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THE RELATIONSHIP BETWEEN PRINCIPALS' PILLARS OF DIGITAL LEADERSHIP ALIGNED VALUES AND ACTIONS AND TEACHER TECHNOLOGY USE

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ABSTRACT

THE RELATIONSHIP BETWEEN PRINCIPALS' PILLARS OF DIGITAL LEADERSHIP ALIGNMENT AND TEACHER TECHNOLOGY USE

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One of the biggest problems facing principals as instructional technology use continues to grow is that most principals are inadequately prepared to become technology leaders, due to both a lack of training and a lack of guidance on how to effectively support teachers as they integrate technology into their classrooms. The purpose of this study was to identify the relationship the Pillars of Digital Leadership, one proposed definition of an effective technology leader, and technology use in the classroom.

Participants in this study will be secondary principals and teachers from three Suffolk County school districts in Long Island, New York. Principals received the Principal Leadership Survey, which determined the level of alignment between their actions and values and the Pillars of Digital Leadership. Teachers received the Instructional Technology Outcomes survey, which determined the frequency and type of technology use in their classroom. Teacher technology use was separated into three distinct categories: administrative and management tasks, planning and delivery of instruction, and student use. Both surveys were designed specifically for use in this study and reviewed by local experts.

The results of this study found that the Pillars of Digital Leadership did not predict teacher technology use in any category.

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Chapter 1: Introduction

Introduction

Technology is increasingly embedded into classroom learning: 78% of elementary students, 69% of middle school students, and 49% of high school students reported regularly using a tablet in school in 2015, and schools' technology expenditures have risen by nearly 300% in the last three decades (Gosmire & Grady, 2007). Additionally, 58% of principals that responded to a Speak Up (2015) survey agreed that effectively using instructional technology is extremely important to student success. Despite the rapid expansion of technology use and the admitted importance of the successful use of technology for learning, very little is known about how to lead and foster technology implementation in schools.

Principals have long been acknowledged as building and instructional leaders. As the leaders, principals set the tone for the building, creating expectations and developing the overall culture of the school. An effective (or ineffective) principal has a significant impact on all aspects of the school, ranging from instruction and student achievement, to things like teacher professionalism and collegiality. As schools begin to implement instructional technology, the onus falls on the principal to take on a leadership role in this new endeavor.

Unlike previous changes in schools, principals tend to be unprepared and unqualified to become technology leaders in their schools. In the past, principals might have been able to rely on their past experience as a classroom teacher or assistant principal as they made changes to instructional programs or building routines. With instructional technology, however, principals are often lacking in the background knowledge necessary to effectively take on a leadership role.

This lack of knowledge is exacerbated by two factors. First, there is lack of consensus regarding effective technology leadership (Gurr, 2004). There are many different, sometimes conflicting, definitions of how a principal can be an effective technology leader. In other words, principals may not clearly understand what is being asked of them in this new role. Second, there is a lack of available training and research on becoming a technology leader (McLeod & Richardson, 2011). Principals have been left to take on a role that is poorly defined, without any available training or guidance on how best to meet these new expectations. It is important, then, to properly identify best practices for effective technology leaders.

Purpose of the Study

This study seeks to evaluate whether the Pillars of Digital Leadership, defined below, is an effective set of guidelines for principals in their role as technology leaders. Specifically, I will measure the alignment of principals' with the Pillars of Digital Leadership and explore how those the pillars associate with technology use by teachers in the classroom. If the degree of alignment between principal's and the Pillars of Digital Leadership significantly predicts teacher use of technology, that will provide validity to the use of this technology leadership framework

Theoretical Framework

This study is built on the premise that principals are integral to change within schools. Fullan's (2004) theory of the culture change principal shows that in order to create sustainable, long-term change, a principal's focus must be on developing the capacity and abilities of the people who make up the organization. The values and actions that a principal brings to his/her leadership, then, must be other-directed, focused on the betterment of the teachers and staff members that make up the school.

In order to support technology use—the focus of this study—principals must model technology use in their own work. Sheninger's (2014) Pillars of Digital Leadership provides one set of guidelines for becoming a technology leader. It outlines a set of seven pillars that describe behaviors that a technology leader should value and model for his/her staff: Communication, Public Relations, Branding, Professional Growth and Development, Increasing Student Engagement and Enhancing Learning, Rethinking Learning Environments and Spaces, Discovering Opportunity.

