found that a schools' vision has a significant effect on organizational learning. This was especially true when concerning technology. As Kurland et al. (2010) identify, the success of schools depends on leaders reinforcing the teachers' efforts to adhere to the school's vision, creating a sense of purpose, and encouraging others to engage in continuous learning during a change process. As Senge (2006) maintains, leadership in a learning organization starts with the principle of creative tension. Creative tension comes from seeing clearly where we want to be (the vision) and discussing where we currently stand with change (the current reality). With creative tension, the energy for change comes from the vision created and from what we want to create amidst the current reality (e.g., remote learning).

Machado & Chung (2015) conducted a mixed study to gather leader perspectives and found that in order to be effective technology leaders, school leaders must develop and implement a long-range technology plan that articulates a vision of how technology can produce change. As Machado & Chung (2015) assert, leaders are capable of raising the level of teacher technology literacy and classroom technology integration by establishing a clear laid out plan and direction (i.e., vision and goals). Lim & Khine (2006) revealed in their case study of four Singapore schools that a shared vision and technology integration plan gave school leaders and teachers an avenue to coherently communicate how technology can be used, a starting point, a goal to achieve, and a guide along the way. Further, Hew & Brush's (2007) review of K-12 technology integration factors specify that after a vision has been successfully created and communicated, the next step is to articulate a technology integration plan, which provides a clearly laid out blueprint or guide for the technology integration vision and action plan (short-term and long-term). Moreover, studies have suggested that on a yearly basis, technology leaders should modify and update their technology plans, align their technology planning with their vision and mission, and attempt to include various stakeholders in the planning process (Ritzhaupt et al., 2008; Dexter & Richardson, 2020). Finding ways to include parents and the community so they can perceive a sense of influence in their schools is a critical component (Hitt & Tucker, 2016). As Ertmer (1999) explains, although schools or districts are likely to make adjustments in their vision over time, a shared vision offers a vehicle for coherent communication among all stakeholders (e.g., leaders, teachers, parents, students, community leaders, community partners). Thus, as new issues,

problems, or opportunities arise, the shared vision keeps educators focused on what is essential to their technology efforts.

Christensen et al. (2018) contend that technology leaders who are able to motivate, communicate, and facilitate the enhancement of teachers with the implementation of the vision of the school or district is essential for sustaining a thriving technology integration culture in education. Essentially, if a leader is passionate about technology integration, and their vision reflects that, then that mindset has potential to transfer to the teachers (Machado and Chung, 2015). As Gurfidan & Koc (2016) maintain, if leaders and teachers share a common vision and have strong relationships, they will then be more inclined to collaborate and support each other with regards to integrating technology. Subsequently, technology leaders must provide and enable opportunities for teachers to collaborate with peers so they can feel empowered in their technology integration journey.

Empowerment & Collaboration

It's vital for teachers to feel empowered in their learning process during technology integration initiatives (Tucker, 2019). As Howell et al. (2014) assert, "empowerment can lead to a sense of ownership and support that promote positive beliefs about the role of twenty-first century tools in K-12 classrooms" (p. 39). Subsequently, technology leaders need to provide teachers with opportunities to participate in conversations that drive and support technology initiatives (e.g., technology committees), and environments where they are able to facilitate their learning process (e.g., professional learning communities) in order to increase their proficiency and confidence with instructional technology (Ertmer, 1999; Tucker, 2019). As Chang (2012) indicates,

technology leadership involves structuring the environment and support for teachers to help transition their mindsets to be able to create new instructional or pedagogical models. ISTE (2018) recommends that technology leaders create a culture where teachers and learners are empowered to use technology in innovative ways in order to enrich teaching and learning.

As Dexter & Richardson (2020) argue, people and processes should be the focus on technology leaders' efforts, rather than a focus on the technology itself. Teachers need to have opportunities to learn as a primary means for building capacity to integrate technology. Dexter (2011) concluded that teachers' technology integration efforts was also heavily influenced by social learning interactions with other colleagues, which include forming communities of practice for teachers where they provide ongoing collaboration and support for one another's educational technology learning (Dexter & Richardson, 2020). As Hitt & Tucker (2016) maintain, developing human capital in schools must be approached on both an individual and collective level.

Cifuentes et al. (2011) utilized a mixed methods approach with three rural school districts to examine a technology integration learning community. The authors found that teachers became more confident and empowered with their respective technology integration decisions and began employing a wider selection of new technologies in their classrooms as a result of a learning community (i.e., PLC's). Sugar, & Slagter van Tryon's survey study (2014) found that most teacher participants expressed much interest in discussing and interacting with other teachers about technology integration related issues or topics regarding new instructional technology tools. The study also found that all of the teacher participants stressed the importance of sharing technology resources,

including lessons, digital resources, and other technology teaching tools with their colleagues. As Zhao & Frank (2003) suggest, by giving teachers opportunities to interact and help one another, teachers begin to feel more empowered in the process of technology integration, and ultimately, schools may be able to increase their overall level of technology use.

According to Tucker (2019), technology leaders who are seeking to create change in their districts and encourage innovation must "invest time, energy, and resources into building a sustainable professional learning infrastructure to support that change" (p. 57). Part of the learning infrastructure includes professional learning communities (PLC's). Professional learning communities group teachers together in learning teams that meet regularly to connect, collaborate, and learn together (Tucker, 2019). Collaboration with colleagues is key to the learning process for teachers, and PLC's enable that platform. When engaged in a PLC, teachers become active agents of their own learning - they make key decisions about what they want and need to learn (Tucker, 2019). As Sugar, & Slagter van Tryon (2014) indicate, learning communities enable teachers to share ideas and resources among each other, explore new technology tools, "create a shared knowledge base of best practices, and provide a sense of collective accountability" (p. 55).

Zhao & Frank (2003) conducted a mixed-methods study with nineteen school districts from a midwestern state to examine how institutional factors affect technology use in schools and districts. The researchers found that opportunities to learn and explore new instructional technology tools have strong effects on both the teacher and student use of technology. The study highlighted the importance of school districts and buildings

allowing teachers release time to engage with instructional technology and "consider its applications in their specific contexts" (Zhao & Frank, 2003, p. 832). Thus, establishing and providing scheduled times for PLCs to meet regularly is crucial. Moreover, Anderson & Dexter (2005) suggest for technology leaders to establish technology committees to effectively develop a schoolwide shared vision for technology. Technology committees are established as an organizational system for developing consensus on technology visions, discussing implementation plans, and evaluating the district's current technology infrastructure (Anderson & Dexter, 2005). Consequently, it is important that leaders and stakeholders come together (e.g., technology committees) to develop and commit to a vision and unifying set of goals to direct their current and future efforts amidst educational change (Ertmer, 1999).

Ultimately, technology leaders are responsible to ensure that teachers are able to be part of technology integration conversations (e.g., technology committees) and be part of collaborative and learning environments with peers and colleagues (e.g., PLCs). Thus, by establishing and participating in technology committees and grouping teachers in professional learning communities (PLCs), technology leaders are better able to support teachers as they shift from traditional teaching practices to effectively integrating technology in their instruction (Tucker, 2019). As such, technology leaders need to establish and design a system infrastructure that adequately supports technology integration initiatives.

Systems Designer

As part of the support that technology leaders put into place, technology leaders must create effective organizational conditions and learning environments for teachers'

technology integration efforts (Bleakley & Mangin, 2013; Dexter, 2011; Machado & Chung, 2015; Tucker, 2019). Technology leadership is more than just the purchasing and implementation of hardware, software, and accounts (Bleakley & Mangin, 2013). It involves designing and establishing a system of interrelated support components that are integral to the instructional technology infrastructure of schools and districts. According to the ISTE standards for educational leaders (ISTE, n.d.), technology leaders must assure that systems are in place to effectively implement, sustain, and continuously improve the use of instructional technology to support teaching and learning. Chang et al. (2008) determined that the roles and responsibilities of a technology leader include enacting a support team (e.g., technology coach; IT department), ensuring that facilities for technology use are adequate, and evaluating school and district technology plans. Thus, a technology leader must design a system that is based on support, learning, and collaboration. Technology leaders must also facilitate the integration and use of technology by organizing and budgeting resources effectively as students' needs change and technological trends emerge (ISTE, n.d.). Hence, a robust system infrastructure must be in place to support dynamic instructional technology needs. As Bleakley & Mangin (2013) offer, within a system infrastructure, technology leaders must assess technology needs, identify appropriate products and services, establish support for instructional technologies, and provide adequate opportunities for teachers to enhance their practice. Part of that system infrastructure include technology committees, professional learning communities (PLC's), enhancement opportunities (e.g., trainings, workshops), and support teams (e.g., technology coach/es, IT department)

Studies have identified that time is an essential consideration that technology leaders must consider in their system infrastructure if they want teachers to effectively integrate technology in their instruction (Machado & Chung, 2015; Lu & Overbaugh, 2009). Teachers appreciate the support they are provided when they are given the time to spend with instructional technology or devices (Lu & Overbaugh, 2009). Moreover, research has shown positive links to time and support provided by leaders (Zhao et al., 2002). Subsequently, timely and relevant professional development opportunities should be planned for teachers to cultivate awareness, knowledge, skill, and dispositions towards technology (Liu et al., 2017). Additionally, follow-up and available support after attending workshops have been found to be more impactful than one-time workshops (Karlin et al., 2018). As Karlin et al. indicate, many teachers need the additional follow-up from technology workshops to fully gain commitment in utilizing and integrating the technology in their instruction. As Tucker (2019) acknowledges, teachers who put the effort to attempt a new technology strategy may encounter difficulties, abandon the strategy in favor of what has worked in the past for them, and eventually become disillusioned. Thus, technology coaches within a system of technology integration initiatives are the bridge between training and implementation of instructional technology (Tucker, 2019, p. 57).

Most of the studies reviewed by Dexter et al. (2017) recommended that leaders create a technology integration specialist, or coach, position to provide teachers with guidance, support, training, and access to social capital. According to Machado & Chung (2015), the instituting and utilization of technology coaches by school districts are necessary to provide the adequate follow-up and long-term involvement that teachers

need from professional development sessions. In previous research, professional development has been described as short, infrequent workshops with little focus on-ongoing support (Plair, 2008). Plair states that many technology-related professional development may lack the "continuity that teachers need to develop the confidence" and understanding that leads to success with technology integration (p. 72). Machado & Chung (2015) found that teachers' unwillingness to integrate technology into their instruction may be due to fear of the unknown. Fear of the uncertainty of how change will affect their instruction. Accordingly, a viable solution to overcoming teachers' fears or unwillingness with instructional technology is with the systemic establishment of a technology coach. In theory, technology coaches make themselves available to help teachers integrate technology into their instruction and assist with any instructional issues or questions with technology (Machado & Chung, 2015).

Providing teachers with the kind of support needed to develop technology proficiency and confidence means that technology leaders need to systemically designate the role of a coach and assure that the person is both knowledgeable and frequently available to them (i.e., full-time). Plair (2008) describes a technology coach as someone who "supplements the information available to teachers by attending conferences, participating in collaborative efforts with other tech-savvy teachers, and staying current with the latest literature" (p. 72). Studies have also asserted that since technology is rapidly evolving, most teachers will not be able to keep up with the latest technology without the support and assistance from a technology coach (Machado & Chung, 2015; Sugar & Slagter van Tryon, 2014). Importantly, a technology coach can help teachers translate what they learned in a training and apply it to their specific classroom and

student population. As Tucker (2019) contends, technology coaches can assist teachers in utilizing a particular technology tool in the context of their subject area.

Another important contributor to technology integration in the classrooms is the availability of support staff, such as an information technology department (IT), to help resolve technology-related issues (Liu et al., 2017). Specifically, teachers need access to technicians to resolve technical problems as they occur during the school day. Some of these technical issues may include, but not limited to accounts management, licenses and software, hardware repair, bandwidth, network (Wi-Fi), etc. As Liu et al. (2017) assert, it only takes one failed technology experience to negatively influence a teacher's perspective of instructional technology. Subsequently, ISTE (2018) acknowledges a quality support system (e.g., IT; technology coach) as a key antecedent to technology integration. Anderson & Dexter (2005) contend that more important than technology resources are the availability of support services. Studies have also suggested that access and support have been identified as important predictors of technology integration in K-12 schools (Inan and Lowther; 2010; Liu et al., 2017). Hilton's (2015) qualitative case study indicated that a lack of school email addresses for students, long waits to unblock specific websites, and a complicated process for approving new applications for downloading, all created technology roadblocks that inhibited smooth technology integration in classrooms. The teacher participants from Hilton's study (2015) found that members of the technology department at their school district played a major role in their technology integration process. Fundamentally, concerns or constraints around spending have also been linked with being part of the systemic design of technology leaders (Chang et al., 2008). As Chang et al. (2008) found, expense directly influenced the

availability of adequate facilities, which impacted technology use. Technology leaders, according to most teacher respondents in their study, should "provide instructional equipment, hardware and software to meet faculty and student needs" (Chang et al., 2008, p. 239). Hence, technology leaders must ensure a continuous budget for technology, and be able to seek funding, if needed, to provide adequate technology resources to teachers and students.

As vast research has shown, a technology system infrastructure is essential. However, for instructional technology to become an integral part of a school system, technology leadership must set the path and structure for all the essential components of the system to be established and implemented within the dynamics of a school system. Essentially, technology leadership provides the means for a system infrastructure to be established. Technology leaders must provide the resources and structure (e.g., technology coaches; IT; technology committees; PLC's; trainings/workshops; devices) to promote a supportive environment for teachers to build and strengthen their instructional technology capabilities and experiences. Importantly, the components of an effective technology integration system infrastructure that have been aforementioned, work in a systemic way. They all interconnect to help sustain a system of technology support and enhancement. Accordingly, during these times of instructional change and transition (e.g., remote learning) and the evolving nature of technology in K-12 classrooms, it has become vital for learning organizations (i.e., schools, districts) to establish a supportive, sustainable, and interconnected technology system infrastructure.

Model and Advocacy

A school's technology efforts are jeopardized unless technology leaders become actively involved with technology and put forth the effort to spend time with it (Anderson & Dexter, 2005). If technology leaders expect teachers to utilize specific technology platforms or tools, demonstrating and modeling the usage and value of that technology is integral in gaining their support. Essentially, leaders must lead by example and actively model the technology and strategies they are advocating (Tucker, 2019). As Ertmer (1999) suggests, modeling useful ways to use technology can help teachers understand its usage, value, and functionality, and often allows teachers to gain new instructional ideas. Tucker (2019) suggests for technology leaders to identify a handful of teacher leaders who "can be champions of the initiative moving forward" (p. 59). Classrooms belonging to these teacher leaders can be peer modeling opportunities for other teachers who want to see the technology being used in action.

Teachers need to see concrete examples of what the technology looks like in practice. Some teachers may not understand how these ideas translate into practice. Therefore, technology leaders need to provide teachers with experiences that enable them to observe similar others (e.g., colleagues) using the specific technology and witness how the change benefits their students (Ertmer, 2005). Ertmer et al. (2002) surveyed a group of leaders and responses indicated that modeling and coaching were all strategies that technology leaders should practice. Moreover, according to the national ISTE technology standards for education leaders, technology leaders need to model digital citizenship by intentionally adopting and demonstrating best practices to teach others (ISTE, 2018). Similarly, Zhao & Cziko (2001) maintain that examples and modeling are important

strategies for technology leaders to facilitate both teacher technology proficiency and usage.

As Hsieh et al. (2014) argue, a technology leader must also be an avid supporter and advocate of technology, who consistently encourages teachers to attempt to enhance their teaching craft, and who actively introduces new technological resources to teachers and advocate for their usage and effectiveness in the classroom. Similarly, in an earlier study of four schools in Canada, Granger et al. (2002) found that teachers stressed the importance of principals providing encouragement for teachers by acting as advocates, especially during periods of change and ever-increasing demands on teachers (e.g., remote teaching or distance learning). Webster's (2017) qualitative grounded theory study found that the technology leaders participating in the study held positive beliefs about the potential for technology to improve education, thus they embraced its possibilities. Further, the authors maintained that the prevalent philosophy of technology associated with most of the leader participants involved being advocates and promoters for new applications of technology (Webster, 2017). As the research affirms, technology leaders must advocate and encourage technology integration in classrooms by modeling and demonstrating its value and purpose to teaching and learning. In order to stay current and effectively model and advocate for new technologies, technology leaders need to stay connected with other leaders as continuous learners of technology.

Connected Learner

Rapid technical change, such as remote learning in K-12 classrooms, can make technology leadership particularly challenging. Studies have indicated that technology leaders themselves must stay connected as learners in the field of instructional technology in order to remain current with technological trends and advancements (Chang, 2012;

Christensen et al. 2018; Hsieh et al., 2014; ISTE, 2018). ISTE (2018) recommends for technology leaders to sustain a continuous learning mindset in the field of technology by practicing being connected learners. As connected learners, technology leaders must remain current and proficient with emerging instructional technologies (Hsieh et al., 2014). Christensen et al. (2018) contend that learning for technology leaders is an "on-going process and should be refined frequently in response to continuing and rapid developments in instructional technology" (p. 465). Essentially, technology leaders who recognize and understand current trends and knowledge of instructional technology are better prepared to lead their school or district in the twenty-first century (Chang, 2012).

Hence, educational leadership programs in colleges and universities have the responsibility and expectation to prepare K-12 school leaders to serve as technology leaders (Howell et al., 2014). In a survey study with educational leadership faculty from universities across the southeastern United States, Howell et al. (2014) found that most of the participants indicated that their department needed to offer more relevant classes and provide resources and support in order to meet the needs of teaching technology leadership to future leaders. Essentially, educational leadership programs need to stay current with ever-changing technology trends in the K-12 realm to be able to prepare educational leaders. Moreover, technology leaders should also seek and participate in training sessions or workshops to enhance their own technology leadership skills (Christensen et al., 2018). Christensen et al. suggest that virtual professional networks can also be used to develop technology leaders and share best practices. More and more educators in the K-12 environment are using social media and mobile technology as part of their personal learning networks (Christensen et al., 2018). Accordingly, being part of

a wider community of professionals in the field can help technology leaders stay connected and engaged in learning practices.

Research has also revealed that schools whose principals received technology integration training had higher levels of technology integration success than a control group of principals who did not receive the training (Dawson & Rakes, 2003). The researchers concluded, "the more sustained the principal's technology training experiences, the more progress the school is likely to make toward technology integration" (p.45). In another study by Leonard & Leonard (2006), many of the leader participants had serious concerns about their own capacity to lead technology use in their schools. The researchers found that eighty-seven percent (186 of the 214) of the school leaders indicated that they needed to know more about being effective technology leaders. This finding supports previous research that educational leaders require ongoing professional development in the area of technology leadership and places appropriate emphasis on educational leadership programs to better prepare twenty-first century educational leaders. As Leonard & Leonard (2006) contend, "most colleges and universities have been inclined to address and provide leadership education related to the importance of creating a school environment conducive to maximizing the use of technology in the curriculum (p. 222)." This is an area in the field of technology leadership that merits further study and research.

Nonetheless, as crucial as technology leadership has been deemed by past literature, teachers are essentially the driving force of technology integration and change overall within the classroom environment. Hence, the teacher factor within technology integration merits a closer examination.

Teachers as Change Agents

Teachers are viewed as being key to the school change process, especially regarding technology integration (Ertmer, 1999; Ertmer, et al.,1999; Ertmer et al., 2002; Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010; Liu et al., 2017; Tucker, 2019). However, learning to use new instructional technology tools and taking steps to change one's classroom practices will be a challenge for most teachers (Ertmer & Letfwich, 2010). According to Ertmer (1999), the fact remains that "technology is not readily assimilated into teachers' existing routines," which may require teachers to transition their change efforts "along various dimensions of practice (e.g., personal, organizational, pedagogical)" (p. 47). Ertmer & Letfwich (2010) examined literature covering technology integration through the lens of the teacher and discovered technology leaders need to establish a learning environment for teachers that assists them in not only understanding the use of technology to facilitate meaningful learning, but also valuing it.

In order to achieve the kinds of technology uses required for twenty-first century teaching and learning, technology leaders must establish a supportive learning environment for teachers since they are at the forefront of instruction. Further, Fullan (2001) indicates it's also important for educational leaders to recognize the implementation dip that may arise with any new initiative, especially with technology. Technology leaders who understand the implementation dip during a time of educational change know that teachers may experience two kinds of problems when they are in the dip—the social psychological fear of change, and the lack of technical skills to make the change work (Fullan, 2001). Subsequently, leaders need to take the necessary steps to be

responsive to the implementation dip that may occur with teachers during a time of educational change.

Although teachers might believe that technology helps enhance their instruction, they may be reluctant to incorporate the technology into their instruction for a variety of reasons that include lack of relevant knowledge, low self-efficacy, and existing belief systems (Ertmer, 2005; Ertmer & Letfwich, 2010; Lawless & Pellegrino, 2007). Furthermore, the context in which teachers work often constraints or limits individual efforts (Ertmer & Letfwich, 2010). Hence, when seeking ways to change teachers' technology practices, technology leaders must consider these factors, or "they are unlikely to be successful in influencing teacher change over the long term." (Ertmer & Letfwich, 2010, p. 267). Importantly, when thinking about educational technology as an innovation, Fisher (2006) cautioned leaders against viewing technology as an agent of change, rather he argued that teachers must assume this role.

Teacher comfortability and confidence with technology is a well-documented factor related to technology integration (Ertmer 1999; Ertmer et al., 1999; Ertmer, 2005; Ertmer and Ottenbreit-Leftwich 2010). As these studies have found, fundamentally, if a teacher lacks comfort and confidence with technology, they are unlikely to integrate it into their instruction. According to Ertmer (1999), early models of educational change implied that if educators had access to enough equipment and training, technology integration would follow. However, that does not appear to be the case with technology implementation and usage (Ertmer & Ottenbreit-Leftwich, 2010). Hu et al.(2003) conducted a quantitative longitudinal study over a four-week technology training program and noted that it is not the actual devices that prevent technology from being

implemented effectively, but the human aspect that stops it from happening. Similarly, Chung (2015) upholds that putting technology in classrooms may give teachers twenty-first century instructional tools, however, "the energy is only potential waiting to become kinetic upon integration" (p.43). Any technology tool is meaningless without proper integration from teachers. Hence, teachers are the bridge between technology leadership initiatives and actual implementation. Consequently, teachers must feel confident and competent in using certain technologies and skills in order to employ them effectively (Kurbanoglu, 2003)

Two main reasons teachers are hesitant to integrate technology into their instruction are due to a lack of relevant knowledge and a lack of competence with technology (Ertmer & Ottenbreit-Leftwich, 2010). As Ertmer & Ottenbreit-Leftwich (2010) suggest, both of these issues can be addressed by strengthening the technological and pedagogical knowledge of educators through a continuous, comprehensive professional development program (i.e., technology coach). Inan & Lowther (2010) used a path model to analyze responses from 1,382 teachers and explained causal relationships among internal and external factors that affected teacher's technology integration in classrooms. The results of this study demonstrated that the most important factors affecting teachers' technology integration practices seemed to be teachers' proficiency, beliefs, and readiness for technology integration. The authors highlighted that teachers' beliefs towards technology integration could be substantially influenced by their proficiency with technology, as well as the availability of external resources and school support (e.g. leadership; system infrastructure).