Communication. Communication is one of the most important skills for principals to master (Hoyle, English, & Steiffy, 1998). The communication pillar focuses on a principal's ability to leverage technology to communicate effectively and in real-time, using free web-resources such as Twitter and Facebook. A digital leader communicates effectively through a blending of traditional and technological methods, with a focus on social media (Sheninger, 2014).

Public Relations. Public relations focuses on controlling information to shape the narrative around the school. A digital leader uses social media to develop a positive relationship with the community, through sharing success stories and showcasing achievements within the school (Sheninger, 2014). A principal who is particularly strong in this pillar is able to leverage social media to develop strong relationships with the community.

Branding. Branding refers to the ways in which a principal can use social media to curate an image, both of the school and of him/herself as a professional. The goal is for the public to develop positive associations and expectations with the school, much in the same way that the public has expectations when they think of brands in business

(Sheninger, 2014). A digital leader uses social media, again, to develop this brand through projecting their desired image through the information that they share.

Professional growth and development. Professional growth and development are focused on a leader's ability to connect with other educators through social media and other online platforms, creating a digital Professional Learning Network that expands far beyond the physical space of his/her school building. Digital Leaders use social media to increase their exposure to and opportunity for professional learning, connecting with other educators and professionals to learn anytime from anywhere (Sheninger, 2014). A digital leader, then, takes those resources, shared insights and conversations and incorporates them into his or her school and daily work, while constantly staying connected to the PLN that he or she has developed.

Increasing student engagement and enhancing learning. The most important function of a school leader is to ensure the success of students. For a digital leader, that means establishing a vision and strategic plan for what technology use and digital learning will look like in the school (Sheninger, 2014). Digital leaders focus not on technology for the sake of technology, but rather on the pedagogical shifts that technology allows. Digital leaders also focus on a set of essential skills, rather than specific curriculum topics or facts, including creativity, collaboration, communication, critical thinking and problem solving, entrepreneurism, global awareness, technological proficiency, digital media literacy, and digital citizenship (Sheninger, 2014). A focus on these essential skills, combined with the resources and tools made available by instructional technology, lead to more opportunities for authentic learning that has

application to the real world and, thus, an increase in student engagement and achievement.

Rethinking learning environments and spaces. Similar to the Pillar of Increasing Student Engagement and Enhancing Learning, this aspect of digital leadership asks a leader to rethink traditional methods of classroom organization and design and embrace trends from outside of the realm of education. Digital leaders should critically reflect on and analyze the learning spaces in their buildings asking themselves if traditional spaces are conducive to modern day learning goals (Sheninger, 2014). By focusing time and resources into the learning environment, leaders can make sure that classrooms lend themselves to authentically engaging students.

Discovering opportunity. Digital leaders (Sheninger, 2014) leverage social media—particularly Twitter—to develop strategic partnerships. The connectedness of a digital leader allows for cost-efficient opportunities of various kinds: university partnerships, in which school districts connect with departments at local university for learning opportunities for either teachers or students; experiential learning partnerships, which are designed to maximize student learning through experts in the field; intraschool partnerships, that allow schools to collaborate and support each other in the effort to develop leaders, learners, scholars and citizens; corporate/community partnerships, in which school districts work with local businesses or corporations to achieve educational goals or gain funding for initiatives; mental health partnerships, that allows students easy access to support agencies that tend to the foundational needs of students who might not be able to reach them otherwise. Opportunity arises through a digital leader's ability to be connected, leveraging social media to forge connections.

For the purposes of this study, Branding and Public Relations have been excluded. These two pillars play an important role for a digital leader in leveraging technology to support the overall success of the school, however, they play little role in encouraging teachers to bring technology into the classroom, given they focus on relationships outside of the school district. The remaining five pillars provide principals with ways to encourage teacher technology use through their own practice—by modeling technology use, promoting ongoing professional learning, designing learning spaces that are aligned with digital learning, creating learning opportunities outside of the school building, and shifting the instructional focus away from traditional content and toward 21st century skills. Theoretically, a principal who is aligned with the Pillars of Digital Leadership is one who, through their values and actions, encourages teachers to bring technology into their classrooms.