A current quantitative study by Liu et al. (2017) found a positive and significant relationship between a teacher's confidence and comfort using technology and classroom technology integration. This finding reinforces the importance of teacher dispositions towards technology, which includes having the confidence to use technology effectively in teaching and learning. As Liu et al. suggest, purposeful and relevant opportunities for teachers to learn and practice technology should be planned accordingly by technology leaders in order to "heighten teacher technology knowledge, proficiency, and dispositions towards technology integration (p. 807). Further, Wozney et al.'s (2006) quantitative study notes the strong influence of both confidence and perceived value on technology classroom use, which suggests that confidence by itself may not be enough. As Ertmer & Leftwich (2010) concur, teachers must also value technology as an instructional tool if they are inclined to utilize it. When new technologies are introduced, teachers often filter the new information through the lens of value or relevance that they perceive from it before they incorporate it into their existing pedagogy. In essence, the more value the teacher places on the technology approach or tool, the more likely they are to use it. The value often derives from the relevance the technology may have on teacher grade level or content area. As Ertmer & Leftwich (2010) assert, "when technology learning experiences have no specific connections to grade or content, teachers are unlikely to incorporate technology into their practices (p. 263).

Barriers

According to Ertmer (1999), teachers often grapple with "both practical and philosophical problems" presented by the technology integration process (p. 59). Accordingly, studies have organized and categorized the factors that inhibit teacher

technology usage in the classroom into main groups: first and second order barriers (Ertmer, 1999; Ertmer et al, 1999; Hew & Brush, 2007). As Ertmer (1999) interprets, first-order barriers refer to obstacles that are extrinsic to teachers and are typically described in terms of the types of resources (e.g., equipment, time, training, support) that are either missing or inadequately provided to teachers in their school environments (building or district). School or teacher culture is also tied to first-order barriers to technology integration. According to Ertmer & Ottenbreit-Leftwich (2010), adhering to and following group and social norms are important to teachers given the particularly strong cultures that exist within schools. As Ertmer & Leftwich (2010) further indicate, every school or team of teachers within a school (content or grade level based), often have a set of norms that guide their behaviors and instructional practices. Subsequently, it's not surprising that "teachers are reluctant to adopt a technology that seems incompatible with the norms of a subject culture" (Hennessey et al., 2005, p. 161). In their mixed-methods study with four Midwestern state school districts, Zhao & Frank (2003) noted that a technology innovation was less likely to be adopted if it deviated too greatly from the existing values, beliefs, and practices of the teachers and leaders in the school. As the study indicated, changes in beliefs about technology use occurred more often among teachers who were socialized by their peers to think differently about technology integration (e.g., team learning).

Moreover, barriers that interfere with or impede fundamental change are referred to as second-order barriers (Ertmer, 1999). These barriers typically derive from teachers' underlying beliefs about teaching and learning and "may not be immediately apparent to others or even to the teachers themselves" (p. 51). Importantly, these barriers are often

thought to cause more difficulty than first-order barriers due to them being more personal and more deeply ingrained and rooted, thus making them less concrete and tangible (Ertmer, 1999). To assist teachers in overcoming second order barriers (i.e. beliefs, confidence) with instructional technology, Ertmer & Leftwich (2010) offer the following recommendations for technology leaders: (a) providing time to practice with the technology; (b) begin with small successful experiences (small steps of success); (c) working with knowledgeable peers; (d) providing access to view models of practice; (e) establishing professional learning communities; and (f) providing technology coaches. Nonetheless, it is possible that some teachers will not face second-order implementation barriers (i.e., values, beliefs). Some teachers who have already redefined their traditional teaching and pedagogy may find that technology fits well into their existing classroom instruction. However, adding technology to instruction may cause logistical and technical problems (i.e., equipment, time, training, support) to emerge that weren't evident before. As Ertmer (1999) concludes, this suggests that first and second order barriers may never be eliminated completely, rather they will "continue to interrelate throughout the evolutionary technology integration process" (p. 52).

As the research has shown, it is fundamental for teachers to develop confidence and perceived value with instructional technology in order for technology integration initiatives to be attainable. As Ertmer & Leftwich (2010) maintain, although teachers may change their pedagogical beliefs to integrate technology into their instruction and gain the knowledge to utilize it, they still need the elements of confidence and perceived value to commit to implementation. Subsequently, technology leaders should place their emphasis and focus not on technology itself, but rather on the development of the teachers who are

expected to integrate it meaningfully into their instruction. Technology leaders must provide the resources and structure (e.g., technology coaches; PLC's relevant trainings; time) to promote a supportive learning environment for teachers to build and strengthen their instructional technology confidence, beliefs, capabilities, and experiences.

Technology Integration Accountability

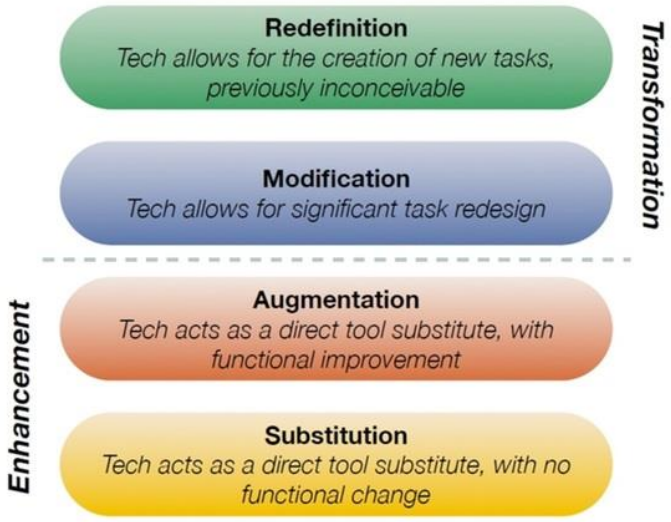
As Chang et al. (2008) asserts, evaluation and research should be integral in measuring the effectiveness of technology integration. It's important for technology leaders to implement evaluative procedures that allow for the technology growth of teachers by utilizing established technology standards, such as ISTE, to help guide their technology integration growth. Chang et al. (2008) found in their study that evaluation and research significantly contributed to effective technology leadership. Prominently, two commonly utilized and researched evaluative tools for instructional technology include the Substitution, Augmentation, Modification, Redefinition model (SAMR) or the Technological Pedagogical Content Knowledge model (TPACK). Both evaluative and reflective models are discussed and reviewed at length.

As Chang (2012) argues, technology leaders must establish procedures for measuring the technology growth of individual teachers by using a rating rubric or framework. Created by Ruben Puentedura, the SAMR (Substitution, Augmentation, Modification, Redefinition) model is a technology integration assessment tool that can provide a rating framework for technology integration (Chang, 2012). As Kirkland (2014) identifies, the key to using the SAMR model is to not think of it as an evaluation tool, but rather as a means to helping teachers progress with technology and be able redesign traditional ways of teaching using technology. SAMR is meant to facilitate the

technology proficiency and growth of both teachers and students with the hope of cultivating 21st century skills (Hilton, 2015). Attempting to integrate the technology into the mix of instruction adds an extra element of risk and uncertainty for teachers. Subsequently, SAMR is meant to provide the means for assisting in such a process (Hilton, 2015). As shown in Figure 4, the SAMR model categorizes four different degrees or levels of classroom technology integration: Substitution, Augmentation, Modification, and Redefinition, which are grouped under two different areas, Enhancement and Transformation. Figure 4 below represents the SAMR model.

Figure 4

SAMR Model



Note: Adapted from Hilton, J. T. (2015). A case study of the application of SAMR and TPACK for reflection on technology integration into two social studies classrooms. *The Social Studies, 107*(2), 68–73.

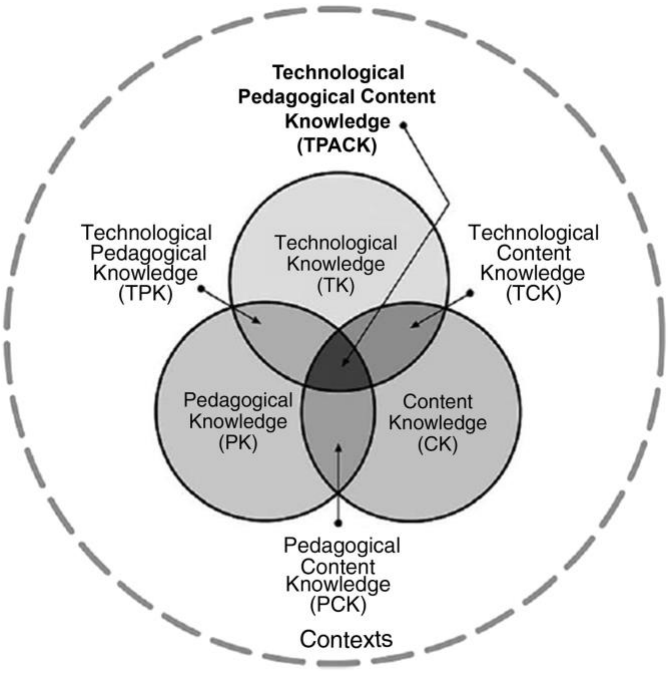
The tasks of Substitution and Augmentation are grouped as Enhancement, meaning they leverage technology to replace or improve existing tools in the lesson; while tasks of Modification and Redefinition are grouped as Transformation, meaning

they provide new opportunities for learning that are not easily possible without the technology (Kirkland, 2014). In essence, the SAMR model provides the means for examining each instructional task or lesson to determine the depth and complexity of the technology integration utilized by the teacher for a specific lesson or activity (Hilton, 2015).

As an additional technology integration tool, the Technological Pedagogical Content Knowledge (TPACK) is a consolidated framework designed to bring together elements of content, pedagogy, and technology in a manner meant to "assist teachers in delivering effective technology-infused instruction" (Hilton, 2015, p. 69). As depicted in Figure 5 below, the TPACK framework revolves around three main domains: technology knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). As Hilton (2015) elaborates, the framework creates three intersections between pedagogy and content (PCK), technology and pedagogy (TPK), and technology and content (TCK). In the center lies the intersection of all three domains, which results in technological pedagogical content knowledge (TPACK). The framework suggests that each of the three domains can function individually as well as together to sustain meaningful technology integration in the classroom (Hilton, 2015). Essentially, the TPACK model allows teachers and technology leaders to "reevaluate their uses of technology to ensure that elements of good technology use, engaging pedagogy, and meaningful content blend together into more effective instruction" (Hilton, 2015, p. 69). Figure 5 is a representation of the TPACK model.

Figure 5

TPACK Model



Note: Adapted from Hilton, J. T. (2015). A case study of the application of SAMR and TPACK for reflection on technology integration into two social studies classrooms. *The Social Studies, 107*(2), 68–73.

As Kihoza et al. (2016) determine, the impacts that the TPACK and SAMR models have on teacher practice and pedagogy are evident through teachers' abilities, competencies, and apparent change in behavior and attitude with instructional technology. With both frameworks, teachers and technology leaders can determine individual teacher technology integration levels, thus prompting shifts in the design of their instruction while utilizing technology (Kihoza et al., 2016). Importantly, the usefulness of TPACK and SAMR frameworks depend on the commitment that teachers have on themselves in enhancing and increasing the effectiveness of their teaching practices (Kihoza et al., 2016). It's apparent that the TPACK and SAMR models have

vast differences; however, they both are intended to guide the planning, implementing, and evaluation of technology integration practices (Kihoza et al., 2016). Although both models offer evaluative frameworks for teachers and technology leaders to utilize to reflect on their use of instructional technology practices, the SAMR model has been reported by teachers to be the preferred tool (Hilton, 2015). In a qualitative case study of two eighth grade social studies classrooms in an urban school district in southwestern Pennsylvania, Hilton (2015) found that both teacher participants in the study agreed that the SAMR model was the easier model to apply as opposed to the TPACK model. As the teacher participants report, they were able to learn more from thinking about their technology integration from a SAMR lens and perspective and were better able to generate ideas about ways to modify future instruction. Participants of the study also perceived the visual representation of the SAMR model to be easier to understand than the TPACK model. Although both teacher participants in Hilton's (2015) study saw merit in the TPACK model, they felt that the model was quite complex to utilize as an instructional technology progression tool.

Moreover, studies have indicated that due to the rapidly evolving nature of instructional technology, it is integral that district or building technology implementation plans are evaluated annually so the results can be incorporated into ongoing and future technology planning processes (Chang et al., 2008; Cory, 1990; Karlin et al., 2018). Part of the evaluative process should include assessing teacher instructional technology use in the district or building and evaluating new and existing technology in terms of cost, benefits, and impact (Chang et al., 2008). Such evaluations will provide technology leaders with the appropriate data to effectively assess and improve technology plans in

their schools or districts (Chang et al., 2008). Furthermore, technology evaluation also includes utilizing data as research to make data-driven decisions (Chang et al., 2008). For example, comparing school technology evaluation data with district and national data can often inform technology leaders of trends and impact of effective technology integration practices (Chang et al., 2008).

Importantly, evaluations of technology workshops by teachers have been identified as insufficient by past studies (Karlin et al., 2018; Lawless & Pellegrino, 2007). As Lawless & Pellegrino (2007) point out, self-reported data from workshop evaluations only allow researchers to discover teacher perceptions of the training, as opposed to what has been learned or "how the workshop has led to changes in teacher technology integration practices" (Karlin et al., 2018, p. 727). Karlin et al. reveal that once a technology integration initiative has been implemented, technology leaders need an assessment or evaluative tool "for identifying whether changes in teachers' technology integration practices have occurred" (p. 726). Subsequently, measures of instructional technology integration, such as the SAMR or TPACK models, should be employed by technology leaders to have a complete understanding of the impact that technology initiatives are having with teacher instruction and pedagogy.

Additionally, the ISTE technology standards can also serve as a technology accountability tool. They have been adopted by many school districts to guide technology integration initiatives (Christensen et al., 2018). Moreover, recently a new revision of the standards was created and released that focuses on K-12 technology leaders (ISTE, 2018). The new standards identify essential components of technology leadership to be utilized as guidelines and direction for educational leaders. As Gurfidan & Koc (2016)

maintain, the ISTE standards for educational leaders play a guiding role in enhancing the K-12 classroom environments according to innovations within our current digital age. Since the ISTE standards are presented more as guiding principles for technology leadership, technology leaders need technology assessment tools to not only assist teachers in measuring and evaluating their progression with instructional technology usage, but to also create and sustain a system of technology integration accountability within their building or district. According to Christensen et al. (2018), there is a call for a more practical approach to attain growth with technology integration from teachers, which requires them to reflect on their pedagogy to enable the effective use of instructional technologies in their classrooms. Moreover, in an evolving educational technology landscape, it is vital for technology leaders to view and treat continuous and sustainable technology initiatives as a process. The process includes allowing teachers to learn and grow progressively with technology, rather than expecting instant results. Accordingly, technology leaders must utilize appropriate technology assessment tools in order to provide teachers with guidance and measures of success in enhancing their instruction with technology (Christensen et al., 2018). Fortunately, the existence of the SAMR and TPACK models provide such tools.

Currently, as teachers engage with new technology initiatives that place technology platforms and applications at the forefront, it is essential that teachers and technology leaders approach technology integration in a systematic and reflective way. Subsequently, the SAMR and TPACK educational technology integration models provide the means for teachers to reflect on how to integrate technology into their classrooms effectively and progressively (Hilton, 2015). Conclusively, the ISTE technology

standards establishes a base of knowledge and understanding of technology guidelines for teachers and technology leaders, while the SAMR and TPACK models hold teachers accountable by providing an evaluative framework for technology integration practices. Ultimately, the SAMR or TPACK models not only guide technology leaders in reaching higher levels of technology integration within their building, but also encourages teachers to set instructional technology targets or goals to enhance their instruction (Chang, 2012; ISTE, 2018). As Christensen et al. (2018) assert, when teachers and technology leaders collaboratively discuss the added value of technology for teaching and learning and assess their level of technology integration, they are both practicing being "reflective practitioners and action researchers in their quest for effective technology-enhanced instruction" (p. 468).

In summary, technology leaders are responsible for "leading, navigating, and changing schools to include modern, digital content in a changing technological environment" (Christensen et al., 2018, p. 462). This involves enacting effective technology leadership practices and establishing sustainable and functional system structures within K-12 schools and districts. Additionally, since teachers are considered key agents of school, it is necessary for technology leaders to build a supportive system for teachers to be able to progress and grow with instructional technology. Moreover, as the COVID-19 pandemic prompted teachers to adopt and employ instructional technology methods and tools, accountability for its use and effectiveness is needed. Accordingly, technology leaders and teachers will benefit from adapting and utilizing models that are both evaluative and reflective. Ultimately, while a sustainable and supportive system infrastructure will be necessary to effectively adopt technology into

the school culture, strong technology leaders are necessary to promote and sustain it (Ertmer et al., 2002).

Conclusively, since instructional technology changes at such a rapid pace, research on K-12 technology integration is an ongoing process that must be reassessed and extended in the current literature base. Importantly, most of the peer-reviewed literature have been either quantitative in nature or utilized mixed methodologies. The research base has shown a great need for more qualitative studies, especially case studies, in the field of K-12 technology integration. The case study approach has been seldom utilized in past qualitative studies and may be integral in understanding and attaining a comprehensive outlook of the lived experiences of key educational stakeholders regarding technology integration best practices and sustainable systems design amid COVID-19.

CHAPTER 3

METHODOLOGY

Introduction

This chapter provides a comprehensive overview of the methodology and procedures for data collection and analysis that the researcher utilized for this study. As the previous chapter has identified, in an age of advanced technology and an unprecedented remote teaching and learning landscape in K-12 schools nationwide, it has become necessary to explore the leadership elements and systems infrastructures that produce an environment that facilitates effective technology integration in schools and classrooms. Moreover, the aforementioned merged theoretical frameworks of Hargreaves & Fullan and Peter Senge will provide a basis and foundation for the findings and conclusion sections in the subsequent chapters. As this chapter will discuss, the qualitative aim of this study is to target perspectives of current K-12 educational leaders and teachers, which will serve as vital and pertinent contextual viewpoints within an evolving research field. Subsequently, this study uses qualitative research methods to explore the impact and profound effects that leadership practices and systems design currently have on technology integration and adaptation efforts during an aberrant educational shift (i.e., remote teaching).

Research Design

The researcher utilized a comparative case study methodology for this study to demonstrate varying perspectives within a real-life, contemporary context (Creswell & Poth, 2018) - K-12 technology integration during a time of change (e.g., COVID). As Creswell & Poth further indicate, case study research is a qualitative approach that allows

the researcher to explore bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information. Moreover, the case study researcher often purposefully selects more than one case to show different perspectives on the issue. As such, the researcher conducted and compared two instrumental case studies in this study. As Stake (1995) maintains, instrumental case studies allow insight into a particular issue or phenomenon from a bounded representative sample (e.g., two school districts). Further, within instrumental case studies, the particular cases that are chosen are of less importance than selecting cases that allow the researcher to investigate an issue or phenomenon (e.g., technology integration amid COVID). Accordingly, the ramifications that COVID has had on K-12 instructional technology merits attention on this unprecedented phenomenon from varied perspectives, rather than on the selection of cases.

Case study research involves exploring a case or cases within a bounded system; bounded by setting, time, or place (Stake, 1995). The bounded system of the cases in this study consists of a contemporary context or setting (e.g., COVID pandemic) during a bounded time frame, which in these cases was portrayed during the 2020-2021 academic school year that commenced after the COVID school closures. Additionally, the cases will be bounded by demographic elements that will depict their geographic region (e.g., Long Island), which will be explained in the forthcoming settings section. By utilizing the case study approach, the researcher developed an in-depth understanding and identified the factors and dynamics involved with effective technology integration at the K-12 level. Moreover, each case (school district) within the study provided insight from various stakeholder perspectives (administrators and teachers), which facilitated

understanding of their district's technology integration system design during a time of change.

As Stake (1995) indicates, two principal uses of case studies are to obtain the descriptions and interpretations of others. Essentially, since the case will not be seen the same by each district or participant, interviews (individual and focus group) was the main road to multiple perspectives in this study. Conclusively, specific leadership practices, systems, and structures within the case studies (school districts) was be explored and discovered through detailed and in-depth data collection methods involving multiple sources (e.g., teachers and leaders) and methods (i.e., interviews, focus groups, artifact/document analysis) of information.

Research Questions

This study examined educational leader and teacher perceptions regarding practices and systems design that are regarded as means to effective technology integration in K-12 schools. This study's purpose is guided by the following research questions: 1) What leadership practices and approaches influence technology implementation and adaptation efforts at the K-12 level? 2) What elements within a system infrastructure are necessary to effectively support and sustain technology integration initiatives at the K-12 level? 3) What are teacher perceptions regarding leadership practices and systems and structures that influence their technology integration experiences?

Setting

The researcher used purposeful sampling to select two high-achieving school districts to serve as a comparative case study that examined systemic educational technology leadership practices and systems design. Specifically, two suburban school

districts in opposite countries (Nassau and Suffolk) in Long Island, New York were pursued for this study. Since educational technologies require adequate funding and resources, the researcher has chosen to seek two school districts that are bounded by the amount and quality of instructional technology resources that are available to their teachers and students, which are reflected by high-achieving school districts. Both district cases have also been identified as a district having efficient technology integration practices by Nassau BOCES, evidenced by the amount of technology resources currently in the district, including but not limited to, 1:1 devices, instructional technology licenses, department leadership personnel, and/or the amount of funds allocated for technology. For comparative purposes, both districts differ in their demographics and overall district size and technology leadership structure (e.g., administrative roles and technology positions). They will be referred to as District A and District B for anonymity. The comparison between both district cases can be further viewed in Table 1 below.