Significance of the Study

As 1:1 or BYOD programs become more ubiquitous, this study hopes to provide principals with a clearly identified set of leadership skills that do and do not correlate with technology use in the classroom. This information will help principals allocate time and resources to specific actions that have demonstrated value in terms of supporting and encouraging teachers to effectively use technology in their classroom.

Research Questions

This study will collect principal and teacher survey data and use a combination of linear and mixed model regressions to answer four research questions.

1. Are teacher technology use outcomes in one category associated with technology use in the other categories?

2. Is any Pillar of Digital Leadership a stronger predictor than the others of the frequency and/or kind of technology use in the classroom?
3. Does a teacher's grade level or years of experience predict technology use in any of the technology use categories?
4. Does a teacher's subject area predict technology use in any of the technology use categories?

Definition of Terms

1:1 Program: a technology initiative in a school district in which all students are assigned a mobile device by the district and expected to bring it to and from school each day.

Bring Your Own Device (BYOD) Program: a technology program in a school district in which students are expected to bring their own mobile device to and from school each day. While a device is not provided for the student, they are still expected to have one in order to participate in class.

Instructional Technology: refers to technology, either hardware or software, being used with the delivery or planning of instruction as its goal.

Chapter 2: Literature Review

Introduction

This chapter is presented in four sections. The first section provides some context on Sheninger's Pillars of Digital Leadership, connecting this theory to other concepts and standards regarding principal leadership and technology. The second section explores the necessity for principals to spearhead change in schools, along with a look at their ability to do so. The third section explores various attempts to develop a definition of technology leadership. The fourth and final section looks at the ways in classroom technology use can be measured.

Review of Related Literature

Defining an Effective Principal

It has long been understood that the principal plays a crucial role in the change process in schools. Without an effective principal at the helm to maneuver the many pitfalls of implementing change, it is quite difficult for any meaningful or long-lasting change to take hold in schools. Multiple studies have demonstrated that the quality of leadership is one of the most important factors in school improvement (Gaziel, 2007; Marzano, Waters, & McNulty, 2005;Fink & Resnick, 2001). The principal's ability to create change expands beyond school improvement, as schools with strong leaders have been more likely to successfully implement reforms to school culture, teacher professionalism, curriculum and assessments (Demski, 2012; Newmann, King, & Youngs, 2000). The principal, then, plays an integral role in determining the success or failure of change in schools.

In today's school culture, the principal has taken on many more responsibilities than in the past. Principals today lead professional development, engage in data analysis,

work with committees to make decisions, and are required to have a deep understanding of the latest trends and research in education (Barnett, 2004). These new responsibilities have shifted the role of principal from manager to instructional leader, someone who works with teachers to ensure the best possible learning outcomes for students rather than simply ensuring that the building runs smoothly and efficiently (DuFour, 1999; Fink & Resnick, 2001). With these expanded expectations for what it means to be a principal comes a need for a definition of leadership that empowers principals to fulfill all these roles.

Fullan (2002) however, argues that defining principals as instructional leaders does not go far enough in fulfilling the roles of the position. Defining effective leadership solely as instructional leadership puts the focus too much on academics—achievement on exams—and not enough on developing skills that are critical to student success outside of the classroom, particularly problem solving and critical thinking. The focus of the instructional leader is too narrow to develop change that can produce transformative, sustainable results. Rather, Fullan purports that school leaders must become culture change principals, principals who are focused on the people who make up the school and developing relationships and systems that promote change and improvement of the organization (Fullan, 2002). A culture change principal can have a deeper and more lasting impact on the school because his or her focus expands beyond the outcomes of standardized exams or test scores.

Fullan describes his five components of a culture change principal as: moral purpose; understanding change; relationship building; knowledge creation and sharing; and coherence making. The common thread between principals as instructional leaders

and culture change principals is the desire to increase student achievement and improve schools, but the path for a culture change principal is vastly different than the route taken by a principal fulfilling the role of instructional leader. These leadership components hope to increase student achievement by creating a culture of reform, in which teachers, administrators and students develop the capacity for learning and changing. The focus on people is meant to make the change sustainable, even when there is a change in building leadership. Once a culture of change is developed, future change becomes easier (Fullan, 2002).

Other research has also shown that the expectations for the role of the principal have expanded well beyond the scope of instructional leader. Teachers' perspectives on what makes an effective leader now include promoting teacher self-reflection and encouraging teachers to engage in continuous professional learning (Thompson, 2017). Other studies have found that supporting and developing people is crucial to becoming an effective school leader (Heck & Hallinger, 2009);(Darling-Hammond & Richardson, 2009). This idea of shifting the focus of principals away from strict instruction to professional development is also seen in the works of Fullan (2002), Leithwood, Seashore, Anderson & Wahlstrom, (2004), and Zhan, Lin and Foo (2012), all of whom concluded that the most effective principals are the ones who develop professional capacity in their teachers and promote a school culture that is accepting of change.

An area of concern arises, however, when leaders start to think about leading technology-based change in their schools. Technology leadership has been shown to be an integral part of effective technology integration in schools (Anderson & Dexter, 2005). This study found that due to the large impact that leadership can have on instructional

outcomes, a principal's technology leadership was even more important than a school's technology infrastructure. The problem lies in the fact that technology change is an area in which current principals feel unprepared and uncomfortable taking on leadership roles (Burns, 2013; Masullo, 2017; Sheninger, 2014; McLeod & Richardson, 2011). Further, there is a lack of guidance for principals to become technology leaders. McLeod & Richardson (2011) found that between 1997-2009, the top journals on leadership, and those that were cited most often by authors in the top journals, included only 43 articles related to the topic of school technology leadership. And, with the demands of a position that is vastly different from that of a classroom teacher, it is difficult for a principal to stay current on the latest and most effective instructional technology tools available (Masullo, 2017).

Despite these limitations, school leaders understand that they play an important role in technology integration. Principals have reported that they see technology integration as very important to student success (Speak Up, 2015) and that a successful integration is more likely if the principal sees him or herself as a technology leader (Demski, 2012). These identify a clear need for a definition of technology leadership that can aid principals as they support teachers using instructional technology in the classroom. Principals understand the importance of becoming technology leaders, yet they lack proper training and support resources to effectively take on this new role. The next section will review the literature on technology leadership, as well as looking at some proposed definitions.

Principals as Technology Leaders

The nineteenth century saw schools preparing students to meet the demands of the manufacturing industry, as a response to industrialization and the rapid growth of

manufacturing in our country. Today's students are entering a technology-driven world, needing to learn how to access and parse digital information. Schools and school leaders are left with no choice but to embrace this change in the name of student learning and achievement (Sheninger, 2014). While the need to embrace technology change in schools is obvious, there is no consensus on what it means to be an effective technology leader (Gurr, 2004). The remainder of this section will look at four attempts to build a definition of effective technology leadership.

O'Dwyer, Russel & Bebell (2004) sought to identify characteristics of schools and districts that correlated with teacher technology use. Based on their findings, they recommended that school leaders supporting technology needed to make sure that technology was readily available for use, teachers were given adequate time for collaborative planning, and that there was effective and ongoing professional development regarding teaching with technology. Schools that provided poor or infrequent professional development saw the least use of technology by teachers. An effective technology leader, by this definition, is rather simple: someone who makes technology available and provides ongoing and effective professional development for teachers.

A different approach to identify important technology leadership characteristics was taken by Chang, Chin, & Hsu (2008). Rather than looking at school or district characteristics, this study looked at teacher perceptions of the technology leadership abilities of principals. Technology leadership was broken up into five dimensions—interpersonal and communication skills; technology infrastructure and support; staff development and training; vision, planning and management; evaluating and research—to

better identify the different aspects of leadership and their effects on technology use. This study found that all five of the dimensions were important to a successful technology leader, with interpersonal and communication skills being the most important. A successful technology leader, according to this study, is someone well-versed in all of these dimensions, someone who is able to articulate a vision, train and encourage professional development, provide adequate support and resources, and understand that technology is only piece of a performance assessment for teachers.

A third approach by Oliver, Mollette, & Corn (2012) built a definition of technology leadership through interviews with administrative teams who were part of successful technology integrations. These teams were comprised of principals, district technology directors, school technology facilitators and school media coordinators who were part of technology rollouts. Based on interviews with the participants, the researchers proposed a definition of technology leadership with five components: instructional leader, motivator/change agent, technician, purveyor of resources, and evaluator. A successful technology leader by this definition is, again, versatile and multi-faceted, being able to understand the software and digital resources that are available; provide adequate time for professional development and collaboration; have an understanding of managing technology; balance budgetary needs for long-term sustainability; and establish goals and methods for assessing programs and progress.