Table 1

Case Settings Overview

	Case 1: District A	Case 2: District B
Geographic Location & Type of District	Suburban – Suffolk County, Long Island	Suburban – Nassau County, Long Island
Total Number of Students	3,000+	6,800+
Student Population	86% White, 9% Latino, 3% Asian or Pacific Islander, 2% Multiracial, and 0% Black	90% White, 6% Latino, 2% Asian or Pacific Islander, 2% Multiracial, and 0% Black
Additional Student Sub-Groups	18% Students with Disabilities, 2% English Language Learners (ELL); and 14% are economically disadvantaged	12% Students with Disabilities, 0% English Language Learners (ELL); and 10% are economically disadvantaged
Number of School Buildings	5 Total - (2) K-3 elementary buildings; (1) 4-5 intermediate school; (1) 6-8 middle school; and (1) 9-12 high school	9 Total - (6) K-5 elementary buildings; (1) 6-8 middle school; (1) 9th high school; and (1) 9-12 high school
1:1 Devices	1:1 Chromebook initiative for grades 4-12 only	1:1 Chromebook initiative for all grades (K-12)
Technology Leadership Structure	Director of Technology; two K-12 Instructional Technology Coaches (one full-time; one part-time); five computer aides (one in each building), and an IT department with three technicians	Executive Director of Technology; Director of Information Management; (4) K-12 Instructional Technology Coaches; 2 computer aides in each building; and an Information Technology (IT) department with five technicians.
Teaching Delivery Model	Hybrid instruction	Hybrid instruction

Case 1: District A

As Table 1 shows, District A is a suburban K-12 public school district within Suffolk County in Long Island, New York, and is currently operating in a hybrid model of instruction (both in-person and remote instruction). The district has two K-3 elementary buildings, one 4-5 intermediate school, one 6-8 middle school, and one 9-12 high school, for a total of five school buildings. The district has approximately a little over 3,000 students. The student population consists of 86% White, 9% Latino, 3% Asian or Pacific Islander, 2 % Multiracial, and 0% Black. Additionally, about 18% of the student population are Students with Disabilities, 2% are English Language Learners (ELL), and about 14% of students are economically disadvantaged. The school district has approximately a 98% graduation rate and is categorized as a school in "Good Standing" according to the New York State Education Department (NYSED), which demonstrates success in all performance goals. Regarding devices for technology integration, the district recently transitioned to 1:1 Chromebook devices for grades 4-12. Grades 1-3 currently are not part of 1:1 Chromebook initiative but have iPad carts throughout their buildings.

The technology leadership structure of District A consists of a Director of Technology (oversees instructional technology and IT department); two K-12 Instructional Technology Coaches (one full-time and the other part-time); five computer aides (one in each building), and an IT department with three technicians. Additionally, the district technology committee created and enacted a 2018-2021 Instructional Technology Plan, which is publicly made available through its district website. Lastly, District A has a user-friendly district website that has a direct link to the instructional

technology department. Within this link, staff, students, and parents have access to vast amounts of technology resources that range from their Instructional Technology Plan and other pertinent technology policies and documents, to instructional technology tutorials and accounts management information for staff, parents, and students.

Case 2: District B

As reflected in Table 1, District B is a suburban K-12 public school district within Nassau County in Long Island, New York, and is currently operating in a hybrid model of instruction (both in-person and remote instruction). The district has six K-5 elementary schools, one 6-8 middle school, one high school for 9th graders only, and one 9-12 high school, for a total of nine school buildings. The district has approximately 6,800 students. The student population consists of 90% White, 6% Latino, 2% Asian or Pacific Islander, 2 % Multiracial, and 0% Black. Additionally, about 12% of the student population are students with disabilities, 0% are English Language Learners (ELL), and about 10% of students are economically disadvantaged. The school district has approximately a 96% graduation rate and is categorized as a school in "Good Standing" according to the New York State Education Department (NYSED). Regarding devices for technology integration, the district recently transitioned to a full 1:1 Chromebook initiative for all grades (K-12). All teachers also have 1:1 Chromebook devices.

The technology leadership structure of District B consists of an Executive Director of Technology (oversees instructional technology and IT department); one Director of Information Management (data leader), four K-12 Instructional Technology Coaches (two at the elementary level, and two at the secondary level); two computer aides in each building, and an Information Technology (IT) department with five

technicians. The IT department is further broken down into two network managers - an operations manager and a network manager. The district technology committee of District B also created and enacted a 2018-2021 Instructional Technology Plan, which is publicly made available through its district website. Lastly, District B also has a user-friendly district website that has a direct link to the instructional technology department. Within this link, staff, students, and parents have access to vast amount of technology resources that include: their Instructional Technology Plan, Smart Schools information, parent and students help desk links and video tutorials, Chromebook student agreements, web-filtering policy, Education Law Section 2-D information; staff technology resources, accounts management information (e.g., PowerSchool, Frontline), ISTE standards, and their technology mission.

In order to gain access to both sites, the researcher emailed the technology administrators from both school districts and followed up with phone calls. Both leader and teacher consent letters for this study (see Appendices B & C) and interview protocols (see Appendices D & E) was also shared with the technology administrators to make them fully aware of the study's purpose and procedures. Lastly, the researcher acknowledged that he may have some personal biases in the study due to currently being employed as a technology coach in a different school district. To mitigate potential biases, the researcher triangulated several data collection methods and used unobtrusive measures, such as reading the site's publicly accessible documents (Miles et al., 2014). As Miles et al. further suggest, the researcher also made sure the study's purpose and intentions were clear for participants and kept the interviews focused on the research questions.

Participants

The researcher pursued elementary and secondary level principals and teachers, and district-level technology directors and building-level leaders to encompass the participant pool for this study. Specifically, the researcher interviewed one focus group of teachers from each school district (2 focus groups in total) and conducted individual interviews with two building and district level administrators from each district (4 in total). The teacher focus groups consisted of three teachers from each district from various grade levels and subject areas. From the administrative perspective, individual interviews were conducted with one building-level leader (principal) and one district-level leader from each district. Creswell & Poth (2018) describe qualitative research interviews as "attempts to understand the world from the subject's point of view, to unfold the meaning of their experience, to uncover their lived world" (p. 164). Accordingly, the researcher formulated meaning from teacher and leader experiences and perspectives. Additionally, maximum variation as a sampling strategy was utilized to represent diverse teacher and leader viewpoints (Creswell & Poth, 2018).

Two educational leaders from each district were purposefully selected to attempt to represent different levels of leadership (building level and district level). Individual emails were sent to each, inviting them to participate in an individual interview. Leader participants had the option to have their scheduled interview either at their respective office or remotely (via Zoom), and at a date and time that suited them. As Creswell & Poth (2018) emphasize, regardless of the interview mode, care must be taken to "create an environment as comfortable as possible" (p. 164). The researcher selected one leader participant to reflect a building level leadership perspective (e.g., Principal), while the

other leader participant represented a district level leadership perspective (e.g., Superintendent or Director of Technology). For confidentiality purposes, leader participants were referred to using their coded pseudonyms listed in Table 2 and Table 3, separated by school district. The varying demographic differences between leader participants across both cases are listed on the tables and described below.

District A Leader Participants

Table 2

District A Leader Participant Demographics

Leader	Position	Grade Level	Years of Experience	Level of Education
District-level	Superintendent	K-12 District-wide	19	Doctorate
Building-level	Middle School Principal	6-8	18	Masters +

Assistant Superintendent. The leader has been the Superintendent for District A (grades K-12) for the past seven years and has nineteen overall leadership years of experience. He oversees not only instructional and curriculum matters with the district, but also supervises the district's Director of Technology. His district currently has a 1:1 Chromebook initiative for grades 4-12 only. Every student in grades 4-12 has 1:1 Chromebook devices, while every teacher in the district, regardless of grade level, has a Chromebook device as well. He previously held leadership positions as K-12 Science Supervisor, Assistant Principal, and Assistant Superintendent for Curriculum and Instruction in other districts. His highest level of education includes a Doctorate in Educational Administration.

Middle School Principal. The leader has been the middle school principal for District A for the past six years and has eighteen total leadership years of experience. Her middle school covers grades 6-8. All teachers and students in her school building have 1:1 Chromebook devices. She previously held an assistant principal position for the same district and school. Her highest level of education includes a Master of Arts in Liberal Studies and a certificate of advanced study in Educational Leadership.

District B Leader Participants

Table 3

District B Leader Participant Demographics

Leader	Position	Grade Level	Years of Experience	Level of Education
District-level	Executive Director for Technology	District-wide	7	Masters +
Building-level	Elementary School Principal	K-5	14	Masters

Executive Director for Technology. The leader has been the Superintendent for District B for the past four years and has seven overall years of educational leadership experience. He oversees not only instructional technology matters with the district, but also supervises the district's information technology (IT) department. His district has a full K-12 1:1chromebook initiative. Every student and teacher in every grade have 1:1 Chromebook devices. He previously held leadership positions as Principal and Assistant Principal for the same district. His highest level of education includes certificates of advanced study in school building leadership (SBL) and school district leadership (SDL).

Elementary School Principal. The leader has been the elementary school principal for District B for the eleven six years and has fourteen total years of educational

leadership experience. Her elementary school covers grades K-5. All teachers and students in her school building have 1:1 Chromebook devices. She previously held an assistant principal position for the same district and school. Her highest level of education includes certificates of advanced study in school building leadership (SBL) and school district leadership (SDL).

The researcher also purposefully selected three teachers of varying grades and subjects from each school district to participate in a focus group interview. First, permission from the Superintendent of District A and Assistant Superintendent from District B were pursued to gain access to their respective districts. Once access was granted, both district leaders shared the study's flyer with their respective teachers to assist in recruiting participants for the teacher focus group interviews. For recruiting purposes, the researcher created and electronically shared a flyer inviting teachers to participate in the study (see Appendix F). The digital flyer also contained a hyperlink for teachers to complete a survey through the Survey Monkey platform, which served as the participant questionnaire that collected their demographic data prior to the focus group. All participant demographic information collected via Survey Monkey was password protected by requiring participants to enter a password (provided by the researcher) to access the survey. Only participants who had access to the password were able to complete the survey. Additionally, participant demographic information was kept confidential by not collecting participant names or emails. The email that was sent to teachers from each district contained the digital flyer, the study's letter of consent, along with focus group interview protocols. Importantly, due the current social distancing guidelines amid COVID, the researcher conducted virtual teacher focus groups for each

school district. As Creswell & Poth (2018) contend, web-based platforms, such as virtual focus groups, provide participants with time and space flexibility that helps to create a non-threatening and comfortable environment. Thus, providing greater ease for teacher participants to engage in deeper and reflective responses.

Additionally, virtual focus groups offered an alternative for groups of teachers that may have difficulties scheduling a date and time that works best for them due to their daily work constraints. According to Creswell & Poth (2018), it is essential for the researcher to create a comfortable group setting environment to encourage all participants to talk. Accordingly, the researcher determined a specific date and time that worked best for the group of teachers from each district and set-up a Zoom meeting to meet remotely. To attempt to increase participant representativeness from teachers across grade levels, at least one teacher from the elementary, middle, and high school levels were purposefully selected. Each teacher participant varied by position, content area, grade level, and years of teaching. For confidentiality purposes, all references to teacher participants utilized the prescribed pseudonym according to Table 4 and Table 5. The varying demographic differences between teacher participants across both cases are listed on the tables and described below.

District A Teacher Participants

Table 4

District A Teacher Participant Demographics

Teacher	Position	Grade Level	Years of Experience	Level of Education
District -level	Instructional Technology Coach	K-12	15	Masters
Elementary Teacher	5th Grade Teacher	5	18	Masters
Elementary Teacher	4th Grade Special Education Teacher (ICT)	4	16	Masters

Instructional Technology Coach (K-12). The Instructional Technology Coach from District A covers grades K-12 in her district. She is the only full-time technology coach in her district. The other technology coach is only part-time. She's been working in this capacity for the past three years and has been teaching overall for fifteen years. Her highest level of education includes a Masters in Liberal Arts and Studies.

5th Grade Elementary Teacher. The 5th grade elementary school teacher from District A teaches only English Language Arts (ELA) and Social Studies to her students. She's been teaching this grade in the same school and district for the past nine years and has been teaching overall for eighteen years. All her students have 1:11 Chromebook devices. Her highest level of education includes a Master of Arts in Communication.

4th Grade Special Education Teacher. The 4th grade special education teacher from District A teaches in an ICT (Integrated Co-Teaching) setting. She's been in this position for the past five years and has been teaching overall for sixteen years. All her students currently have 1:1 Chromebook devices. Her highest level of education includes a Masters in Arts degree in Teaching Students with Disabilities.

District B Teacher Participants

Table 5

District B Teacher Participant Demographics

Teacher	Position	Grade Level	Years of Experience	Level of Education
High School Teacher	9th Grade History Teacher	9	6 months	Masters
High School Teacher	10th-11th Grade History Teacher	10-11	2	Masters
Elementary Teacher	Kindergarten Teacher	K	33	Masters +

9th Grade History Teacher. The high school history teacher from District B teaches world history to 9th graders. She's been working in this position for the past six months and is currently in her first-year teaching overall. All her students currently have 1:1 Chromebook devices. Her highest level of education includes a Masters Degree in TESOL and Social Studies Education.

10th Grade History Teacher. The high school history teacher from District B teaches 10th grade global history and 11th grade U.S. history to her students. She is in her first-year teaching in this position and has been teaching overall for two years with the same district. All her students currently have 1:1 Chromebook devices. Her highest level of education includes a Master of Science in Special Education.

Kindergarten Teacher. The elementary school teacher teaches Kindergarten and teaches all core subjects. She's been teaching this grade in the same school for the two years but has been teaching overall for thirty-three years. All her students currently have 1:1 Chromebook devices. Her highest level of education includes a Certificate of Advanced Study in School Building Leadership.

Data Collection Procedures

The researcher utilized several qualitative data collection strategies to discover leadership practices and systems that create an effective instructional technology environment from the perspectives of key stakeholders. The data for this study was collected during the Fall 2020 & Spring 2021 semesters. The research questions were answered using responses from two individual interviews with educational leaders and one focus group consisting of three teachers from each district. Open-ended, semi-structured interview questions were utilized during both individual and focus group interviews. Additionally, district documents (e.g., technology integration plans; Smart School Plan; teacher contracts) and website information were analyzed to gain further input on technology initiatives, budgetary allocations, or contractual language regarding technology integration efforts.

To prepare participants before their interview, they were allowed to preview the interview questions so they can reflect on their responses before the scheduled interview (see Appendices G and H). As Creswell & Poth (2015) maintain, allowing participants to preview interview questions provides them an opportunity for a deeper reflection on the discussed topics. After leader and teacher participants volunteered to participate in the interview, the researcher emailed each participant the following documents: letter of consent; brief questionnaire (demographic data); and a preview of the interview questions. Within the email, participants were prompted to review and sign the letter of consent and complete the questionnaire prior to the interview session. In addition, participants were reminded to preview the list of questions listed to help them reflect on their responses. Importantly, during both individual and focus group interviews, some

participant responses led themselves to specific follow-up questions, thus allowing for further exploration and insight.

Individual Interviews

The researcher purposefully selected one building-level leader and one district-level leader for individual interviews. Both levels of school leadership offered varied perspectives at the micro (Principals) and macro level (Assistant Superintendent). As Stake (1995) argues, each interviewee is expected to have unique experiences; special stories to tell. Stake further contends that a qualitative interviewer should compose a short list of questions for the purpose of attaining descriptions of an episode, a linkage, or an explanation from the interviewees. Subsequently, the researcher created an interview protocol, or guide, prior to the individual interviews (see Appendix G). The interview protocol assisted the researcher in organizing thoughts on items such as list of questions, question prompts, information about participant rights, confidentiality, and/or information on starting or ending the interview (Creswell & Poth, 2018). Specifically, the researcher utilized an interview protocol that consisted of 1) seven to eight interview questions at its core; 2) an introductory statement consisting of the purpose of the study, confidentiality, and participant rights; and 3) a concluding statement thanking participants for their time and input and offering a follow-up email for member checking (see Trustworthiness section).

Focus Groups

As Berg & Lune (2012) indicate, focus group interviewing allows the collection of a large amount of information from large groups of people in relatively short periods of time. Focus groups are also frequently used in combination with individual interviews as a kind of validity check on the findings (Berg & Lune, 2012). Teacher participants

were selected from various grade levels and school buildings to reflect a representative sample of teachers (Miles et. al., 2014). Specifically, teacher perspectives differed by grade level, content area, and years of experience. An interview protocol was also utilized during the focus group sessions (see Appendix H), which consisted of 1) seven to eight interview questions at its core; 2) an introductory statement consisting of the purpose of the study, confidentiality, and participant rights; and 3) a concluding statement thanking participants for their time and input.

Within the teacher focus group interviews, the researcher established several protocols to create an effective group interview process. Specifically, the focus group consisted of only three teachers. As Berg & Lune (2012) suggest, smaller groups of focus group participants are fairly easy to manage, while in large groups a few people talk a lot while other participants are overshadowed. Participants were encouraged to elaborate their responses and stimulate discussions from each other's responses in order to explore the topic further. Berg & Lune assert that the resulting energy from focus groups allows for a larger number of issues and topics to be generated than with individual conversations. The dynamic interactions between focus group participants can stimulate discussions, "resulting in synergy" or "collective brainstorming," during which participants react and respond to each other's comments (Berg & Lune, 2012, p. 170). The researcher also used judgement with regard to probes and follow-up questions as responses and additional topics emerged during the focus group session. Moreover, as Berg & Lune further maintained, to ensure sufficient coverage of information was offered to participants, the researcher allocated 30-60 minutes for each focus group session. Lastly, to assure all questions were answered within the allocated time frame, the

researcher made sure to keep each session moving forward by not spending too much time delving into a single question.

Document Analysis

Archived documents and district websites were analyzed to gather a holistic look at publicly accessible data regarding each district's technology integration efforts. The documents that were analyzed provide essential data that substantiated and corroborated participant responses. Specifically, three district artifacts were analyzed: 1) each district's district website; 2) each district's 2018-2021 Instructional Technology Plan; and 3) each district's current teacher contract. These documents were publicly accessible. The instructional technology plan outlines each district's technology vision and goals for a three-year span; the teacher contract was analyzed to identify specific contractual language regarding instructional technology; while each district's website was explored to investigate the availability and accessibility of instructional technology resources and important information for teachers, students, and parents. The website for District B also provided an additional document (The Smart Schools Investment Plan) that offered insight in how the district used state-funded Smart Schools grants to provide access to instructional technology and high-speed internet connectivity to their students.

In essence, analyzing pertinent district documents provided the researcher a varied method for triangulating findings. According to Stake (1995), documents quite often serve as substitutes for records of activity that the researcher could not observe directly. Subsequently, documents such as an instructional technology plan, teacher contract, Smart School Plans, or website information can be "key repositories or measures for the case" (Stake, 1995, p. 68). Importantly, to develop theme codes for the documents, the researcher also created and adhered to a document analysis protocol (see

Appendix I). Relevant documents underwent content analysis through multiple rounds of descriptive coding that involved strategies such as, but not limited to memoing, noting patterns/themes, making contrasts/comparisons, counting, and clustering technique.

Trustworthiness

The quality of qualitative findings is related to how the validity or trustworthiness of the findings are tested or assessed (Golafshani, 2003). Accordingly, the researcher assessed and checked findings using several tactics for testing or confirming findings. According to Miles et al. (2014), triangulation is supposed to support a finding by showing that at least three independent measures of it agree with a finding. Similarly, Golafshani (2003) asserts that triangulation is typically a strategy for improving the validity and reliability of research or evaluation of findings. Moreover, triangulation can be done by data source or by method (Miles et al., 2014). Accordingly, the researcher attempted to triangulate the data by utilizing not only three methods of data collection (individual interviews, focus group interviews, document analysis), but also three sources of data from divergent stakeholder voices (leader perspectives, teacher perspectives) to confirm this study's findings. Miles et al. further indicate that this will compose a more three-dimensional perspective of the phenomenon. In addition, the differing viewpoints derived from varied district levels, such as elementary and secondary schools, and from building-level (e.g., principal) and district-level (e.g., Assistant Superintendent; Technology Director). As Miles et al. (2014) assert, the main goal of triangulating data sources is to pick sources that have different perspectives and different strengths, so that they can ultimately complement each other. Documents that were accessed and analyzed to confirm interview data include teacher contracts, Smart School Plan, and each

district's 2018-2021 instructional technology plan. In essence, triangulation allowed the researcher to attain "repeated verification" and "corroboration of findings" from three different sources and methods, which "enhances the trustworthiness" of the findings and analysis (Miles et al., 2014, p. 298).

Another method for assessing and confirming the researcher's findings was to check the meaning of outliers. As Miles et al. (2014) contend, any given finding usually has exceptions, and the researcher can certainly attempt to explain any stated exception if it merits closer examination. According to Miles et al., a good look at the exception can test and strengthen the basic finding in that it not only "tests the generalizability of the finding" but may also help the researcher "build a better explanation" (299). Since outliers can consist of inconsistent or atypical cases, it's important for the researcher to verify whether what is present in them is absent or different in other examples (Miles et al. , 2014). In doing so, the researcher is staying open to the idea that the outlier identified is telling them something useful and important about their conclusion. As Golshani (2003) claims, the aim in any qualitative research is to engage in research that probes for "deeper understanding rather than examining surface features" (p. 603).

While constructing themes for this study, the researcher also weighed the evidence to further assess the findings. As Miles et al. (2014) suggest, data that is considered strong can be given more weight with the conclusion. Miles et al. further contend that data from some participants are "better" or "stronger" depending on the context of the study (p. 298). Lastly, the researcher confirmed the accuracy of interview transcripts by utilizing a member checking strategy to obtain feedback from interview participants to verify their responses. According to Miles et al. (2014), one of the most logical sources of corroboration are the people that have talked to the researcher. With

member checking, participants can act as judges, thus evaluating the findings from their responses (Miles et al., 2014). Getting participants to review transcripts of their interviews is useful to be able to determine not only if the transcripts were accurate, but to also confirm meanings from their responses. In doing so, Miles et al. assert that the researcher is then able to "connect to the participant feedback, understand it, and relate it to their perceptions" (p. 309). As such, the researcher confirmed accuracy and meaning of interview transcripts from each participant, thus affirming trustworthiness of the interview data collected.