In contrast to the prior three definitions, Avolio and Kahai (2003) propose a definition of technology leadership, called e-Leadership, rather than building a definition based off of describing leaders in schools that use technology. Similar to previous definitions, Avolio and Kahai offer four behaviors that they argue will successfully

develop relationships in a digital-age organization: balance the traditional with the new; communicate your intent; use the technology to reach out and touch others; use the technology to deal with greater diversity. An e-Leader, then, is someone who is able to blend new technology with past practice, use technology to communicate effectively, leverage technology as a tool for motivation and inspiration and, finally, use technology to bridge cultural and other differences in the school community.

All of the reviewed definitions placed an emphasis on communication and professional development. Similarly, they all require leaders who are versatile and flexible in their abilities, able to take on many roles and fill many needs. There are, however, some important differences between all of these definitions that could create problems for principals. For example, the definition proposed by Chang, Chin, and Hsu (2008) emphasizes principals being able to manage technology themselves while O'Dwyer, Russel, and Bebbel (2004) say that principals need simply to ensure that there is support available for technology-related problems. Oliver, Molette, and Corn (2012) was the only study to mention the long-term planning necessary to create a sustainable technology program, as well as the need for a means to determine the efficacy of technology programs in schools. These differences demonstrate that there is no clear, coherent definition for what it means to be a technology leader, despite some similarities between various attempts to determine best practice.

The Pillars of Digital Leadership

While the definitions of digital leadership outlined in the previous section are primarily descriptive—built from observing leaders in schools that are using technology—Sheninger's Pillars of Digital Leadership offer a definition of digital leadership that is not only grounded in practice, but is also closely aligned with

professional standards for educational leaders (Sheninger, 2014). They are meant not only for leading technology change, but as a means of leveraging technology to make changes that improve schools. Each individual pillar represents a specific way in which leaders can meet the increasing demands for technological fluency and integration in schools.

For the purposes of this study, the Pillars of Digital Leadership being studied are communication, professional growth and development, increasing student engagement and learning, rethinking learning environments and classroom spaces, and discovering opportunity. While all of the pillars are important for a digital leader leveraging technology for the success of the school, these five are the most directly involved in supporting and encouraging teachers as they bring technology into their classroom.

Similar to Fullan's culture change principal, the Pillars of Digital Leadership guide principals to leverage technology to create systemic change in schools. Each pillar is focused on values or actions of a principal that promote the development, growth and learning of others, whether it is students, teachers or community members. That kind of other-directed focus lines up with the values of the culture change principal, who strives to develop long-lasting, sustainable change by building the capacity of the people who make up the school community. Both theories are grounded in developing a culture of empowerment, support and embracing new ideas as the ways to bring about sustainable change in schools. A principal who aligns his or her actions and values to the Pillars of Digital Leadership begins the change process by modeling the things that are expected of teachers. An effective leader, then, in this context, uses technology to develop a capacity for change in teachers.

What sets this definition of technology leadership apart from others is that it connects easily with other national standards and frameworks for leadership and school improvement, including: the International Society for Technology in Education (ISTE) NETS-A Standards, the National Association of Secondary School Principals (NASSP) Breaking Ranks Framework, and the National Policy Board for Educational Administration's (NPBEA) Professional Standards for Educational Leaders.

ISTE has been a trusted organization for technology-related curriculum and resources since its inception in 1979 (Johnstone, 2003). The ISTE Standards for Education Leaders are specifically designed to highlight best practices for administrators working to support technology use in their schools (International Society for Technology in Education, 2018). Created through collaboration among leaders in the field of Instructional Technology, these standards describe five focus areas for school leaders that are important to successfully support technology use and digital-age learning. These include using technology to: increase equity and access, creating a vision, plan, and evaluation cycle for learning with technology, empowering teachers to innovate with technology, develop systems to implement and improve technology use, and promote continuous professional learning (International Society for Technology in Education, 2018). The Pillars of Digital Leadership share these same values, embedding the virtues of the ISTE standards within the definition of technology leadership. Table 1, below, shows how the ISTE standards map to the Pillars of Digital Leadership.

Table 1. ISTE Standards for Educational Leaders and Pillars of Digital Leadership

Pillar of Digital Leadership	ISTE Standard
Communication	1, 2, 4, 5
Professional Growth and Development	2, 3, 5
Student Engagement and Learning	1, 2, 3, 4
Learning Spaces and Environment	1, 2, 4, 5
Opportunity	1, 2, 5
Branding	1, 5
Public Relations	1, 5

Note: ISTE Standard 1 is Equity and Citizenship Advocate,; ISTE Standard 2 is Visionary Planner, ISTE Standard 3 is Empowering Leader, ISTE Standard 4 is Systems Designer, ISTE Standard 5 is Connected Leader

While the ISTE Standards are focused specifically on supporting technology use and digital learning, the NASSP Breaking Ranks Framework is designed to address school improvement more broadly. This framework is meant to improve student learning, by helping schools to develop stronger relationships, creating a learning environment that is more conducive to student achievement. (National Association of Secondary School Principals, 2014). Rather than laying out a specific model for schools to follow, this framework asks leaders to use data from their own school to customize a school improvement plan that is tailored to the specific needs and culture of the school by focusing on three overlapping areas when implementing change for the purposes of improving student performance: collaborative leadership; personalizing the school environment; curriculum, instruction and assessment. In addressing these areas, however, leaders must be sure that it is done in a manner that is fitting to the specific needs and culture of their school (National Association of Secondary School Principals, 2011). Due to the open-ended nature of this framework, school leaders can easily incorporate technology as a tool for driving change, or technology use as a goal for school improvement.

Digital leaders, aligned with the Pillars of Digital Leadership, leverage technology as the means for igniting the types of change detailed by Breaking Ranks (Sheninger, 2014). That is, while Breaking Ranks provides an outline for ways that leaders can think about change, digital leaders use technology as means of implementing that change for the purposes of increasing student achievement. The Pillars of Digital Leadership can be used to achieve the goals of the Breaking ranks framework. Table 2, below, shows how the Breaking Ranks Focus Areas are aligned with the Pillars of Digital Leadership.

Table 2: Breaking Ranks Focus Areas and Pillars of Digital Leadership

Pillar of Digital Leadership	Breaking Ranks Focus Area
Communication	Collaborative Leadership (CL)
Professional Growth and Development	CL, Curriculum, Instruction and Assessment (CIA), Personalizing the School Environment (PIA)
Student Engagement and Learning	CL, CIA, PER
Learning Spaces and Environment	CL, CIA, PER
Opportunity	PER
Branding	CL
Public Relations	CL, PER

If the ISTE standards represent guidelines for leaders implementing technology change and Breaking Ranks provides a framework for school improvement, the National Policy Board for Educational Administration's (NPBEA) Professional Standards for Educational Leaders are meant to describe best practice in educational leadership. The NPBEA describes their standards as, providing an outline for foundation principals of leadership and as being designed to help leaders meet all the challenges associated with the role (National Policy Board for Educational Administration, 2015). The 10 standards that form the NPBEA Professional Standards for Educational Leaders are guidelines for

directing professional practice. They are: Mission, Value and Core Values; Ethics and Professional Norms; Equity and Cultural Responsiveness; Curriculum, Instruction and Assessment; Community of Care and Support for Students; Professional Capacity of School Personnel; Professional Community for Teachers and Staff; Meaningful Engagement of Families and Community; Operations and Management; School Improvement. These standards echo the Pillars of Digital Leadership, placing value on equity, instruction, professional learning, and supporting student learning. Particularly, the NPBEA Standards espouse the efficacy of distributed leadership and student-centered learning, both of which are critical aspects of the Pillars of Digital Leadership. Table 3 shows how the NPBEA Standards match up with the Pillars of Digital Leadership.

Table 3. NPBEA Professional Standards and Pillars of Digital Leadership

Pillar of Digital Leadership	NPBEA Professional Standard
Communication	1, 2, 7, 8
Professional Growth and Development	1, 2, 6, 7, 9, 10
Student Engagement and Learning	2, 3, 4, 5, 6, 10
Learning Spaces and Environment	3, 4, 5, 8
Opportunity	4, 5, 6, 7, 8
Branding	1, 3, 8, 9
Public Relations	1, 3, 8, 9

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

As such, the Pillars of Digital Leadership provide a well-rounded, research-based and standards-aligned outline for becoming a technology leader. They stand out as a

model for technology leadership due to their alignment with widely-accepted standards, frameworks and best practices for school improvement and change. The Pillars, then, lend themselves to being used as a guideline for supporting and promoting technology use in school or layered over a set of standards or framework for school improvement as a means for leveraging technology to achieve a goal.