Importantly, the researcher's position as an outsider with each school district may portray possible researcher effects on participant responses. Therefore, to avoid any biases stemming from researcher effects on the cases (Miles et. al., 2014), the researcher made sure to present the intentions of the interviews clearly to the participants, both in writing through a consent form, and verbally during interviews while using an interview protocol. Also, the researcher utilized unobtrusive measures, such as accessing and analyzing the district's publicly accessible documents (i.e., Instructional Technology Plan; teacher's contract) to further mitigate any biases from researcher effects on the case (Miles et al., 2014).

Research Ethics

The protection of the two participating districts and all participants who consented to participate in this study was of utmost importance throughout the duration of this study. Prior to data collection and analysis, all necessary levels of consent and confidentiality were communicated and assured to not only be able to access the site, but also to be able to have interactions with the participants. Once the researcher identified the participating

districts, initial consent was obtained from the leader of the district. The researcher sent emails to district leaders from both districts to request permission to utilize their district for the comparative case study. It's important for researchers to seek permission to conduct research on-site and convey to individuals in authority how and why the organization was selected, how the research will be conducted with the least disruption, and a brief written description of the intended casework should be offered (Creswell & Poth, 2018; Stake, 1995). As such, letters of consent and interview protocols were presented to the aforementioned district leaders for approval.

Upon approval, emails were sent to educational leaders (building-level and district-level) from each district requesting their participation in the study, while also requesting their permission to interview teachers in their building. Once principals granted permission, the researcher sent a mass email to teachers from each building describing the study and requesting their participation in a focus group. A recruitment flyer (see Appendix F) will also be attached to the email and will be posted throughout the school buildings. After receiving teacher interest, the researcher will purposefully select three teachers that represent various grade levels and subjects from each district to participate in the focus group. After both leaders and teachers volunteered their participation in the study, the researcher emailed each participant the following documents: the letter of consent (see Appendices B and C); a Survey Monkey link that collected demographic data (see Appendix F); and a preview of the questions that were asked (see Appendices G and H). It is important to disclose the purpose of the study to participants, which is often stated on an informed consent form with the college letterhead (Creswell & Poth, 2018). Within the email, the researcher reminded participants to review and sign the letter of consent and

complete the questionnaire prior to the interview session. In addition, participants were reminded to preview the list of questions listed to help them reflect on their responses.

According to Creswell & Poth (2018), addressing ethical issues in research involves providing measures for respecting the privacy of participants and ensuring the consent process is clearly communicated, including the right of participants to withdraw from the study. Subsequently, as part of the introductory statement from the interview protocol, participants were reminded that participation in the study is considered completely voluntary. This assures that there are no associated risks and will allow participants the option of opting out of the interview if they feel uncomfortable. Both leader and teacher letters of consent accounted for ethical considerations and concerns of the subjects. As the letters of consent reflect, all participants who willingly participated and offered information will remain confidential regardless of the activity. Further, demographic data collected from the questionnaires were kept confidential by not collecting participant names and utilizing pseudonyms to address participants in the research. After all interview data is recorded and collected, the researcher safeguarded the interview recordings on a password protected phone application called Voice Recorder. Interview transcripts will also be safeguarded on a password protected web-based platform called Dedoose. Dedoose is a data analyzing software program that allows researchers to conduct mixed methods and qualitative research analysis and can only be accessed with a username and password via the web platform, thus assuring a stronger level of security.

Data Analysis Approach

To approach the data analysis of both cases efficiently and thoroughly, the researcher examined the data first using a within-case analysis followed by a cross-case

analysis. According to Creswell & Poth (2018), when multiple cases are chosen in a study, a typical strategy is to provide first a detailed description and themes within each case (i.e., within-case analysis), and then followed by a comparison analysis of themes across the cases (i.e., cross-case analysis). In doing so, the researcher learned in-depth about the issue or phenomenon (e.g., technology integration amid COVID) and thus able to make interpretations across the cases.

During the teacher focus groups and individual leader interviews, the researcher gathered audio and video recordings, transcriptions, and field notes. The researcher composed field notes during all interviews to record notes regarding participant interaction, body language, nuances between participant responses, and cues that the participants may exhibit during conversations with them during the interviews. All interview sessions were also recorded using a password-protected phone application software called Voice Recorder. This allowed the researcher to listen closely to participant responses without any distractions and be better able to follow-up with prompting questions, if necessary. Recordings were then transcribed into a document using the Voice Typing feature within Google Docs. To check for accuracy, the researcher reviewed the recordings several times while reading the transcriptions. Upon completion of the data collection and accuracy checks, the transcribed responses were shared with the respective participants for member checking. As Miles et al. (2014) posit, one of the most logical sources of corroboration are the people the researcher has talked with. In that sense, the teacher and leader participants engaged in member checking to confirm the accuracy of their interview transcriptions. Additionally, during document

analysis, the researcher wrote jottings, or emergent reflections, on themes or relevant data that cross-reference with participant responses (Miles et al. 2014).

After member checks, all transcribed data and relevant documents were then uploaded into Dedoose to begin the first cycle coding. Coding is a form of qualitative analysis that consists of deep reflection and interpretation of the data's meanings (Miles et al., 2014). Prior to commencing the coding process, the researcher read and reviewed the participant transcripts several times to get a holistic sense of the narratives provided by all the teacher and leader participants. Creswell & Poth (2018) suggest that researchers should read transcripts in their entirety several times in order to "immerse themselves in the details, trying to get a sense of the interview as a whole before breaking it up into parts" (p. 187). A descriptive coding method was utilized by the researcher to assign labels to data pieces from the transcripts in order to summarize, in a word or short phrase, the main aspect of the data excerpts (Miles et al., 2014). A starting list of codes was initially created during the first cycle of coding, and was determined based upon research literature, interview data, and the research questions.

Next, the researcher created two descriptor sets within Dedoose - one for the participants in the individual interviews (leaders) and the other for the focus group participants (teachers). Descriptive sets are a collection of information that describes the source of data at a particular level of analysis (www.dedoose.com). Generally, descriptors are the characteristics of the participants in the research. For this comparative case study, the questions within the participant questionnaire served as the descriptor fields. For each descriptor set (leaders and teachers), the researcher created the same descriptor fields since both sets had similar questionnaire items. The descriptor fields from both sets included: ID (representing participant number - ex. Leader #1, Leader #2,

etc.); Position; Gender; Level (ex: elementary, high school, district, etc.); Years in field (total years in education); Years in position; and Higher education level. For each participant added, their respective descriptor fields were selected and identified within the Dedoose platform.

During a second cycle of coding, the researcher included in vivo coding with some data pieces in order to not only emphasize some of the phrasing, or terminology, used by the participants, but to also give participants a voice in the research. As Miles et al. (2014) explain, in vivo coding uses words or short phrases from the participants' own language in the data as codes. Some of the initial starting codes were condensed and sub-coded, into child codes, or details within the main parent codes. Lastly, the researcher utilized memo techniques throughout the coding process. Memos are short phrases, ideas, or key concepts that may occur as the researcher is reviewing the data (Creswell & Poth, 2018). The researcher used the memo section within the Dedoose database during the cycles of coding to make note of emerging ideas or thoughts regarding the data. Jottings from document analysis were also be added as memos to cross-reference codes. As Miles et al (2014). assert, memos can strengthen coding by identifying a deeper or underlying issue that deserves analytic attention. The researcher referred back to the memo notes during the process of creating themes for the data.

After both cycles of coding, the researcher will reread and review the final list of codes and memo notes in order to discover patterns with the data, with the intention of generating themes that will emerge from the data. In order to effectively identify and develop themes from the data, the methods of counting and clustering will be utilized. As Creswell & Poth (2018) inform, the counting method provides an indicator of frequency among data pieces. In essence, counting refers to how often particular codes appear

within the data set in order to place significant meaning to them, which leads to emerging themes. As Miles et al. (2014) further assert, when something is considered important, significant, or recurrent, researchers have come to that conclusion, in part, by making counts, comparisons, or weights of the particular data pieces. As such, the number of times a specific code appears in the transcripts will signify its relevance in the data, thus signaling the need to establish a theme for it.

Additionally, the clustering technique will also be used to categorize and organize the transcribed data by condescending or reducing them into chunks or groups that have commonalities (Miles et al. , 2014). As Miles et al. maintain, in all clustering instances, the researcher is attempting to understand a phenomenon better by grouping or conceptualizing data pieces that have similar patterns of characteristics. The chunking, or clustering, of the data allowed the researcher to collectively group specific data points according to their commonalities or significance, which ultimately condensed the various codes and created themes. Ultimately, the researcher implemented an elaborate process of data analysis within this study to not only effectively extract and organize the qualitative data, but to also attempt to extrapolate meaning and relevance to the data provided by the participants.

Researcher Role

As a researcher, it is imperative to reflect on our role and how our perspective, beliefs, and experiences will serve as factors in the study. As Banks (1998) describes, how individuals or researchers interpret their experiences is mediated by the interaction of a "complex set of status variables, such as gender, social class, age, political affiliation, and religion" (p. 5). Accordingly, certain personal variables such as ethnicity,

childhood and educational experiences, and even the researcher's current role as an educator all present underlying values and influential factors that may frame the values as a researcher. As Banks (1998) asserts, as researchers, we need to better understand and make implicit our biographical journeys and values so that we can more closely approach the aim of objectivity in our research.

The researcher's hardships as an inner-city, Latino immigrant student from Ecuador growing up in Jamaica, Queens provided him with the raw reality that educational resources are limited based on demographics. Furthermore, as the researcher's teaching career transitioned from working with urban schools, students, and parents during his first nine years in the profession to his current role as an Instructional Technology Coach in a suburban district, this journey has carried him through many school settings that presented him with opportunities to work with school systems of varying demographics. Subsequently, the researcher's current technology role has provided him with valuable experiences and viewpoints of the current educational technology realm and its forthcoming initiatives for students, teachers, and leaders, especially during the current remote teaching landscape due to COVID. Conclusively, the researcher's past and present experiences in education both as a student and teacher have molded a holistic perspective of the impact of instructional technology resources within the fabric of K-12 schooling.

As a researcher interacts with participants in a study, it has become important to become aware of how knowledge is constructed as it is being collected. As Banks (1998) articulates,

> Individuals are socialized within ethnic, racial, and cultural communities in which they internalize localized values, perspectives, ways of knowing, behaviors,

> beliefs, and knowledge that can differ in significant ways from those of individuals socialized within other microcultures (p. 7).

Consequently, Banks (1998) created A Typology of Cross-Cultural Researchers for researchers to identify their researcher status as they embark on exploring a community of participants. The typology has four types of researchers: the indigenous-insider, the indigenous-outsider, the external-insider, and the external-outsider. Using Banks typology, the researcher has identified himself as an external-outsider researcher within this study. According to Banks, an external-outsider has partial understanding of the values, perspectives, and knowledge of the community he or she is studying. Since the researcher is not employed by the participating districts in the study, he lacks understanding and internalization of the school's district's values, beliefs, and behaviors within the realm of instructional technology. Hence, as an external-outsider, the researcher believes that he is the most legitimate researcher to study the participating districts due to him having a more objective and outside view of the district communities than researchers who live or work within them (Banks, 1998).

In order to mitigate and account for the researcher's identified status variables, the researcher utilized a couple of strategies that will establish credibility and trustworthiness with participant responses. The researcher implemented member checking of transcribed responses after culminating both the focus group and individual interview sessions. Since credibility involves showing that the findings are accurate, with member checking, the researcher shared with the research participants a summary of the transcribed responses for their review and confirmation. Additionally, the researcher also utilized triangulation of data to support participant responses, which included finding other sources of data to support the data interpretations (i.e., documents, artifacts).

Conclusively, the methodology of this study places relevance on the voices and perspectives of key stakeholders within the scope of K-12 technology efforts. Further, a qualitative methodology not only provides the platform for interpreting contextual factors that impact technology integration efforts but will also allow other educators to comprehend and grasp the dynamics and change efforts that COVID has brought upon K-12 educators. Ultimately, the data collection and analysis examined in this chapter provides the basis for the findings and conclusions of this study.

CHAPTER 4

Introduction

This comparative case study explored teacher and leader perspectives to understand the impact that leadership practices and structural systems have with technology integration within the fabric of K-12 schooling during a time of change. The researcher took a qualitative approach to conduct a total of four individual interviews with K-12 leaders, two focus group interviews with K-12 teachers, and analyzed various public documents to gather data. The prevalent story that emerged from the data revolved around organizational framework. Every element or aspect of effective technology integration identified by the participants across both districts revolved around the structure and support the district had set up for teachers, currently and beforehand, to be able to experience success with technology integration in the classroom. Accordingly, three pertinent overarching themes emerged from the study: a) Influential Leadership; b) Dynamics of a System; and c) Communication. Throughout the findings, teacher and leader voices were utilized to convey their experiences, beliefs, and reflections, while also correlating district artifacts (e.g., website; Instructional Technology Plan) to participant responses.

Theme 1: Influential Leadership

As an overarching theme, influential leadership was organized into subthemes to further categorize perceived effective leadership components. Accordingly, the sub themes that encompass influential technology leadership elements include a) interpersonal qualities, and b) practices.

Interpersonal Qualities

Across both districts most teachers and leaders indicated that specific interpersonal attributes from technology leaders play an integral role in framing how teachers respond to technology. Patience, humility, and approachable were among the essential attributes shared by teacher and leader participants from both districts. However, there was some variance between what each district identified as essential technology leader attributes. Specifically, approachability was shared by only teachers and leaders from District A.

Patience

Two teachers from District B, one teacher and one leader from District A had similar sentiments regarding the importance of patience. As the Kindergarten Teacher from District B indicates, "for a technology leader, I think patience is a huge thing." Similarly, the Middle School Principal from District A elaborated on the reason patience is essential,

> We have such a wide range of expertise and experience with technology in every single building, so I think just patience in trying to find and offer the exact levels of support that teachers need. And just knowing that everybody's support and experience is different.

The Kindergarten Teacher from District B further adds that a technology leader must "understand their audience and know their level of comfort with technology." The 9th Grade History Teacher concurred with the Kindergarten Teacher as she offered, "A tech coach or someone in technology leadership should be realistic that not every teacher is as experienced with technology as the next." Interestingly, the 4th Grade Special Education Teacher from District A refers to the patience needed from technology leaders as being "similar to a teacher recognizing that certain students in their class may need a little more

support than others; learning technology can be viewed the same with teachers." This statement by the 4th grade teacher affirms that similar to students, differentiation is needed when assisting teachers with technology integration.

Humility

Humility to accept and seek to learn from others during a time of change was also recognized as an important interpersonal skill for technology leaders according to some leader participants across both cases. As the Elementary School Principal from District B shares,

> I never say that I know it all. Whenever I'm using technology, if a teacher can show me a different way, I welcome it. You have to be flexible and know there's always more than one way to present things. I like to learn from them. I like to remind them to show me, or if I'm not doing it right tell me.

The Superintendent from District A agrees that technology leaders "need to just accept help from others." Continuing, the Technology Coach from District A argued that "there's not enough administrators like that at all - that can be humble and kind of put themselves out there. But it's important." An anecdote from the 4th Grade Special Education Teacher from District A describes how the Superintendent communicated his frustrations with a technology platform while learning alongside the teachers,

> During our pandemic closure, the Superintendent would do a little Friday talk about the week and it would be him on Zoom trying to figure things out. He wasn't afraid to model. And it was interesting to watch him evolve with the technology- figuring out breakout rooms and he'll say, 'we failed today, we will try again tomorrow' So, to see someone in that role kind of embrace failure and move on from it, I think is huge.

This anecdote from the 4th Grade Teacher presents an example of humility displayed by her district leader.

Approachable

Notably, only District A teachers identified approachability as an essential attribute for technology leaders. The 5th Grade Elementary Teacher and 4th Grade Special Education Teacher from District A both agreed that technology leaders "need to be approachable and be a people person before anything else." According to the 5th Grade Teacher,

> It's a matter of establishing a comfort level for teachers to know they can approach a technology leader with questions or concerns regarding instructional technology. Teachers want to feel at ease in knowing the technology leader is an approachable person.

As the 5th Grade Teacher District A argues, "being honest, accessible, and approachable are huge things as a technology leader. If they are not approachable, teachers are not going to feel comfortable sharing their thoughts or opinions." As a strategy to build trust and relationships with teachers, the Executive Director for Technology from District B indicated,

> It's really important during any big shifts to be able to check-in with teachers. It allows you to listen to them and remind them that you support them. If you don't check -in, teachers may become frustrated with technology, and may be deterred from using it.

This statement by the district leader demonstrates his efforts to build trust with his teachers by checking-in and listening to them during change initiatives. By doing so, the leader is demonstrating his approachable side as a leader, which helps with building trust with teachers.

In all, while all teachers from both district cases agreed that technology leaders must be patient and humble, only teachers from District A referenced the approachable attribute. Interestingly, as the findings reveal, all leader participants across both districts alluded to the three aforementioned interpersonal skills, but implied them using different

wording, while all teacher participants across both districts were direct and specific with the interpersonal attributes.

Practices

Alongside leader qualities, specific practices were also recognized to be essential for the success of technology leadership. The sub themes that emerged as integral technology leadership practices are a) listening to understand; b) allocating time; c) continuous learning mindset; and d) modeling makes a difference.

Listening to Understand

A common practice identified by all leader participants from both districts was to listen to understand. Technology leaders must listen to others' perspectives and experiences not just for the sake of listening, but to listen to "try to home in on what the challenges and successes are. As the Elementary School Principal from District 2 maintained, "you have to be a keen listener to really understand how technology is working or not working for students, parents, and teachers. I think that is so critical. Especially in our current environment." The Middle School Principal from District A argued that leaders must also recognize that there may be "other external stressors in teachers' lives and homes" that may affect their technology utilization. As the principal noted, it is the responsibility of technology leaders to "listen to understand teachers." Continuing, the Executive Director for Technology from District B asserted that leaders are "able to make giant shifts simply by listening to other perspectives." As the Executive Director for Technology elaborated, "I think it's really about listening to the teachers; having discussions with curriculum leadership; understanding how students are learning; and then taking a look at all of them together to make recommendations for different

platforms." The Superintendent from District A polls his teachers to listen to their perspectives. As he explained,

> What we try to do for conference days in August and November is poll our staff - What do you want to learn more about? We really try to listen to what the teachers are telling us with what they still need practice with, and we try to provide those trainings to best support them.

Notably, all references to listening as an essential technology leadership practice derived from leader voices. None of the teacher participants mentioned or discussed listening as an essential practice.

Allocating Time

Allocating and allowing time for teachers to grow and enhance their proficiency with instructional technology was another practice that was perceived as effective by most teachers from both districts. Interestingly, although teacher participants from both districts shared that having time to learn and practice with instructional technology platforms is crucial, it seemed that only District A teachers were actually being provided time by their administration. Unfortunately, District B teachers alluded to wanting more time to learn and practice with instructional technology platforms. During the focus group interview, when asked to identify things or situations that prevent them from integrating technology in the classroom or remotely, the 10th Grade History Teacher from District B maintained,

> We know there's stuff out there with technology to get students involved, but then it goes back to time. I think a lot of things come down to time to learn and practice the technology, while also having time to collaborate with colleagues.

Similarly, during the District B focus group, the Kindergarten Teacher agreed and added,

> Whenever we get these PD's, having that time later on to digest everything that was said and be able to collaborate with peers and put it into practice with a small group is a great practice to do. Considering our busy teacher schedule, it's a great thing to be afforded the time to collaborate. But I think we need more of that.

Conversely, recently District A allowed their staff to self-navigate their conference days to cater to their technology needs. As the 5th Grade Elementary Teacher affirms,

> It is set up as, 'come and learn how you want to.' The conference days we've had this year were organized in a way that gave teachers time and a choice to go to whatever technology workshop they wanted to go to.

Continuing, the 4th Grade Special Education Teacher from District A further commented that it was the first time during their conference days that administration allowed them time to "navigate and explore the conference day virtually" on their own. As the teacher continued, "teachers were really grateful and productive." In the same sense, the Middle School Principal from District A confirmed that all of their conference days were focused on what the teachers needed. As she explained the process,

> We look at feedback from our staff and look for topics that interest them. Then we provide "on your own time" to explore things during the conference days. This provides them with the gift of time which I think is what teachers want, so they can shift over their resources to the digital world.

In addition to time, across both cases, relevance and applicability of instructional technology tools were noted as an essential factor by two teachers from District B and a leader from District A. Both the 9th Grade and 10th Grade History teachers from District B agreed that they would rather learn things that are "applicable and relevant to them." As the 9th Grade History teacher explained,

> I know if I saw something at an elementary level with technology, I'd be less likely to try that out. So, I feel that taking the time to integrate some content specific stuff and how we can use this technology to enhance the content is a great practice for technology leaders.

In the same sense, the Middle School Principal from District 1 offered a similar point regarding finding ways to get teachers engaged with instructional technology:

> If teachers find that things can get easier as a result of using technology, I think that's helpful to someone who feels very overwhelmed by technology. So, if you

> can find little, tiny nuggets of ways that will make life easier for them with technology, it will boost their confidence and play a large role.

Continuous Learning Mindset

Considering the shifting landscape within our current K-12 educational landscape, it has become apparent that educational leaders must also shift their mindsets to continuously learn to stay current with instructional technology. However, variation existed across both district cases regarding technology leaders having a continuous learning mindset. All leader participants from District A suggested for technology leaders to remain current in the field and practice having a continuous learning mindset, while surprisingly none of the District B leader participants recognized the need for such practice by technology leaders.

The Superintendent of District A alluded to the notion that technology leaders "have to be on their game and stay current on what's possible and current on tools that teachers and students need to engage in this new world." Similarly, the Middle School Principal from District A maintained, "technology leaders must be innovative; they have to reimagine what we're doing." The Superintendent from District A shared a book resource that has allowed him to stay current within the educational technology landscape. As the district leader indicated,

> There's very little research on the effectiveness of distance learning. However, an important resource that we've relied recently on as a district has been Fisher, Frey, & Hattie's book, "The Distance Learning Playbook." We've utilized and implemented some of the strategies in their playbook with students this year.

Moreover, the Middle School Principal from District A offered ways that she practices a continuous learning mindset and remains current,

> I think it's important to read publications that are out (ex. Ed Leadership) and follow different people from afar and local colleagues on Twitter. That really

> helps me stay current with technology. A lot of dialogue from these networks is always about looking to move our schools ahead and that continual improvement.

Similarly, the Superintendent from District A contends that another way to stay current is for leaders to remain "connected with local technology groups or associations (ex. LITES and NASTECH)." As he asserts, "local instructional technology groups will keep you current and informed on what's new and innovative with educational technology."

Reflecting on the continuous learning responsibilities of a technology leader, the Superintendent from District A acknowledged that leadership preparation programs lack technology leadership content that leaders need more than ever today. As the district leader stated, "It's also interesting that there's really not a lot of coursework that prepares you for flipping to a technology intensive model like we have today." This statement from the Superintendent implies the lack of knowledge that leaders today have not been exposed to within their leadership preparation programs, which supports the notion that leaders need to remain as continuous learners within the field of educational leadership.

Modeling Makes the Difference

Across both district cases, modeling by leaders and peers was determined to be an effective technology leadership practice. All leader participants from both districts viewed modeling as a practice that makes a difference in persuading teachers to integrate technology in tehri instruction. Moreover, two teachers from District A and one teacher from District B made references to the significance of modeling that coincided with what leader participants mentioned.

The Superintendent from District A acknowledged that "leaders need to be willing to tinker with some of these tools as well in order to be effective technology leaders." The Elementary School Principal from District B noted that it's important for

her to model what she knows her teachers are going to use. As she explained, “the more I use it and implement it with them, the more they can see it in action.” Similarly, the Middle School Principal from District A felt that it’s “important for leaders to model the way we use technology ourselves”. As she described her modeling behavior, “we need to embed that instructional technology expectation with everything that we do; always looking for the next exciting thing for them.” Continuing, the middle school principal added that sometimes, she likes to pilot the technology herself to inspire her staff.

Lastly, teachers should also be utilized and leveraged to serve as models of practice, thus further helping to facilitate and market technology integration. Leveraging peer modeling and showcasing other teachers’ successes with instructional technology was perceived as an effective technology leadership practice by most teacher and leader participants from both districts. The 5th Grade Elementary Teacher from District A argued that technology leaders need to have a “willingness to highlight teachers who really are doing great things or bring some sort of spotlight on things.” The 4th Grade Elementary Teacher from the same district indicated that whenever the Director of Technology would “observe something in a classroom that he really liked with technology, he would have those teachers teach or showcase the technology to others.” As she further expressed, “to give those teachers that encouragement and to make them want to lead is really a great thing.” Moreover, the 10th Grade History Teacher from District B acknowledged that some teachers prefer to learn from other teachers. As she expressed,

> There is just something different about learning and hearing something from your peers rather than from a workshop. From peers, we get the understanding of it from a teacher's perspective, and not from someone who maybe does not even teach.

Encouraging small successes was also emphasized by the Middle School Principal from District B as she explains,

> I think lack of confidence really inhibits what some of our teachers are capable of. I tell them all the time, 'If I would have told you this time last year, you'd be live streaming your teaching to 15 kids at home with their pajamas, while also having 15 kids in front of you, while also testing, assessing, and having dialogue with your students in this way, you would have told me I'm crazy! Look at the mountain you've already moved.' So, I think celebrating those successes with teachers helps a lot.

Overall, listening to understand others' perspectives and experiences; having a continuous learning mindset; modeling expectations with instructional technology; and allocating time for teachers to learn relevant and applicable instructional technology were all perceived as effective technology leadership practices from both teacher and leader participants from both districts.

The theme of influential leadership was evident across both participating districts. Regarding leadership qualities, for the exception of the characteristic of being approachable, most leader participants identified leadership qualities that coincided with what the teacher participants shared. With leadership practices, a common practice identified by all leader participants from both districts was to listen to understand. Allocating time for teacher learning was prevalent with most responses from teacher participants from both districts, however, there was variance in whether the teachers actually had time to learn and practice with instructional technology. District A teachers seemed to appreciate their allocated time for technology learning, while District B teachers desired more time to learn. Moreover, variation with leader responses existed across both cases regarding technology leaders having a continuous learning mindset. Lastly, across both district cases, modeling by leaders and peers was a prevailing technology leadership practice determined by all leader participants and some teacher

participants. Moving from leadership attributes and practices, the dynamics involved within an instructional technology system will be discussed next.

Theme 2: Dynamics of a System

The second overarching theme that emerged during the data analysis was understanding the organizational dynamics of a sustainable technology integration system. For organizational purposes, this section is branched into four subsections that reflect integral elements of a technology system infrastructure: a) Foundational Needs; b) Enhancement Opportunities & Collaboration; c) Integral Positions & Leadership Structure; d) Available Support; and e) Accountability.

Foundational Needs

Aside from leadership practices and characteristics, a functional system for instructional technology has to be set in place in order to offer its full capabilities to educators. Without this foundation, all technology platforms, devices, and supports will be futile. Part of this foundational aspect of a school district's technology infrastructure includes its bandwidth and Wi-Fi capabilities. Across both cases, all leaders form District A and one leader from District B made references to the foundational aspects of the district's bandwidth and Wi-Fi capabilities. Additionally, one teacher from each district made reference to the district's bandwidth or Wi-Fi foundational needs. Overall, there was no variance in what the leader and teacher responses alluded to. Both leader and teacher responses emphasized the essential aspect of a district's technology infrastructure foundational needs.

The Executive Director of Technology from District B suggested the need for certain system capabilities to be established, such as internet bandwidth and Wi-Fi, before any technology initiatives are put forth. As he maintained, any district or school

"needs a solid foundation to support technology integration." They need to have their system "infrastructure set first to make sure they have the ability to support something that's remote." As he further indicated,

> There are a lot of different pieces that really need to be in place and come together for our technology system to work effectively - the devices; the bandwidth and wi-fi capabilities; an efficient learning management system; a portal that students can access all their information (log-in info); the support personnel (tech coaches; IT dept.). Once all those things come together we are able to build a foundation and systems that are required for effective technology integration in the district.

Moreover, the Executive Director of Technology from District B stated that every year they spend a lot of time working on their system infrastructure. As he explained, "we're always expanding our network; we're always looking at best practices and hardware. Continuing, the district leader offered, "we spend a lot of time just looking at the fundamentals of what exactly we need as a foundation and then expanding them." The Executive Director of Technology's actions coincided with what the district outlined in its 2018-2021 Instructional Technology Plan document. One of the technology objectives of the district is to "enhance and expand existing infrastructure with secure, reliable and high-speed school connectivity, including a robust wireless network for all users." All leader participants and one teacher from District B shared similar sentiments regarding leadership making decisions to be proactive and precautionary. The Executive Director of Technology acknowledged that when they decided to increase their bandwidth, "it wasn't out of need rather it was more out of raising our ceiling up." Initially, District B had the bandwidth in place (1 gig at each building), which provided enough for Google Meet video conferencing, however, they "decided to increase it to 2 gigs at each building, just to be extra safe." The Elementary School Principal from District B affirmed the proactiveness of her district as she indicated that "the district is always continually

checking and maintaining the Wi-Fi or raises it a little bit more to be sure." The Kindergarten teacher from District B was in agreement with how the increased bandwidth and Wi-Fi capabilities have made a difference. As the teacher explained,

> They have increased the bandwidth; they have increased the ability for internet access, and it has been a lot less trouble. If we are all a sudden remote again, our students have the ability to log in and be part of that classroom virtually without big issues.

Additionally, the Elementary School Principal from the same district agreed with the proactive efforts of the district as she stated,

> We've been building up to this and had most things in place. All of these system factors have been part of our district technology for the past couple of years. So, when March hit (pandemic), we were able to roll everything out knowing that we have the support set in place.

Similarly, one of the first things that the Superintendent from District A focused on with his district was increasing their bandwidth. The Superintendent offered a metaphor to explain the importance of increasing bandwidth capabilities in a school or district:

> I always explain it in terms of water flow - sometimes you have to increase the size of the pipe because you can only push so much water through a small pipe. So, we brought in the 'big pipes' so that come September we could support from a bandwidth state of mind, meaning every student in the district can be logged on at the same time without crashing the system.

The 2018-2021 Instructional Technology Plan of District A also established a goal that took into account their foundational system needs. According to the document, the district is tasked with creating a "strong and secure network that will allow all students, staff and visitors to access connectivity." As the document states, "this will include wireless access and upgrades to the district's infrastructure to allow for further integration of technology integration into our instructional practices." Similar to District A, District B made precautionary decisions regarding their bandwidth. As noted in their 2018-2021

Instructional Technology Plan, they made sure that they not only met, but also exceeded the Federal Communications Commission's (FCC) standards:

> We will demonstrate that sufficient infrastructure meets the Federal Communications Commission's 100 Mbps per 1,000 students standard. Our plan calls for 350 Mbps so that we can exceed the Federal Communications Commission minimum speed standard of 100 Mbps per 1,000 students.

Due to the current remote landscape, Wi-Fi had to be accessible for everyone, in school or at home. As the 2018-21 Instructional Technology Plan of District A suggests, the district must "continue to consult with local area technology companies to ensure that wired and wireless systems are robust and capable of sustaining adequate bandwidth in each school." In the same sense, the Executive Director of Technology from District B pursued local partnerships to get "hot spots from BOCES, Verizon, and T-Mobile for students and parents, while also creating a process to request the hot spots if they didn't have internet access."

Securing devices for staff and students was another system dynamic that leader participants from both districts discussed. According to the Superintendent from District A, it was imperative "to make sure the teachers had devices in their hands first." As he asserted, "teachers need to be comfortable with the devices before we expect them to use it in the classroom." Further, the Executive Director of Technology indicated that on top of assuring devices, "there are the systems that need to be in place to provide a level of support for the devices." As he explained, "everything that is established needs a level of support." For example, how are Chromebooks supported at home? How is the repair process? As was explained by the Executive Director, "a leader really has to go deeper and think about how they're going to support any technology initiative." Thus, structuring a system of support for devices and remote capabilities was perceived as

essential. According to the Elementary School Principal from District B, they have a system set up through their website where "tickets are placed to get support from the IT department, who are always overseeing the tickets." This allows for a systematic process for software applications to be approved by the systems management team (IT) in order to assess its security and functionality measures. The 4th Grade Special Education Teacher from District A made a convincing point that sums up the importance of establishing a systems infrastructure for effective technology integration, "in order to use technology year to year, the district needs to allow and provide for that. They need to establish a system set up to support technology initiatives. One can't work without the other." Ultimately, across both cases, the aforementioned structural system aspects were perceived as foundational pieces to an effective technology integration plan or initiative.

Enhancement Opportunities & Collaboration

Across both cases, the majority of leader and teacher participants reported that technology leadership must continuously structure enhancement opportunities for teachers by establishing an environment for support and growth. Accordingly, the Instructional Technology Plan from each district identified objectives for growth and learning opportunities with technology for teachers. Across both district cases, each district had similar objectives for enhancement opportunities with technology for teachers. As District B's 2018-2021 Instructional Technology Plan highlights, the district aims to "design and implement ongoing and relevant professional learning opportunities to explore, apply, and reflect on best practices utilizing instructional technology." Similarly, the 2018-2021 Instructional Technology Plan of District A tasks the district to "develop and foster professional learning communities in all schools that support the integration of technology. Teachers will learn and share best practices in the use of

technology and digital resources in the classroom." Interestingly, the Middle School Principal from District A also indicated that, through the observation process, she likes to get insight into what aspects of technology teachers need more support with. As she shared,

> I think mostly teacher feedback regarding technology is rooted in our observation process. Asking my teachers what they need, what apps, or what technologies they are interested in learning and then trying to support those specific interests.

This coincides with District B's efforts to gain feedback from teachers in order to guide technology workshop and support availability.

As District B's 2018-2021 Instructional Technology Plan further states, technology leaders must "provide structured time for faculty and staff to work collaboratively on tasks and increase their social capital." Similarly, the Smart Schools Investment Plan from District B reveals that "the district has a plan to provide professional development to ensure that administrators, teachers and staff can employ the technology purchased to enhance instruction successfully." The Instructional Technology Coach from District A presented an example of how an elementary school principal from her district provides coverage for teachers while they attend technology workshops or collaborate with peers:

> One of our elementary school principals sets up a 1.5-hour workshop where the teachers actually use the technology together collaboratively to create things that are usable in the classroom. He gets a sub into the building and the sub rotates through the classrooms during the day of the workshop to provide coverage for those teachers.

This alludes to the notion that building leaders are responsible for structuring learning and collaborative opportunities for teachers regarding technology integration. As the Instructional Technology Coach from District A asserts, "it's through the support of the administration in offering good PD (professional development) and time to use the PD to

the teachers that works well." Collaboration and time with peers were perceived as key factors. The Elementary School Principal from District B noted the benefits of peer collaboration as she shared,

> The best is when teacher colleagues are sharing with each other and tapping into each other. They learn more from each other's experiences. That's really what's been helping us and getting us through all of this.

Most teacher responses from District B also recognized their district efforts in offering growth opportunities with technology for teachers. The 9th Grade History Teacher acknowledged that she often receives a lot of emails "from administration letting us know that we can attend virtual workshops for certain platforms." Continuing, the Kindergarten Teacher maintained that "information and opportunities for growth and learning are there and available to us. It's always offered to us. It's just up to us to put it in place." As the teacher excerpts from District B portray, their district has been very supportive with their technology growth and adequately provides and communicates resources and learning opportunities to their teachers. When asked how they would deal with resistance from teachers regarding integrating technology into their instruction, the Elementary School Principal from District B made a compelling point:

> Right now, it's really difficult for them to resist. It was tough when we shut down in March. Some teachers were just fearful of the change. So, it wasn't like they were resisting, it was more of being fearful of how to do certain things. So again, it's not about resisting because we have set up a system of support that makes it hard for teachers to resist help. Everybody just knows this is where we are at, this is what we need to do. So, it's more fear of the unknown, as opposed to really the resistance of doing it.

As the Elementary School Principal portrayed, the system of support established by District B acts as a buffer to avoid resistance from teachers. In the same sense, the Middle School Principal discussed how she addressed technology resistance from teachers:

> You have to recognize that sometimes teacher resistance with technology stems from a lack of confidence and a lack of experience. You have to look for nuggets of ways that the technology will help them be more efficient. From the efficiency standpoint, I think once you make that point clear, that's usually a little bit more helpful. If they find that things are getting easier as a result of using technology, that's really helpful to someone who feels very overwhelmed by it.

Lastly, the Executive Director for Technology from District B emphasized the importance of providing follow-up opportunities with teachers after introducing an instructional technology platform. As the District B leader asserted,

> You have to go beyond just the training piece. After you introduce a technology platform, it's crucial to have that consistent support and follow-up take place. You don't want technology workshops to just be like a one-and-done opportunity. It's about constant coaching, constant support, and following up with teachers.

As was expressed from participant responses, teacher growth and learning opportunities are best structured when it's collaborative in nature and part of a continuous system of support. Providing settings and opportunities for teachers to learn and grow with technology was perceived as a system structure that must be established by school leaders. Teachers need support when it comes to instructional technology. Accordingly, the next section will present the findings regarding the importance of specific technology positions, roles, and departments within a K-12 district or school system that provide that support.

Integral Positions & Leadership Structure

As leader and teacher participants will portray in the following findings, there are specific positions and departments regarded as integral to an instructional technology system design. In addition, the structure of technology leadership for each district case was analyzed to identify any vast difference between the leadership structure of each district. Accordingly, this section will encompass the following subthemes: a) leadership structure and b) integral positions.

Leadership Structure

The researcher examined the websites of each district to analyze the technology leadership structure from each school district. Across both cases, their respective website had direct links to their technology, or instructional technology, department, which identify their leadership structure. As shown in Table 6 below, variance was found in the breakup of positions and responsibilities.

Table 6

Technology Leadership Structure Across District Cases

	Case 1: District A	Case 2: District B
Technology Leadership Structure	Director of Technology; two K-12 Instructional Technology Coaches (one full-time; one part-time); five computer aides (one in each building), and an IT department with three technicians	Executive Director of Technology; Director of Information Management; (4) K-12 Instructional Technology Coaches; 2 computer aides in each building; and an Information Technology (IT) department with five technicians.

District A had a sole technology leadership position titled as Director of Technology and Data Systems. Conversely, District B had two overarching technology leadership positions - one is the Executive Director of Technology and the other is the Director of Information Management. As District B portrays, technology responsibilities are split into two domains - the instructional aspect of technology and the other is the data protection and management aspect of technology. In the case of District A, the Director of Technology and Data Systems role has the responsibilities of balancing instructional technology duties with that of a data leader. As the Instructional Technology Coach from District A conveys regarding the combined position of Director of Technology and Data

Systems, “it is a tremendous role! I’m not a data person, but the amount of work that needs to go into that position, you really do need to have technology run like a well-oiled machine.” Importantly, the Instructional Technology Coach further discussed how the current director of technology position in her district originated:

> Years ago, instead of hiring another person for that previous technology coordinator position, the district decided to combine positions - the data coordinator and the technology coordinator - and named it Director of Technology and Data Systems. And they kept me as the instructional technology support person to help on the instructional technology side.

Similarly, the Superintendent of District A made the same reference regarding the origination of the director of technology position six years ago:

> The technology director at the time, although her title was a little different, retired and we restructured completely. We made that position a true administrator, so we now have a Director of Technology and Data Systems.

In all, the variance between the leadership position structure within the technology department of both districts reveal compelling disparities that prompt further analysis.

Integral Positions

Notably across both cases, all leader and teacher participants reported the instructional technology coach as a necessary district position. Moreover, the IT (Information Technology) department and the director of technology leadership position were also described as integral by both teacher and leader participants from both districts.

Instructional Technology Coach

According to the Middle School Principal from District B, “school technology support lives in two areas.” There is the instructional integration area, which the technology coaches cover, and then there is the information technology (IT) side, which deals with the hardware or software components of technology. As the principal maintained, “those two areas are probably the biggest things with technology

integration." Notably, the technology coach position was the most referenced position by all participants from both districts, thus amplifying their influence. As identified in various teacher and leader participant excerpts, a technology coach is an integral piece to the technology system structure of any school or district. The Superintendent from District A shared an interesting point in discussing the difference between the technology coaches and IT personnel. As the Superintendent discussed,

> IT techs are great, but they don't think instructionally. They think more in coding-type perspectives. You want someone whose sole mission is helping teachers integrate technology in the classroom. You want someone who wants to be a leader in technology. You want them working alongside teachers and respected by them so that teachers feel comfortable seeking their help.

As the following focus group excerpts reflect, teachers from District B expressed their appreciation of the support that a technology coach provides them:

> "I think the tech coaches play a huge role in supporting us" (9th Grade History Teacher)
>
> "We're very fortunate in this district to have tech coaches. They make resources available for us in a modality of ways" (Kindergarten Teacher)

Similarly, teachers from District A conveyed the same sentiment regarding the integral role of the technology coach. As the Instructional Technology Coach from District A indicates, having someone in her position in every building would be ideal "because then you have opportunities to really have a more intimate way with classes and knowing exactly what they're doing and helping them grow together with technology." Agreeing with her during the focus group, the 5th Grade Teacher from the same district emphasized,

> The keeper of the keys is definitely the technology coach position. That's a big position because teachers will always have reasons to need support - whether it's a glitch, or a reset of a password. Even more, the support is not only for the teacher, but also for the students.

Additionally, the 5th Grade Teacher was adamant in the notion that "technology coaches are absolutely key to have alongside a director of technology." As she explained,

> It's very difficult for a director of technology to do both the networking side (all the back-end hardware/software stuff) and the instructional technology side. So, technology coaches can help support the instructional technology aspect.

The Executive Director of Technology from District B alluded to the same point as he expressed that it would be "extremely beneficial to have someone on the instructional technology side" because "they can work directly with curriculum leadership on a weekly basis to support them as needs arise." The district leader further acknowledged that technology coaches "play a leadership role" As the Executive Director of Technology described,

> They are checking in with the teachers; they are building relationships with teachers; they are pushing into classrooms; they are modeling how to use platforms or devices. They are in fact leading the staff with our technology efforts.

Importantly, District A indicated the need and importance of technology coaches through the following action steps in their 2018-2021 Instructional Technology Plan:

> To develop and foster professional learning communities in all schools that support the integration of technology through teacher leaders and technology integration specialists. Teachers will learn best practices in the use of technology and digital resources in the classroom through technology integration specialists.

IT (Information Technology)

In addition to instructional technology, information technology (IT) was another department perceived by some teacher and most leader participants as integral to technology integration efforts. Across both cases, all teacher and leader participants placed high regard to the IT department. According to the Executive Director of Technology from District B, "the IT department and staff are an essential component of a school or district's infrastructure systems." As the district leader asserted, "that

department drives technology projects and platforms and, most importantly, monitors network security." With the current remote landscape, the Executive Director of Technology emphasized that "it's important to make sure you have IT systems that are up-to-date, efficient, secured, and to assure that those are the right systems for your building or district because things are always changing." Moreover, the Superintendent from District A makes sure to have IT technicians with varying levels (Level 2, Level 3) because he wants to assure that they have "specialists who are really looking at the network infrastructure, which includes security, bandwidth/Wi-Fi capabilities, and hardware/software issues or needs." As the Kindergarten Teacher from District B acknowledged,

> The technology coaches know the programs and apps, but the IT guys, they are the hardware guys. They are the ones fixing the devices and troubleshooting network or hardware/software issues. They are the back-end support of technology.

The Superintendent from District 1 discussed the structure of the IT department in his district and how he prefers to outsource IT technicians:

> We have the IT technology support we need from an outsource company we use. I like the model of outsourcing IT because you don't want your level 1 technician to be a level 1 technician forever. You want them to become a level 2 technician eventually; you want them to grow. Having those IT techs ready and able to learn and grow is important because otherwise you're not learning to do anything new.

This statement by the district leader implies that outsourcing IT technicians allows for the district to retain technicians that are motivated to grow in their craft, as evidenced by their levels of certification. In comparison, District B also outsourced their IT technicians. The Executive Director for Technology discussed the structure of his IT department:

> We have two network managers - we have an IT operations manager, and we have a network manager. And then underneath that we have a systems technician

> who does phones and cabling, and then we have five on-site technicians. The on-site technicians take care of the help tickets; they're replacing and repairing devices; they're taking care of the networking at the building. So, the entire IT side are all outsourced and sub-contracted through BOCES.

Director of Technology

Across both cases, a leadership position exists that oversees the technology department, a technology leader. In both district cases, someone is responsible for the management and sustainability of the technology infrastructure of their respective district. Variance existed in not only the name of the position, but also in some of their responsibilities. According to their district websites, District A lists the technology leader position as Director of Technology and Data Systems, while District B refers to it as Executive Director of Technology. Most of their responsibilities are similar, however, District A's position has the added responsibility of data management, while District B has a separate leader position that works specifically with data management - Director of Information Management. The difference in district demographics between both cases may be a factor in the variance of technology leadership structure, which will be discussed further in the next chapter.

During their individual interviews, all leader participants from District B emphasized the importance of a director of technology position within a school district. The Executive Director for Technology from District B emphasized the importance of having a director of technology position who oversees instructional technology and the IT department. As the district leader conveyed,

> For districts or schools looking for organization, I think a Director of Technology that oversees the whole technology infrastructure (instructional technology and IT) is needed because communication within departments is huge.

As explained by the district leader, the technology department may have different teams (technology coaches; IT technicians; data team) “so having all of them understand the same information about what's happening and what direction the district may be moving towards is extremely beneficial.” In essence, the Director of Technology position helps to facilitate communication with everyone. When asked to offer any positions she felt were necessary in the district technology department, the Elementary School Principal from District B without hesitation stated, “Definitely (technology leader name)! I always tap into him. To me, he seems so much at the forefront of what we need. He has those technology visions.” This statement by the building leader affirms the support that other building principals rely on from a director of technology.

Other Notable Positions

Noted as outliers in the data set, some leader participants identified other key positions that they felt strengthen and support technology integration efforts. The Executive Director of Technology from District B suggested for schools or districts to have a data leader - “a person who is doing all the state reporting, doing everything with the student information system. That's a huge position right there.” A librarian was also conveyed as another supportive piece of technology support. During the focus group interview with teachers from District B, the 10th Grade Teacher mentioned that the librarians in her building have been “helpful in providing a catalog of technology resources to teachers.” After the librarian reference, the Kindergarten Teacher in the same focus group followed up by acknowledging that “librarians communicate digital citizenship guidelines for students to follow.” As she explained, “the librarians are very involved in that kind of instruction (digital citizenship) and making sure that they are holding the students accountable for their digital citizenship.” An interesting position that

was presented by the Superintendent from District A was that of a clerical position (secretary for the technology office). The Superintendent describes the position as "a help desk that can serve as our customer service; someone who can answer the phone on a regular basis and can help guide staff and families in the right direction when they call for support."

Overall, all teacher and leader participants identified positions and departments that were determined as integral to technology integration efforts in a K-12 school system. It's important to note that not all school districts have directors of technology or tech coaches. This is a leadership choice that has greatly paid off during a time of change, such as in the pandemic. However, there are many school districts that don't have any technology coaches or a leader in charge of the technology department in general. As such, it's important to recognize that districts having these positions have a positive impact with technology integration efforts, thus is notable.

Available Support

Across both cases, the availability and feasibility of the aforementioned support systems were also deemed as necessary by all teachers and leaders. All teachers from both districts agreed that the help desk ticket system that their respective districts have in place along with the technology coaches, creates an efficient system of available support. Teachers have accessibility to support from either the IT technicians or the instructional technology coaches. However, variance between both cases did exist with the amount of technology coaches in each district. District A employs one full-time and one part-time K-12 instructional technology coach across five school buildings, whereas District B employs four technology coaches across eight school buildings within their district.

As the Kindergarten Teacher from District B offers, if an administrator did not know the answer to a technology question, "within a few hours they had an answer for you." Continuing, "they (administration) are very quick to respond through email or phone to find out the answer for you and get help for you as soon as possible." Agreeing, the 10th Grade History Teacher in the same district recognized,

> Whenever we have issues with technology (ex. Smartboard; computer), we can put a help ticket online on our district website. And within a day you'll have a response from someone regarding what they are going to do about the issue.

Continuing, the Kindergarten Teacher from District B discussed the availability and flexibility of support from the technology coaches:

> The technology coaches actually come in sometimes and do the PD's live or sometimes you can sign up for a virtual. So, like I said, the information is there and available to us. It's always offered to us.

At District A, the Middle School Principal explained the vast availability of support that teachers are provided with in her building:

> What we do is we try to really make it like everyday support. We have an excellent support system. We provide teachers with computer TAs (teacher assistants) that have a general understanding of technology; and then we provide teachers with technology learning coaches who go more in-depth with instructional technology.

The 10th Grade History Teacher described the Chromebook support system set up for students and teachers in her school:

> Whenever students have issues with their Chromebooks they can go to our Chrome Depot to get a loaner Chromebook while they're Chromebook is getting fixed. So that's definitely helpful. The same for teachers. We always have access to that support.

In the same sense, the Middle School Principal from District A asserted that "the IT department must have a help desk system so teachers can always be able to put in a ticket

and get help that way." The access and feasibility need to be there for teachers and students.

Along with the Instructional Technology Plan, each district website provided an array of useful and accessible resources for students, families, and staff that included, links to digital learning tools and applications, videos tutorials covering instructional technology platforms, help desk information, and important technology information and updates. Some teacher and leader participants from District B acknowledged the vast availability of resources in their respective district webpage. As the Elementary School Principal from District B describes,

> With the district website itself, there is so much information in there. It is filled with information for parents, students, and teachers. All of the digital resources that students use and anything that is privy to parents and students, it is there. On the staff side, we even have a whole page of all of the different tech resources. Everything is put out there. From all the different sites that teachers can use, it's all there.

As a first-year teacher, the 9th Grade History Teacher from District B shared her appreciation of the resources available in her district website:

> On our home page we have a list of applications and different platforms that we could use. I can just click on different things and explore what we have available as a district. I think it's all at our fingertips. That's helpful for me.

Accountability

Part of a school technology system infrastructure also includes accountability measures - how are technology integration efforts being assessed or monitored? As such, accountability with technology integration efforts is further categorized into the following sub themes: a) Technology Standards & Guiding Frameworks; b) Assessing Teacher Progress with Technology; and c) Feedback & Surveys.

Technology Standards & Guiding Frameworks

Technology standards (e.g., ISTE), models, or frameworks (e.g., SAMR; TPACK) provide school leaders with accountability guidelines or benchmarks for instructional technology. Across both districts, findings revealed that all leader participants from both districts acknowledged the ISTE standards and SAMR framework. However, the variance between both districts were from teacher responses. Most teacher participants from both districts were not knowledgeable or familiar with either standards or framework. When asked about their familiarity with any specific instructional technology standards, guidelines, or models, the 4th Grade Special Education Teacher from District A was transparent when she admitted that she doesn't really know them. As the teacher shared, "I know the next generation standards, a little bit with science and technology, but I don't know the actual technology standards."

Similarly, when the focus group teachers from District B were asked about their familiarity with technology standards or frameworks such as ISTE or SAMR, they all admitted to not having any knowledge of them. After checking the district website during the focus group interview, the Kindergarten Teacher revealed that the International Society for Technology in Education (ISTE) standards were indeed listed under the staff technology resources link. The district had identified and shared the ISTE standards with the school community via their district website. However, the Elementary School Principal from District B acknowledged that the ISTE standards or SAMR framework are "not something at the forefront of what we expect our classroom teachers to put in their lesson plans."

Similarly, the Superintendent from District A admitted that although his teachers may not be well-versed in the ISTE standards, many of them know what they are as a

whole. As he expressed, “the district has introduced them (ISTE) just to get teachers familiar with the language use.” The Middle School Principal from District B recognized how the SAMR model influenced the thinking of leaders in her district:

> When the SAMR model came out, it inspired us to think a little more deeply about how we’re using technology and strive to really integrate technology into instruction and not just replace what we’re doing.

Interestingly, variance existed between the Instructional Technology Plans of both districts. One of the action steps with the 2018-2021 Instructional Technology Plan from District B specifically tasks the district to “use current models of technology integration benchmarks, such as SAMR, TPACK.” Conversely, the 2018-2021 Instructional Technology Plan from District A has no mention of ISTE standards, or the SAMR or TPACK frameworks. The Instructional Technology Coach from District A offered,

> Regarding frameworks, we’ve discussed the SAMR model, but nothing official. Just kind of like, ‘where do you find yourself on this model?’ and kind of trying to help teachers take them to the next step, But nothing evaluative type.

Ultimately, findings from leader and teacher responses across both districts portray a gap in communicating technology standards or technology frameworks or models. Although, leaders from both districts are knowledgeable and recognize the ISTE standards and SAMR framework, most teachers across both districts conversely are not knowledgeable or aware of the usefulness of the standards and framework.

Assessing Teacher Progress with Technology

As teachers are evolving with their technology integration efforts, it’s important for leaders to gauge the progress and growth their teachers are experiencing. In this manner, reflective conversations between leader and teacher can be established with the goal of developing an action plan for growth. However, across both cases, this growth accountability measure is not something that is currently in place yet in either school

district, considering the multitude of change initiatives school districts are already experiencing due to COVID. The Instructional Technology Coach from District A acknowledged that she felt that "administrators are running right along with the teachers learning as we go with our current remote environment." She admitted that most administrators are just starting to talk about the different frameworks in her district. Similar to what the Middle School Principal mentioned previously regarding having discussions about technology integration growth during the observations, the 4th Grade Special Education Teacher from District A shared that technology integration is being discussed more during their evaluation process. As she indicated,

> I think there are more conversations and emphasis on seeing you utilize the new technology now. So, I think that has propelled teachers to become a little bit more interested in working a little bit harder to integrate technology because it's being discussed in their evaluation.

When asked if any technology integration language is embedded in teacher evaluation forms, the Middle School Principal from District A admitted that currently there is no specific language within their evaluations. As the building leader offered,

> The language is not there, but we do try to integrate the technology language more during the reflection process of the evaluation. Such as providing teachers with suggestions on how they can enhance their instruction more using technology.

The Executive Director for Technology from District B explained how his district is currently working towards the ISTE standards,

> So, we take a look at them and try to meet them. I would say that is the model we kind of work towards. We don't publish the ISTE standards, but we do make them available. We do work towards that, and definitely on the technology instructional side with the technology coaches because they really support the instruction side. Those are the standards they work by.

Feedback & Surveys

Accountability with technology usage is crucial in assessing not only the progress with it, but also to determine next steps for growth. The 2018-2021 Instructional Technology Plan from District A explained the process the district utilized to gather feedback from their teachers:

> A district wide survey was developed and administered to garner input from the entire K-12 faculty and students. The results of this survey were analyzed, shared with the districtwide committee, and helped guide the establishment of the district's goals and planning.

Similarly, one of the action plans for technology evaluation within the 2018-2021 Instructional Technology Plan from District B directs the district to "distribute and review staff, student, and parent surveys" to attain key stakeholder feedback. As both district documents reflect, each district validates the opinions of key stakeholders while planning for district technology goals. Interestingly, there is no current language within both district's teacher contracts that specify the expectations of instructional technology usage from teachers. However, as technology change initiatives continue to evolve within schools and districts amid a global pandemic, so too will the teacher's contractual language evolve to convey the new realm of expectations regarding technology utilization within instruction.

Theme 3: Communication

Consistent communication during technology integration initiatives was another common factor highlighted by most teacher and leader participants from both districts. The communication may range from sharing helpful technology resources with teachers to communicating technology goals or expectations. Accordingly, the subthemes

generated within this section are organized as such: a) Provide & Communicate Resources, b) Vision & Expectations, and c) Committees Matter.

Provide & Communicate Resources

Educational leaders have a responsibility to communicate and provide resources to their teachers. More so today, considering the change dynamics that teachers are experiencing with the current remote instructions landscape. Across both cases, findings revealed that most participating teachers from both districts felt that the communication of resources in their district was an essential aspect of support. Most of the communication of resources shared by leaders from both districts was mostly through emails, workshops, or the district website itself. The 5th Grade Teacher from District A discussed the nature of resources that are provided to teachers in her district by the leadership team:

> (Technology coach name) is always available to us. She sends emails; she has a Google Site that she includes other resources to share. Our current Director of Technology has been great in pushing and getting what we need. Everybody's been fully on board. Relevant PD and workshops are being provided by the district. Overall, I think they're (administration) really supporting technology and sharing and communicating various resources with us in the form of our technology coach, workshops, or links.

Further, the Superintendent from the same district discussed how the district has worked hard in communicating as many resources as possible with teachers after the school closures last Spring:

> From that point forward we just tried to offer as many learning opportunities as possible, whether it was through our district people that do PD for our teachers or through BOCES. The support and resources are always there - whether it's a one-hour session on how to do something or a full Google Classroom 101 coursework.

In the same sense, The Middle School Principal from the same district explained how she communicates resources with her teachers,

> Whenever I find something that I think is applicable to teachers, I'll forward it to them (email) and try to find some additional support, whether it be workshops or some kind of conference to support the use of whatever technology they are interested in.

Notably, all leader participants from District A had similar sentiments regarding the importance of sharing resources to teachers. Similarly, most of District B's teacher participants maintained that their district also does a great job of communicating resources with them. As the 10th Grade Teacher from District 2 shared,

> The administration team definitely communicates useful technology or websites or links during faculty meetings, emails, or somehow provides us with the information so we have access and opportunities.

The Kindergarten Teacher from the same district agreed and added that their district also has a website that provides resources and information describing all the technology that is available to teachers and parents. As she shared, the website "gives us access to video tutorials on how to use various technology apps or sites, resource links, and slideshows to help us with their vision of putting technology into our classroom and integrating it." As the researcher further explored, both participating district websites provide an array of valuable resources and documents to key stakeholders, specifically teachers, parents, and students. Some of the pertinent documents include their respective 2018-2021 Instructional Technology Plan and Smart Schools Investment Plans, which highlight their technology vision, goals, and action plans. Across both cases, social media, such as Twitter, was also utilized as a technology communication tool. As this researcher discovered, both district websites consistently posted their Twitter posts regarding student events, accomplishments, and happenings within their district. In this manner, the public can be updated on major happenings within their district through these Twitter posts shared on their website.

Amid the many similarities across both districts, the researcher also found various differences between both district cases. Both leader participants from District A had similar approaches to sharing and communicating resources with their teachers. Conversely, the Elementary School Principal from District B seemed to rely on the Executive Director of Technology to do most of the communication of resources, as opposed to being proactive with communicating resources such as how the Middle School Principal from District A mentioned. This was evidenced by her comment when asked how she communicates technology vision, goals, or resources:

> If anything, I just kind of tap into (name of Executive Director for Technology). To me, he seems so much at the forefront of what we need, that I kind of go with him. To me he has the technology resources.

Another variance between both cases was in the amount and type of resources shared and communicated through their respective district website. Interestingly, District B has a vast number of resources accessible on their website that includes, but not limited to: Instructional Technology Plan, Smart Schools information, parent and students help desk links and tutorials, Chromebook student agreements, web-filtering policy, Education Law Section 2-D information; staff technology resources, accounts management information (e.g., PowerSchool, Frontline), ISTE standards, and their Technology Mission explicitly posted. District A had many similar resources posted on their website; however, they did not have their technology mission posted anywhere on their website and did not cite the ISTE standards anywhere. Another variance with website resources was that District A had some pertinent documents translated in Spanish, whereas District B did not have any. Lastly, from a functionality standpoint, District A had a couple of links on their website that did not work, while District B had all workable links on tehri website.

Vision & Expectations

Both districts utilize their Instructional Technology Plans to communicate and drive the vision and direction of their technology integration initiatives. According to the 2018-2021 Instructional Technology Plan of District B, their technology mission aims to "incorporate technology in the educational program and provide tools to enhance and redefine the learning in all classrooms." Similarly, the 2018-2021 Instructional Technology Plan of District A indicates that they are a "school district committed to the continuing advancement of technology in education." As it states, "our mission is to provide the technological resources necessary to support a fully integrated learning environment that invites and inspires its community to become creative problem solvers and lifelong learners." According to the Executive Director of District B, the instructional plan is created every three years as a directive from the New York State Education Department and drives the vision for the district. Importantly, the technology plan has input from key stakeholders - parents, teachers, students, and leaders. As the district leader describes,

> The way we get feedback is through annual surveys. We take that information and use it as data. A lot of the feedback really helps us stay on course of meeting the needs of students in the classroom and identifies, instructionally, what we're doing with technology.

From a teacher's perspective, the 9th Grade History Teacher made an interesting point when referring to leaders communicating their expectations with teachers and technology. As she elaborated,

> For me personally the best way to deliver the goals would be to just explicitly give us a set of goals. When I'm held to that standard, I'm more likely to perform better. I know if I see it mapped out, they (goals) would be in my head and I would want to integrate them into my classroom.

Interestingly, this statement by the 9th Grade History Teacher implies that the district has not been explicit with their technology expectations or goals.

From an expectation and procedural standpoint, the Superintendent of District A communicates technology expectations to teachers and staff through informational resources that provide responses to pertinent questions such as, "What is synchronous instruction? What is asynchronous construction? What is live streaming? What does that look like? What is it not live streaming? What are you expected to do?" Additionally, the 5th Grade Teacher from District A recognized the efforts of the Superintendent in instilling his technology vision, "Learning with Technology Together," on every district letterhead for the past two years. As the Superintendent explains, "stating the technology vision on our district letterheads not only communicates the vision consistently, but also assures that every stakeholder is aware and reminded of our technology vision."

Within the technology department, the Executive Director for Technology from District B consistently communicates with his technology coaches on a weekly basis to "talk about platforms; talk about training; talk about what's going in the buildings and how we can best support teachers." The weekly communication assures that the technology coaches are staying abreast of the district technology needs and progress, while also keeping everyone on the same page. At the building level, the Middle School Principal from District 1 utilizes "faculty meetings, department meetings, and lead teacher meetings to disseminate information about instructional technology initiatives in order to get a consistent message out to all staff." Continuing, the Middle School Principal further shared that "the teacher observation process and their reflection within the process is where a lot of the vision and goals are communicated as well." Within the observation process, the principal and teachers "can have conversations about their

progress with instructional technology and be able to create action plans to improve their proficiency with technology." As the Middle School Principal's comment suggests, the observation process provides a platform for leaders to make recommendations to teachers in regard to technology integration practices, platforms, or applications that can enhance their instruction.

The Kindergarten Teacher from District B contends that although she has not heard the exact language of the district's vision and goals, she feels the district is still communicating their vision when you consider and "see what they're doing, how they're implementing technology, and how they are giving us all the resources." As the Kindergarten Teacher's response alludes, the actions and initiatives of a district speaks volume and is a way for a district or school to communicate their vision with instructional technology. However, as the 9th Grade History from the same district alluded to previously, more work is needed from the district in being more explicit and consistent with communicating their vision and goals to their teachers.

Committees Matter

Committees are also an integral part of a district's communication. Across both cases, responses from most leader participants from both districts revealed that committees assist in collaborating and communicating a shared technology vision. The Instructional Technology Plans from both participating districts were created through the collaboration and efficiency of a technology committee. As tasked in the 2018-2021 Instructional Technology Plan of District A, the document specifically states,

> In order to develop the district's instructional technology plan a district wide committee has been established. The committee consists of representatives from various stakeholder groups which include teachers, students, parents, support staff, and administrators. The technology committee will continue to meet and analyze all data as feedback that is provided.

The Instructional Technology Coach from District A expressed the purpose and importance of technology committees:

> We talk about the technology and how it fits into the curriculum. We talk about purchased programs and subscriptions. We talk about restructuring subscriptions and programs to be more fitting to the needs of the teachers. We get input from the students, teachers, and from all the buildings administrators to hear what's working for them.

Ultimately, a technology committee allows teachers and leaders to be part of a collaborative process for technology initiatives or changes.

Committees in general were perceived by most leader participants from both districts as a communication avenue for collaborative conversations to take place, especially during a change process. According to the Executive Director for Technology from District B, "we form committees and subcommittees whenever the district is planning on making a change because we're never going to make a change on our own. These committees matter" The district leader alluded to the value of attaining stakeholder input within committees. As he further asserted,

> It's important to sit down and get teachers in the room; to get parent perspectives; to get student perspectives - their input matters in all that we try to do. We gain input from committees - we discuss things that we should or shouldn't look at or consider. We always look at things based on students and teacher needs.

In the same sense, the Elementary School Principal from District B maintains that they are always looking at committees with teachers to get their input. Teacher input matters. As the building leader points out, "It's about our teachers. If they can't utilize it; if it's not something they see that's purposeful, why would we spend the money? Why would we go in that direction?" The Superintendent from District A was adamant in stating that "committees are more important now more than ever." Continuing, the district leader stated that the feedback that committee meetings collect, "will either reaffirm a change

that we just made or bring up issues with the change." The Executive Director for Technology discussed the influence that communication has with getting others on board with initiatives or changes. As the district leader shared, if stakeholders, such as teachers and parents, are informed along the way of changes or initiatives and they have a voice, "they will be ok with any bumps that you hit along the road because it was collaborative in nature; you have communicated with them." Conversely, the district leader continued,

> If you just roll something overnight, without communication ahead of time, you are not going to be able to move in the direction you need to move. You are going to get a lot of resistance. So, I think communication is a huge factor.

In conclusion, both teacher and leader perspectives identified effective leadership practices and systems and structures that have a positive impact with technology integration.

Conclusion

The first research question in this study revolved around leadership practices and approaches that influence technology implementation and adaptation efforts at the K-12 level. Findings were mostly consistent between both district cases, with most teacher and leader participants reporting similar interpersonal qualities that they deemed as influential to technology integration efforts. Patience, humility, and approachable were the most common identified attributes shared by both teachers and leaders across both cases. The analysis of the data found that while most teacher and leader responses were similar, there were some outlier variances in interpersonal qualities such as, risk-taker, honest, and resourceful. These outlier characteristics were shared by an individual teacher from each district. Additionally, outlier qualities shared by leader participants across both cases included being a great communicator and continuous learner. The researcher

decided to reference the communication and continuous learner references within the practices subsection of the influential leadership theme.

Regarding effective practices, across both cases, teacher and leader participants shared the same sentiments regarding technology leader behaviors that are influential. As was referenced by all teacher and leader participants between both districts, technology leaders must listen to understand perspectives and experiences; must allocate time for learning; must continuously learn in their field; and must find ways to model expectations. Interestingly, the variances across both cases regarding technology leadership behaviors were in how the participants worded the specified behaviors. For example, the Middle School Principal from District A mentioned that technology leaders need to be "realistic" in acknowledging that all teachers don't have the same level of proficiency with technology. Subsequently, the researcher decided to designate this reference under the *Patience* subtheme since being realistic involves a level of patience from technology leaders.

The second research question in this study inquired about the elements within a system infrastructure that are necessary to effectively support and sustain technology integration initiatives at the K-12 level. Prominently, across both cases, there was consensus among all leader and teacher participants that the instructional technology coach is an integral district position, along with the IT (Information Technology) department. The availability and feasibility of the aforementioned support systems were also deemed as necessary by all teachers and leaders across both cases. However, variance between both cases did exist with the amount of technology coaches in each district. District A employs one full-time and one part-time K-12 instructional technology coach across five school buildings, whereas District B employs four technology coaches

across eight school buildings within their district. The size of each district case varied greatly, which may explain the variance in the amount of technology coaches. As an additional variance within this domain, only one leader participant and teacher participant across both cases discussed the importance of a director of technology position within a school district. However, the researcher placed emphasis on this position due to the overarching supervisory nature of it. As affirmed by the Executive Director for Technology from District B, there has to be a leader within a school system who must oversee instructional technology and the IT department. Without the guidance from this leadership position, the system infrastructure may not function effectively and efficiently. Lastly, there were some outlier positions that were regarded as integral to a system infrastructure by both teacher and leader participants from both districts. The positions included a data leader, a librarian, and a clerical secretary for the technology office. These positions were regarded as outliers from the data set due to the low number of references to them made by participants across both cases.

Continuing with the second research question, across both cases, most leaders and teachers from both cases emphasized the essential and foundational aspects of the district's bandwidth and Wi-Fi capabilities. Overall, there was no variance in what the leader and teacher responses alluded to. Additionally, across both cases, the majority of leader and teacher participants reported that technology leadership continuously structured enhancement opportunities for teachers. Notably, across both cases, each district had similar objectives for growth and learning opportunities with technology for teachers within their respective instructional technology plan. Moreover, across both districts, findings revealed that all leader participants from both districts acknowledged the ISTE standards and SAMR framework. However, the variance between both districts

were from teacher responses. Most teacher participants from both districts were not knowledgeable or familiar with either standards or framework, compared to leaders. It's interesting to note that across both cases, accountability tools to assist with teacher growth with technology integration efforts, such as SAMR or TPACK, is not something that is currently in place yet in either school district.

Another variance between both cases was in the amount and type of resources shared and communicated through their respective district website. Both cases have a vast number of resources accessible on their website that range from Instructional Technology Plans and other pertinent technology policies and documents, to instructional technology tutorials and accounts management information for staff, parents, and students. However, discrepancy was found between cases in communicating the ISTE standards and their respective technology mission statement on their website. On their website, District B provides teachers with a link to the ISTE standards and lists their technology mission, while District A did not provide either. Additionally, the variance found between the technology leadership position structure between both cases reveal compelling disparities that prompt further analysis in the next chapter. Another variance with the website resources was that District A had some pertinent documents translated in Spanish, whereas District B did not have any translated documents shared on their website. This could have been due to the varied student demographics between both cases.

Lastly, the third research question in this study focused on teacher perceptions regarding leadership practices and systems and structures that influence their technology integration experiences. The overarching conclusion regarding teacher perceptions in this study is that there was a vast amount of consensus between and among teachers from

both districts. All teachers across cases identified vastly similar leadership attributes and practices, along with similar perceptions regarding the system infrastructure. Even though teacher participants between and among both districts varied in years of experience, grade levels, and subject areas, most of their responses during the focus groups centered around similar leadership practices and systems design.

In conclusion, in addition to specific practices and leader attributes, the findings reveal that the infrastructure of a district's instructional technology system serves as a foundational piece for successful technology integration, thus giving merit to its prevalence. In relation to the research questions, the findings have identified viable leadership practices and supportive district systems that influence how technology integration efforts progress within K-12 schools or districts.

CHAPTER 5

Introduction

This comparative case study of two suburban public-school districts in Long Island, New York examined the technology system design and leadership practices across the districts during a time of change and a shifting educational landscape. The study aimed to address three research questions. The first research question sought to understand and identify specific technology leadership practices and approaches that influence technology integration efforts at the K-12 level. Continuing, the second research question explored the systems design, or infrastructure, necessary for an effective and sustainable technology integration school system. Lastly, the third research question aimed to fill a gap in the technology leadership research base regarding the lack of teacher perceptions on leadership practices that influence their technology integration experiences. As Dexter & Richardson (2020) reveal, most studies in technology leadership take the perspectives of leaders and "rarely include the impact of leader practices on teachers" (p. 17). Moreover, teacher perceptions were purposefully targeted in the study to "create a more robust picture of educational technology factors" as well as "bridge the leadership and teacher worlds when it comes to educational technology integration" (Dexter & Richardson, 2020, p. 33). Teachers are at the forefront of instructional technology; hence their viewpoints must be accounted for.

As Chapter 3 discussed, the data collected in this study consisted of individual interviews, focus group interviews, and document analysis. Three overarching themes emerged from the data that was analyzed and deconstructed: a) influential leadership; b) dynamics of a system; and c) communication. The influential leadership theme

incorporates leader attributes and practices that impact technology integration efforts and experiences. The second theme discusses the dynamics of the interrelated elements within an instructional technology system, which closely align with the theoretical frameworks discussed within Chapter 2. Lastly, the third theme regarded communication as a key factor with technology integration efforts, which as some participants shared, can be reflected in various forms. Ultimately, this chapter will discuss the major findings from the analyzed data collected. The researcher will address each of the research questions and connect findings to the existing literature and theoretical frameworks presented in Chapter 2.

Interpretation of the Findings

Research Question #1

The first research question in this study inquired about the leadership practices and approaches that participants deemed as effective for technology integration efforts at the K-12 level. The analysis of the interview data found that technology leadership requires a specific set of interpersonal skills to be able to influence teachers' instructional technology usage. Across both cases, most teacher and leader participants emphasized that technology leaders need patience. Patience to listen and value their perspectives. Patience to understand and acknowledge that teachers have different levels of technology proficiency. As both leaders from District A conveyed, similar with students, some teachers are more proficient than others. Therefore, patience allows technology leaders to differentiate how they approach or speak with teachers regarding technology integration, which helps to build trust.

Humility and approachable were also other notable interpersonal skills mentioned by teacher participants. Interestingly, they derived only from District A teachers as they referenced them as effective leader attributes. Technology leaders must have humility to accept assistance from others when needed, and humility to not be afraid to learn along with teachers. The 4th Grade Special Education Teacher from District A was especially appreciative of the way the Superintendent demonstrated his frustrations and learning curve with Zoom during a video conference. This showed them that he is also learning along with them. In this case, learning can be viewed as a team approach, which coincides with Senge's (2006) team learning discipline within his framework. Additionally, most teacher participants across both cases reported that they felt more comfortable with technology leaders that are approachable. In order for teachers to feel comfortable approaching a leader with technology integration questions or concerns, that leader must be cordial and amiable, or easy to speak to. The teacher responses coincide with Chang et al.'s (2008) study that found that without interpersonal and communication skills, leaders cannot be effective technology leaders. In essence, interpersonal skills allow technology leaders to build trust and communicate change efforts more effectively.

Influential leader practices were also identified by teacher and leader participants across both districts. Among the main practices identified by most leader and teacher participants included, modeling expectations, allocating time for teachers, listening to understanding, and practicing a continuous learning mindset. Notably, all leader participants from both districts indicated that modeling technology expectations to their teachers is an effective practice. The Superintendent and Middle School Principal from District A, along with the Elementary School Principal from District B all identified

various instances of technology modeling that they themselves portray to their teachers during in-services and meetings. Similarly, the 4th Grade Special Education Teacher from District A acknowledged how the superintendent in her district led by example and modeled using Zoom during a conference day. Coinciding with the national ISTE technology standards for education leaders, technology leaders must "model digital citizenship by intentionally adopting and demonstrating best practices to teach others" (ISTE, 2018). Moreover, most teacher participants from both districts appreciated modeling not only from leaders, but also from colleagues. Showcasing best practices by peer modeling during in-services or department meetings was deemed as effective practice by most teacher participants. This finding agrees with the assertion by Dexter & Richardson (2020) that when technology leaders tap into the expertise of individual teachers, it might create a ripple effect and motivate other teachers to take a step forward with instructional technology. Interestingly, the current literature in the field of technology leadership lacks research on the impact that peer modeling may have with technology integration. Subsequently, future studies should seek to explore this emerging finding that was perceived as effective in this study.

All leader participants from both districts also regarded listening as an essential practice by technology leaders. As emphasized, listening involves understanding others' perspectives and viewpoints; it involves taking in consideration the voices of key stakeholders during a change process. Continuing, most teacher participants from both districts revealed that allocating time for teachers to learn and practice instructional technology along with colleagues is an effective practice. This goes along with what Dexter & Richardson (2020) indicate, that teachers need to have opportunities to learn as

a primary means for building capacity to integrate technology. Similarly, this finding closely parallels what Hargreaves & Fullan (2012) refer to as social capital, and what Senge (2006) describes as team learning. Many studies also agree that technology leaders must foster environments for teacher discovery and exchange by structuring time for teachers to learn, collaborate, and share materials with each other (Afshari et al., 2010; Anderson & Dexter, 2005; Dempsey, 1999; Dexter, 2011; Dexter & Richardson, 2020). As expressed by many teacher participants from both districts, time is an essential consideration technology leaders must consider if they want teachers to successfully incorporate technology.

Lastly, leader participants from District A recommended for technology leaders to remain current in the field of leadership and practice having a continuous learning mindset. All leader participants from District A expressed the importance of technology leaders consistently practicing being life-long learners by staying current with best practices, collaborating with other leaders, and seeking learning opportunities. It was surprising and telling, however, that none of the District B leader participants recognized the need for such practice by technology leaders. The continuous learning aspect of technology leadership coincides with what the ISTE technology standards for education leaders state that as "connected learners," technology leaders must "remain current on emerging technologies for learning and innovations in pedagogy" (ISTE, 2018). This practice also corresponds and aligns with the personal mastery discipline from Peter Senge's framework (2006) and the human capital domain within Hargreaves & Fullan's (2012) model. As such, District A leaders seem to be current and striving to learn within today's educational shifting landscape.

Research Question #2

The second research question explored the technology system framework set in place within both school districts. The plenitude of data within this domain reflects the notion that every aspect or element of instructional technology relates back to the system that has been put in place to support and sustain it. Both leader and teacher perspectives were gathered to get a comprehensive view of the system design set in place in each district to effectively support and sustain technology integration initiatives at the K-12 level. Most leaders across both districts agreed that adequate bandwidth speed and Wi-Fi capabilities are crucial foundational system needs. Without adequate bandwidth or Wi-Fi capabilities, schools and districts will not be able to sustain technology integration initiatives. Most teachers across both districts agreed that the increase in bandwidth and Wi-fi capability has made a tremendous difference in their instruction this current school year. As each district leader from both districts asserted, bandwidth and Wi-Fi are part of the foundation. The ISTE technology standards for leaders specify this aspect of leadership as being a "system designer," who ensures that the current systems are in place (e.g., bandwidth; Wi-Fi) to support technology use in school (ISTE, 2018).

In addition to foundational needs, the majority of leader and teacher participants across both cases reported that technology leadership must continuously structure enhancement opportunities for teachers with technology. In agreement, Studies in the field of technology leadership agree that technologies can be integrated and implemented effectively in schools if leaders support their teachers in the process of change by providing them with consistent growth and learning opportunities with technology (Afshari et al., 2010; Chang, 2012; Dexter, 2011; Dexter & Richardson, 2020; Trust,

2016). Hitt & Tucker's (2016) review of research also concluded that leaders must build capacity through professional learning environments for teachers to collaboratively foster new technological knowledge. Responses from each principal from both district participants maintained the notion of consistently providing technology growth and learning opportunities for teachers, either by utilizing the technology coaches as a support and resource or sharing resources with staff consistently to enhance their craft. Moreover, teachers' technology integration efforts have been found to be heavily influenced by social learning interactions with other colleagues (Dexter, 2011), which coincides with the team learning discipline that Senge (2006) highlights and the social capital domain of the Hargreaves & Fullan (2012) model.

Teachers must have support available when it comes to instructional technology. As such, teacher and leader participants across both districts identified specific technology positions and departments within a K-12 district or school system that provide available support. A prominent position that surfaced from all leader and teacher responses across both districts was the notion that having a designated person (e.g., technology coach) responsible for assisting and guiding teachers' technology usage in the classroom is vital to a district's success with technology integration. As expressed by all teacher participants from both districts, having a technology coach available in the district is a form of ongoing professional development that has an impact on their instructional practices (Teemant, 2014). Consequently, this study's findings indicate that the use of technology coaches by school districts are necessary to provide the adequate follow-up and long-term involvement that teachers need from professional development (Machado & Chang, 2015). As all leader participants elaborated, the technology coach

offers support, ideas, strategies, and current technology information to teachers with the goal of enhancing their technology proficiency and experience. Considering the overall weighted strength of the technology coach theme from this study, future studies should explore the overall effectiveness and impact of technology coaches on teacher practice in relation to technology and 21st century learning practices.

The information technology (IT) department was also reported as an essential support component alongside technology coaches. The IT department takes care of all network and hardware/software related matters within instructional technology, while technology coaches focus on the instructional aspect of technology in the classrooms. A surprising finding revealed that the director of technology position was not identified by most teacher and leader participants. Only one leader and one teacher between both districts made any references to the essential aspect of a director of technology for a school district. Nonetheless, prior research has identified the technology coordinator position as playing a key role in the technology leadership of a school (Dexter et al., 2017).

The most telling finding regarding integral positions was the variation of technology leadership structure within each district case. As their respective district website present, District A has the sole position of director of technology, who oversees both instructional technology and data management. Conversely, District B has an Executive Director of Technology position along with a Director of Information Management, who take care of all the student data management matters. Additionally, District A only has one full time technology coach and one part time technology coach, while District B has four full-time technology coaches. The vast differences in

technology leadership structure may be due to their demographic sizes and/or budgetary constraints. District B student enrollment is twice as large as District A. Despite the size variation, the additional technology coaches and data leader position was found to establish a more coordinated and systematized structure for the technology department. As the Instructional Technology Coach from District A conveyed, the data management responsibility within the technology department is a huge job in itself. Hence, the data leader position would be ideal for school districts to allow the director of technology to focus on the instructional technology and network needs of the district. Essentially, the more support and hands on deck within the technology department, the better.

Findings also revealed that technology accountability seems to be an important aspect that needs improvement in both district settings. The only aspect of technology accountability that either district has is its respective 2018-2021 Instructional Technology Plan. The three-year plan identifies and outlines the district's technology vision, short-term and long-term goals, and action steps with instructional technology. Although all leader participants across both districts indicated that they communicate technology visions and goals to teachers and the community through their instructional technology plans, staff meetings, in-services, or school events, some teacher participants were unsure of how to locate and access their district vision and goals. As the researcher discovered, both district's 2018-2021 Instructional Technology Plan highlight the respective district's current technology vision and goals and are accessible to the public through their district website. However, teacher participants expressed that although they are encouraged to utilize technology in their classroom and attend technology workshops, there was uncertainty of the existence and accessibility of the district's technology plan. This may

suggest a need for leaders to establish better communication with teachers regarding the district's current technology vision and goals.

The presence of each district's 2018-2021 Instructional Technology Plan aligns with what the ISTE technology suggests, "technology leaders should build on a shared vision by collaboratively creating a strategic plan that articulates how technology will be used to enhance learning" (ISTE, 2018). Continuing, the ISTE technology leader standards also indicate that technology leaders need to communicate effectively by "keeping stakeholders informed" and allow a means to "get feedback by using online surveys." This technology leadership standard was met by all leader participants when they shared that their district utilizes Google Forms as surveys to gather information from parents, students, teachers and administrators to evaluate the needs and progress of their technology initiatives. As such, both district cases are engaging stakeholders in establishing a strategic plan and ongoing evaluation cycle for transforming learning with technology.

Continuing, all leader participants across both settings deemed committees in general as an effective way to gather stakeholder input when it comes to technology integration efforts. Having a technology committee is an organizational system mechanism for developing consensus on technology visions and action steps (Anderson & Dexter, 2005). Accordingly, all leader participants expressed the importance of establishing technology committees within the district to collaboratively work towards a technology vision. Creating technology committees coincides with the ISTE standards for education leaders which refers to leaders as "visionary planners" (ISTE, 2018). Additionally, establishing committees coincide with the team learning and decisional

capital aspects of Senge's (2006) learning organization framework and Hargreaves & Fullan (2012) professional capital model.

Another important finding was that no other guiding framework, such as the SAMR model, or standards, such as ISTE, are currently being utilized by teachers or leaders within each district. Across both districts, findings revealed that although all leader participants from both districts acknowledged the ISTE standards and SAMR framework, most teacher participants from both districts were not knowledgeable or familiar with either standards or framework. As leader participants from both districts admit, the ISTE standards have been introduced and discussed as a whole with the district, however, it has not been at the forefront of their initiatives considering the magnitude of challenges and changes teachers are facing with remote teaching currently. Nonetheless, this key finding alludes to the notion ISTE technology standards and guiding frameworks such as SAMR are just touching the surface of awareness by K-12 educators. As the educational technology landscape continues to shift and evolve, awareness of the ISTE standards and the SAMR framework may continue to expand in time. A rubric for measuring technology usage in the classroom, like the SAMR model, not only holds teachers accountable, but also provides them with a growth framework. This highlights the need for future studies to examine the influence or impact that technology assessment tools, such as the SAMR model, may have with technology integration efforts.

Interestingly, most of the literature on technology leadership tends to ignore infrastructure dynamics except to acknowledge that they are important as resources (; Anderson & Dexter, 2005; Chang et al. 2008). Therefore, future studies need to further

examine the dynamics of a technology system infrastructure within school systems to better understand the foundational aspect of it. However, the findings discovered within this domain are closely aligned with the systems thinking discipline that Senge's (2006) theoretical framework presents. As the findings reflect across both district cases, a system thinking approach is necessary to acknowledge and understand the interrelatedness of all the elements identified within a K-12 technology integration system infrastructure.

Ultimately, technology systems design within school districts is more than just the purchasing and implementation of devices, hardware/software, and accounts. It involves designing and establishing a system of interrelated support components that are integral to the instructional technology infrastructure of schools and districts. In accordance with the ISTE standards for education leaders, technology leaders must assure that systems are in place to effectively implement, sustain, and continuously improve the use of instructional technology to support teaching and learning (ISTE, 2018).

Research Question #3

The last research question aimed to attain teacher voices within the data set. Teacher perspectives were purposefully collected by the researcher to fill a gap in the research base. Most studies in technology leadership focus on leader perspectives and leave out teacher voices (Dexter & Richardson, 2020).

As responses from all teachers from both districts suggested, interpersonal skills and communication skills are essential characteristics in technology leadership. Regarding specific leader practices, all teacher participants across both settings value and appreciate technology leaders who: a) have interpersonal skills; b) provide time for teachers to grow and enhance their proficiency with instructional technology; c) model

their expectations and allow teachers to model best practices; d) provide foundational resources; and e) provide continuous and consistent support with technology personnel (e.g., technology coaches; IT). These findings are in accordance with the study done by Hsieh et al. (2014) who collected elementary teacher perspectives and concluded that technology leaders must develop environments that help teachers integrate technology into their instruction and establish a technology team and support system that continuously sustains an organization's use of new technology. The responses from this research question bridged the leadership and teacher worlds when it comes to educational technology integration, thus providing for a holistic discussion on the topic of technology leadership and systems design of K-12 schools.

Relationship Between Findings and Prior Research

As discussed in the research question sections, many of the practices and systems set in place across both district cases coincide with what most of the research base in technology leadership tells us works well with technology integration efforts (Anderson & Dexter; 2005; Dexter, 2011; Dexter et al., 2017; Dexter & Richardson, 2020; Ertmer et al., 2002; Hsieh et al., 2014; ISTE, 2018; Karlin et al., 2018; McLeod & Richardson, 2011; Richardson et al., 2012). As all of the district leaders from both districts concluded, to lead successfully in today's growing educational technology landscape, technology leaders must consider the evolving nature of technology and establish ways to ensure its effective integration within instruction (e.g., system infrastructure). Further, all leader participant responses were consistent with the research base (Anderson & Dexter; 2005; Dexter & Richardson, 2020; Hsieh et al., 2014; ISTE, 2018; Karlin et al., 2018) that contends that technology leaders must also encourage teachers to continuously seek

training and professional enhancement opportunities to improve their technology proficiency, while also establishing a communal, supportive, and learning school environment where everyone learns from each other (i.e. PLC's).

It's important to recognize that the coherent and aligned similarities between the findings and prior research may be due to the setting of both cases in terms of student demographics, geographic region (Long Island, New York). In addition, they are both well-funded school districts with resources. Taking this notion into consideration, both districts have the resources to be able to establish a technology system design conducive to technology integration efforts. It would be interesting for future research to explore the technology integration efforts from school districts with lower poverty levels as it will further substantiate the digital divide research base. Unfortunately, not all districts have available resources or are well-funded to provide a sustainable instructional technology system design, which alludes to the notion of a digital divide. Lack of access to resources necessary for effective technology integration is not new. As Richardson et al. (2012) argue, it is concerning that less attention has been paid to the digital equity aspects of technology leadership within the research base. Moreover, Schrum et al. (2011) worry about the financial challenges for continued funding needed to maintain and expand the technology infrastructure in low-poverty schools and the ongoing issues of student equal access to technology. These revelations within the findings and research base establish a need for more research spotlighting the digital divide within K-12 technology integration efforts.

Ultimately, this study supports the existing literature. Effective practices and systems design that were identified by most participants in this study closely align with

those that have already been identified in prior research. However, as technology in education today is evolving and transforming instructional pedagogy technology leadership, research in the field must continue to be ongoing and progressing to keep up to date with evolving times.

Limitation of the Study

Since the design of this study is a comparative case study, it has limited generalizability (Stake, 1995). It's important to note that it is likely that the parallels between the findings from both cases is a result of both settings being well-funded and having similar demographics within the same geographic region. The results are not generalizable to other district populations. Other school districts are needed to capture varying demographics, which can bring to light other factors not captured in this study. Also, based on responses, it can be presumed that those teachers or leaders who participated in the study are average or above average with instructional technology proficiency. As such, it would be interesting to gather perspectives from those teachers or leaders who do not consider themselves tech-savvy.

Further, the research and data collection process took place during the COVID pandemic, which prompted many school districts to shift to remote or hybrid environments. This resulted in all of the data collection to be done remotely, including interviews. Therefore, on-site access to both settings was not possible, which would have allowed the researcher to observe and report on the instructional technology culture within each district. Adding observations of the technology integration culture will allow future researchers to strengthen their triangulation of the data. Moreover, the findings within this study may be limited to the current particular circumstance, the COVID

pandemic, and may not be generalizable to other change circumstances. Lastly, another notable limitation of the study was the lack of longevity of the study. The data collection for this study was conducted during the 2020-2021 academic year from November 2020 through March 2021 (approximately 4- 5 months). A longitudinal study can capture the progress of a district case with technology integration efforts over a longer span of time.

Implications for Future Qualitative Research

Future qualitative studies should investigate leader preparation programs and determine if leadership programs are adequately preparing leaders to become technology leaders. As some prior studies have argued, many school leaders consider themselves unprepared to assume the role of technology leader (Dexter et al. 2017; Leonard & Leonard, 2006; Schrum et al., 2011) . Leadership preparation programs have an influential effect on how school leaders portray technology leadership. Dexter et al. (2017) concluded that educational leadership programs are responsible for teaching 21st-century leaders the knowledge and skills necessary for effective technology leadership. The current lack of preparation from educational leadership programs merits further investigation (Schrum, 2011).

Future studies should also examine the influence or impact that technology assessment tools, such as the SAMR, may have with technology integration efforts. There are few studies that investigate ways that school leaders can effectively measure, monitor, or assess teacher progress with instructional technology. Considering today's remote and hybrid teaching environments, many teachers are learning and progressing with their technology efforts now more than ever. Frameworks such as SAMR or TPACK can be useful tools to help guide teacher technology integration growth. Additionally, the

researcher discovered that contract language regarding instructional technology expectations was non-existing in the participating district's teacher contract. This accountability aspect to contract language merits further exploration considering the ever-changing aspects of technology in classrooms and instruction.

The digital divide between school districts with varying demographics is also an area that merits further study. As prior research has highlighted (Richardson et al., 2012; Schrum et al., 2011), lack of access to resources necessary for effective technology integration is not new. However, the COVID pandemic has brought to light the digital divide that exists between many school districts across the nation. Therefore, more studies are needed to discuss the digital equity aspects of technology leadership within the research base. Future studies also need to examine more deeply the dynamics of a technology system infrastructure within K-12 school systems to add to the research base as instructional technology continues to evolve. In relation to the ongoing support that teachers need with technology integration efforts, the influence that technology coaches have with instructional technology also merits further exploration. Technology coaches have been deemed as integral to the support system; therefore, their relevance cannot be ignored within the research base. Lastly, a longitudinal qualitative case study of a school district using Senge's (2006) systems mindset can provide more in-depth data regarding its effectiveness and its implications during a time of transformation.

Implications for Future Practice

The findings from this study contribute to the existing literature within the K-12 technology leadership field. School districts, educational leaders, and leader preparation programs can utilize the findings from this study to provide a basis to inform and guide

21st century technology leadership by identifying both the influential leader practices and structural and foundational factors needed to be in place for any instructional technology plan to be effective.

The findings from this study brought to light the first theme of influential technology leadership. There are specific practices and attributes from technology leaders that are influential with technology integration efforts. The findings from this study identify these practices and attributes, thus providing K-12 technology leaders clarity and guidance during a tumultuous educational landscape. Further, the theoretical frameworks and literature review discussed provide K-12 leaders with research-based actionable steps to lay the foundation for a system-wide technological transformation and shift during a time of change and uncertainty. Additionally, the teacher perspectives from this study provide a lens to understand what teachers view as being needed from their school leaders to encourage, support, or require them to use technology in curricular and engaging ways.

The findings from this study also exposed the second theme of systems thinking. Findings revealed that K-12 technology leaders must establish processes (e.g., collaboration and team learning) and establish systems structures (e.g., technology coaches; bandwidth and Wi-fi capabilities; help desk support; 1:1 devices) that foster success with technology integration efforts . Accordingly, a systems thinking approach (Senge, 2006) that includes the development of professional capital (Hargreaves & Fullan, 2012) may assist schools and districts in establishing and sustaining an effective instructional technology plan during a culture of change. Additionally, as the COVID pandemic prompted teachers to adopt and employ instructional technology methods and

tools, accountability for its use and effectiveness is needed. Therefore, K-12 Technology leaders and teachers will benefit from adapting and utilizing models that are guiding, evaluative, and reflective such as the ISTE standards, and the SAMR and TPACK evaluative models. The researcher also discovered that contract language regarding instructional technology expectations did not exist in both district's teacher contracts. This accountability aspect to contract language may need to be revisited in future labor management conversations in order to hold teachers more accountable with instructional technology expectations.

Lastly, the findings from this study revealed a third theme that focused on communication. The communication domain included, sharing helpful technology resources with teachers, communicating technology goals or expectations, and utilizing committees as a form of collaboration and communication among stakeholders. This finding provides K-12 technology leaders with an understanding of the different facets of communication, which may assist them with engaging in collaborative efforts with key stakeholders.

Conclusion

After interviewing and listening to the stories of leaders and teachers from both participating districts, the researcher identified several conclusions: a) technology leaders must portray interpersonal skills to gain the trust of teachers; b) technology leaders must establish collaborative learning environments for teachers; c) the availability of instructional technology coaches are necessary for schools to be able to increase teachers' comfort levels with instructional technology and effectively support teachers' ongoing growth with technology integration; d) basic system needs (e.g. bandwidth; Wi-Fi;

technology budget) and structural elements (e.g. technology committees; integral positions and departments) are essential foundational aspects of the technology infrastructure within a school system. Ultimately, it was determined that leader and teacher perceptions offered valuable insight on the dynamics of leadership and systemic factors that contribute to effective technology integration practices.

Since teachers are considered key agents of school, it is also necessary and essential for technology leaders to build a supportive system for teachers to be able to learn, progress, and grow with instructional technology. The main role of technology leadership today is to mobilize the collective capacity of teachers to challenge difficult circumstances (e.g., remote/hybrid teaching). This involves K-12 technology leaders cultivating professional capital (Hargreaves & Fullan, 2012) within Senge's five disciplines of learning organizations (Senge, 2006). The human and social element of Fullan's professional capital theory strengthens and reinforces the dynamics of Senge's systems thinking in collaborative and efficient ways. In times of ambiguity and drastic change within education, systems thinking that involves fostering, leveraging, and elevating the knowledge and learning of others within schools and districts becomes ever more essential.

Conclusively, creating a system that nurtures teacher's growth with technology, and providing a framework for consistent collaboration and communication among stakeholders were found to be vital components for a functional, efficient, and effective instructional technology environment in schools. In a technology age that is evolving rapidly, it has become imperative and necessary to continue understanding the depth of influence that leadership practices and systems and structures have on technology

implementation and adoption at the K-12 school level. Only then, can educational leaders establish and sustain the means to experience success with technology implementation initiatives.

APPENDIX A: IRB APPROVAL

Federal Wide Assurance: FWA00009066
Nov 24, 2020 9:32:54 AM EST

PI: Gustavo Loor
CO-PI: Catherine DiMartino
Ed Admin & Instruc Leadership

Re: Expedited Review - Initial - IRB-FY2021-190 The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level during a time of change

Dear Gustavo Loor:

The St John's University Institutional Review Board has rendered the decision below for The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level during a time of change. The approval is effective from November 23, 2020 through November 22, 2021.

Decision: Approved

PLEASE NOTE: If you have collected any data prior to this approval date, the data must be discarded.

Selected Category: 7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research

employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Sincerely,

Raymond DiGiuseppe, PhD, ABPP
Chair, Institutional Review Board
Professor of Psychology

Marie Nitopi, Ed.D.
IRB Coordinator

APPENDIX B: LETTER OF CONSENT (LEADERS)

ST. JOHN'S
UNIVERSITY

School of Education
Department of Administrative and Instructional Leadership
(Fall 2020)

Letter of Consent (Leaders)

Title of Research Topic: The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level amid COVID

Researcher: Gustavo M. Loor

Institution: St. John's University, Queens, NY

You are invited to participate in a study that explores the impact that leadership practices, and systems and structures have on technology integration within the fabric of schooling amid the current COVID pandemic. This study will be conducted by Gustavo M. Loor, a current third year doctoral student at St. John's University. As part of this study, the researcher will be interviewing district and building leaders in your district regarding the different practices, and systems infrastructure that influence technology integration in the classroom during the current remote teaching landscape. The purpose of the study is to understand your experiences with technology adaptation and perception on leadership practices and systems design as it relates to effective technology integration within your school district.

If you agree to participate, you will be asked to complete a brief questionnaire and participate in an individual interview. The interview will consist of a series of short open-ended questions provided by the researcher. The session should take approximately 30-45 minutes and will be audio or video recorded using a digital video conferencing platform (Zoom or Google Meet) at a designated date and time.

There are no perceived risks involved with participation in this study beyond those of everyday life. However, I will be asking you to give up some of your valuable time. The benefit of participation in this study will be that your perceptions and experiences will assist school and district leaders in establishing a system framework necessary to provide students with a learning environment that supports adequate technology integration and

21st century skills, especially during unprecedented times amid COVID.. If you choose to participate, you may withdraw from the study at any time without explanation or penalty. Refusal to participate or discontinue participation will involve no penalty or loss of benefits to which you are otherwise entitled.

Your identity as a participant will remain confidential. Your name and the name of your school building or district will not be disclosed or included in any forms, transcription, data analysis, or research findings. Pseudonyms will be utilized. This consent form is the only document identifying you as a participant. It will be stored securely by the researcher and data collected will be destroyed at the end of the study. If you are interested in securing a copy of the results, you may contact the researcher. Aggregated results may be published in academic venues to inform educational researchers and practitioners with understanding how to improve technology leadership during the current shift with instructional technology and teaching pedagogy.

If you have questions about the purpose of this research study, you may contact the principal researcher, Gustavo M. Loor, at [redacted] or [redacted]. If you have questions concerning your rights as a human participant, you may contact the University's Human Subjects Review Board at St. John's University at [redacted], specifically [redacted], [redacted], or [redacted], or the researcher's committee mentor, [redacted], at [redacted] or [redacted]. Your participation in this research is voluntary.

Agreement to Participate

Your signature acknowledges receipt of a copy of the consent form as well as your willingness to participate:

_____

Printed Name of Participant

_____ _____

Signature of Participant Date

_____

Printed Name of Researcher

_____ _____

Signature of Researcher Date

APPENDIX C: LETTER OF CONSENT (TEACHERS)

ST. JOHN'S UNIVERSITY

School of Education
Department of Administrative and Instructional Leadership
(Fall 2020)

Letter of Consent (Teachers)

Title of Research Topic: The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level amid COVID

Researcher: Gustavo M. Loor

Institution: St. John's University, Queens, NY

You are invited to participate in a study that explores the impact that leadership practices, and systems and structures have on technology integration within the fabric of schooling amid the current COVID pandemic. This study will be conducted by Gustavo M. Loor, a current third year doctoral student at St. John's University. As part of this study, the researcher will be interviewing teachers across grade levels in your district regarding the different practices, and systems infrastructure that influence technology integration in your classroom during the current remote teaching landscape. The purpose of the study is to understand your experiences with technology adaptation and perception on leadership practices as it relates to effective technology integration within your school district.

If you agree to participate, you will be asked to complete a brief questionnaire and participate in a digital focus group interview consisting of 3 teachers. The focus group session will consist of a series of short open-ended questions provided by the researcher. The sessions should take approximately 45-60 minutes and will be audio and video recorded using a digital video conferencing platform (Zoom or Google Meet) at a designated date and time.

There are no perceived risks involved with participation in this study beyond those of everyday life. However, I will be asking you to give up some of your valuable time. The benefit of participation in this study will be that your perceptions and experiences will assist school and district leaders in establishing a system framework necessary to provide students with a learning environment that supports adequate technology integration and

21st century skills, especially during unprecedented times amid COVID. If you choose to participate, you may withdraw from the study at any time without explanation or penalty. Refusal to participate or discontinue participation will involve no penalty or loss of benefits to which you are otherwise entitled.
Your identity as a participant will remain confidential. Your name and the name of your school building or district will not be disclosed or included in any forms, transcription, data analysis, or research findings. Pseudonyms will be utilized. This consent form is the only document identifying you as a participant. It will be stored securely by the researcher and data collected will be destroyed at the end of the study. If you are interested in securing a copy of the results, you may contact the researcher. Aggregated results may be published in academic venues to inform educational researchers and practitioners with understanding how to improve technology leadership during the current shift with instructional technology and teaching pedagogy.

If you have questions about the purpose of this research study, you may contact the principal researcher, Gustavo M. Loor, at [redacted] or [redacted].
If you have questions concerning your rights as a human participant, you may contact the University's Human Subjects Review Board at St. John's University at [redacted], specifically [redacted], [redacted], or [redacted], or the researcher's committee mentor, [redacted], at [redacted] or [redacted]. Your participation in this research is voluntary.

Agreement to Participate

Your signature acknowledges receipt of a copy of the consent form as well as your willingness to participate:

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

_____
Printed Name of Researcher

_____ _____
Signature of Researcher Date

APPENDIX D: INDIVIDUAL INTERVIEW PROTOCOL

***(Script)**

- **Welcome participants**
  - Thank you for choosing to participate in this educational leader interview. This study will explore the impact that leadership practices, and systems design have on the district's technology integration efforts during the current remote learning landscape amid COVID. I will be the primary researcher in this study. Currently, I am a third-year doctoral student at St. John's University.
- **Purpose of study**
  - The purpose of the study is to understand your experiences with technology adaptation and perception on leadership practices and systems infrastructure within the district as it relates to effective technology integration during the COVID pandemic.
- **Individual interview structure**
  - As an interviewee, you will be asked to complete a brief questionnaire (which you were given already) prior to the individual interview. The interview will consist of 8 short open-ended questions provided by myself. The session should take approximately 30-45 minutes and will be audio recorded using a digital application on my phone.
- **Participant rights**
  - Please be reminded you may withdraw from this interview at any time without explanation or penalty. Refusal to participate or discontinue participation will involve no penalty. Also, be aware that your identity as a participant will remain confidential throughout this study. Your name and the name of your school building or district will not be disclosed or included in any forms, transcription, data analysis, or research findings. Pseudonyms will be utilized instead. The consent form you recently completed is the only document identifying you as a participant, but again, pseudonyms will be used when discussing the research findings.
- **Start the interview:**

1. What factors have influenced your understanding of instructional technology in schools, especially now during the COVID pandemic? (i.e., past coursework; conferences; models or leaders that influence your work)
2. What are some examples of various ways that you have supported instructional technology in your building (or district)?
3. What are some examples of ways that you provide teachers with growth opportunities with instructional technology?

4. What systems or infrastructure are set in place in your building or in the district that assists technology usage remotely and in the classroom? (i.e., devices; internet accessibility; PD opportunities; Tech roles/positions)
5. How have you shared your vision or goals (or district's) regarding technology integration in the classroom, if any)? (i.e., via meetings; within contract language? Specific documents?)
    - When? How often? How was it received?
    - How do you feel about how technology vision or goals are shared or should be shared?
6. Please describe any specific leadership characteristics that you feel may be effective ways to lead as a technology leader.

❖ **Close the interview**

➢ Thank you once again for participating in this interview. Your perspectives and feedback are greatly appreciated and will be very useful in the study. To test for the validity of your responses that I will transcribe, I will soon share the transcriptions of your responses so you can check and confirm for accuracy. Lastly, if you are interested in a copy of the research results, you may reach out to me and I will gladly share my findings.

APPENDIX E: FOCUS GROUP PROTOCOL

***(Script)**

- **Welcome participants**
  - Thank you everyone for choosing to participate in this teacher focus group. This study will explore the impact that leadership practices, and systems design have on the district's technology integration efforts during the current remote learning landscape amid COVID. I will be the primary researcher in this study. Currently, I am a third-year doctoral student at St. John's University.
- **Purpose of study**
  - The purpose of the study is to understand your experiences with technology adaptation and perception on leadership practices and systems infrastructure within the district as it relates to effective technology integration during the COVID pandemic.
- **Focus group or interview structure**
  - **Digital Focus Group:** As a focus group participant, you will be asked to complete a brief questionnaire (which you were given already) and participate in a digital focus group interview consisting of 3 teachers, including yourself. The focus group session will be hosted digitally using a Zoom or Google Meet video conference platform at a designated date and time. The focus group session will consist of 6-7 short open-ended questions provided by myself and should take approximately 45-60 minutes. The digital session will be audio and video recorded using the video conferencing web platform.
- **Participant rights**
  - Please be reminded you may withdraw from this focus group interview at any time without explanation or penalty. Refusal to participate or discontinue participation will involve no penalty. Also, be aware that your identity as a participant will remain confidential throughout this study. Your name and the name of your school building or district will not be disclosed or included in any forms, transcription, data analysis, or research findings. Pseudonyms will be utilized instead. The consent form you recently completed is the only document identifying you as a participant, but again, pseudonyms will be used when discussing the research findings. Also, please keep each other's responses confidential.
- **Start the focus group interview**

1. How does the principal and administration team support the use of technology in your instruction?

2. What are some examples of ways that your building principal provides you with growth and/or learning opportunities with instructional technology? Are any technology integration rubrics used?
3. What systems or frameworks are set in place in your building or in the district that assists you with technology usage remotely and in the classroom? (i.e., devices; internet accessibility; PD opportunities; Tech roles/positions)
4. What things or situations prevent you from integrating technology in the classroom or remotely?
5. How have your building leaders or district leaders shared their vision or goals regarding technology integration in the classroom (if any)? (i.e., via meetings; within contract language? Specific documents?
    - How do you feel about how they share, or should share, their technology vision or goals?
6. Please describe any specific leadership characteristics that you feel may be effective ways to lead as a technology leader.

❖ **Close the interview**

➢ Thank you once again for participating in this focus group interview. Your perspectives and feedback are greatly appreciated and will be very useful in the study. To test for the validity of your responses that I will transcribe, I will soon share the transcriptions of your responses so you can check and confirm for accuracy. Lastly, if you are interested in a copy of the research results, you may reach out to me and I will gladly share my findings.

APPENDIX F: TEACHER RECRUITMENT FLYER

***Survey Monkey hyperlink inside flyer:**

https://www.surveymonkey.com/r/QJPWLPN

ST. JOHN'S UNIVERSITY

INSTRUCTIONAL TECHNOLOGY

ATTN. K-12 TEACHERS...NEED YOUR HELP!!

Looking for teachers from any grade level and subject area in the district to participate in a virtual focus group interview by a doctoral candidate from St. John's University. Participation in this study is strictly voluntary and your identity as a participant will remain confidential. If you have any questions, feel free to contact the researcher at the email found below.

Research Topic: The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level during a time of change

Institution: St. John's University, Queens, NY
Researcher: Gustavo M. Loor

gustavo.loor18@stjohns.edu

If interested, please click on the link below to complete a brief questionnaire from Survey Monkey and the researcher will follow up with you via email.
https://www.surveymonkey.com/r/QJPWLPN

APPENDIX G: INDIVIDUAL INTERVIEW PREVIEW QUESTIONS

ST. JOHN'S UNIVERSITY

School of Education
Department of Administrative and Instructional Leadership
(Fall 2020)

Research Topic: The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level amid COVID

Below, please find the list of questions that you will be asked during the digital focus group panel that will be held at a disclosed date and time. By previewing the questions, my hope is to allow you more time to reflect and be able to respond thoroughly to each question.

Individual Interview Questions (K-12 leaders):

1. What factors have influenced your understanding of instructional technology in schools, especially now during the COVID pandemic? (i.e., past coursework; conferences; models or leaders that influence your work)
2. What are some examples of various ways that you have supported instructional technology in your building (or district)?
3. What are some examples of ways that you provide teachers with growth opportunities with instructional technology?
4. What systems or infrastructure are set in place in your building or in the district that assists technology usage remotely and in the classroom? (i.e., devices; internet accessibility; PD opportunities; Tech roles/positions)
5. How have you shared your vision or goals (or district's) regarding technology integration in the classroom, if any)? (i.e., via meetings; within contract language? Specific documents?)
    - When? How often? How was it received?
    - How do you feel about how technology vision or goals are shared or should be shared?
6. Please describe any specific leadership characteristics that you feel may be effective ways to lead as a technology leader.

APPENDIX H: FOCUS GROUP PREVIEW QUESTIONS

ST. JOHN'S UNIVERSITY

School of Education
Department of Administrative and Instructional Leadership
(Fall 2020)

Research Topic: The impact leadership practices and systems design have on technology implementation and adaptation at the K-12 school level amid COVID

Below, please find the list of questions that you will be asked during the digital focus group panel that will be held at a disclosed date and time. By previewing the questions, my hope is to allow you more time to reflect and be able to respond thoroughly to each question.

Focus Group Questions (teachers):

1. How does the principal and administration team support the use of technology in your instruction?
2. What are some examples of ways that your building principal provides you with growth and/or learning opportunities with instructional technology? Are any technology integration rubrics used?
3. What systems or frameworks are set in place in your building or in the district that assists you with technology usage remotely and in the classroom? (i.e., devices; internet accessibility; PD opportunities; Tech roles/positions)
4. What things or situations prevent you from integrating technology in the classroom or remotely?
5. How have your building leaders or district leaders shared their vision or goals regarding technology integration in the classroom (if any)? (i.e., via meetings; within contract language? Specific documents?
    - How do you feel about how they share, or should share, their technology vision or goals?
6. Please describe any specific leadership characteristics that you feel may be effective ways to lead as a technology leader.

APPENDIX I: DOCUMENT ANALYSIS PROTOCOL

1. Collect relevant publicly accessible documents:
    a. Both district's 2018-2021 Instructional Technology Plan
    b. b. Both districts' most recent teacher bargaining agreement or teacher contract (2020-2021)
    c. c. Board meeting minutes from both district - relevant to budgetary decisions regarding technology in their respective district
    d. d. Both district's website - regarding the availability of technology implementation plans and other technology links or resources for staff, parents, and community
    e. e. Newspaper articles from both districts regarding technology initiatives and achievements
2. Develop an organization and management plan for documents:
    a. Upload documents to Dedoose to store and organize all document data
3. Make copies of original documents for annotation purposes (i.e., memo technique - see below)
4. Assess authenticity of documents
5. Analyze document's purpose and biases
6. Explore background information of documents (if any)
7. Ask questions about document:
    a. Who produced it? Why? When? Type of data?
8. Analyze document content
    a. Data analysis through multiple rounds of descriptive coding
        i. Memo techniques
        ii. Develop theme codes
            1. Noting patterns/themes
            2. Making contrasts/comparisons
            3. Counting technique
            4. Clustering technique

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