Measuring Teacher Technology Use

The concept of instructional technology has changed drastically over the past two decades. Congress spearheaded the first attempts to define how technology was being used in schools by tasking the federal Office of Technology Assessment (OTA) to develop reports on patterns of technology use in schools (Office of Technology Assessment, US Congress, 1988, 1989, 1995). The 1995 OTA report noted that there were many different definitions of technology use, making it difficult to report accurate data. Since 1995, there have been even more frequent and drastic changes both to the quality of technology and its availability. Not only have teachers been able to incorporate ubiquitous access to the internet into their instruction, they now had additional resources when planning and access to email, increasing communication with colleagues, parents, and students (Becker, 1999; Lerman, 1998). Due to the rapidly changing nature of technology, research has lacked a clear definition of what exactly is meant by the term "teachers' use of technology" (Bebbel et al., 2004). This section will review the attempts of multiple studies to build a quantitative definition of teachers' technology use.

The most common thread throughout the research on defining teachers' technology use is the need for multiple categories of technology use (Bebbel et al., 2004; Becker, 1999; Hogarty, Lang, & Kromrey, 2003; Russel, O'Dwyer, & Bebbel, 2003). While each of these studies takes a different approach and, in the end, offers differing

findings on the best way to define technology use, they all advocate for incorporating multiple categories of technology use, allow researchers to capture the wide variety of tasks for which . A multiple categories approach, then, will provide a more accurate picture of not just how often technology is being used, but the purpose for which it is used.

In order to identify how teachers were using technology, Becker (1999) offered the first breakdown of technology use into categories. In his survey of more than 2,000 teachers of grades 4-12, technology use was broken down into four categories: teacher use in lesson preparation; teacher use in professional communications; teacher-directed student use for information gathering; and, student projects and publishing. By separating technology use into categories, Becker was able to offer a glimpse into how exactly teachers were using technology in their classroom, rather than just showing how often it was being used.

Across two studies, Bebbel, Russel, and O'Dwyer (2003, 2004) sought to quantitatively define measures of teacher technology use for the purposes of identifying ways that teachers use technology professionally, as well as the relationships between a teacher's comfort level and beliefs about technology with their use. The results of the 2003 study demonstrated the need for defining categories of use. They were unable to differentiate a teacher who reported using email or performed other administrative tasks with technology from a teacher who infused technology into their instruction. Their 2004 study, however, offered seven distinct categories of technology use: accommodation; delivery; professional email; preparation; student use; student products; grading. With

these in place, the researchers were able to more clearly identify the kinds of technology use in the classroom, along with examining correlations between categories.

The need for multiple categories of technology use was again demonstrated by Hogarty, Lang, and Kromrey (2003). This study broke technology use into four domains: integration, the amount that teachers use technology in instruction; confidence and comfort, which assessed teacher confidence levels regarding technology use; computer support, which measured professional development and other aspects of technology support available to teachers; attitudes towards computer use, assessing teachers feelings and perceptions towards teaching with technology. These domains were then broken down into further subcategories of each.

To further measure the integration domain, technology use was broken out into the subcategories of types of software used and the frequency of computer use in school. This mirrors the breakdown seen in other studies, separating technology use into kinds of use and frequency of use to generate a more accurate depiction of how teachers are using technology in the classroom. While it does not go quite as in-depth as the other studies in this chapter, this is another example of the need to have specific classifications of technology use in order to obtain accurate measurements.

Conclusion

This section outlined the ways in which the role of the principal has changed, moving away from an instructional leader and towards a culture change principal. This transition is even more important as principals work to support teachers bringing technology into their classrooms, taking on yet another new role as their building's technology leader. The Pillars of Digital Leadership provide a research-based, standards-aligned framework for principals as they take on this new role.

Additionally, this section looked at the history of attempts to define technology use by teachers. By looking at past studies that have taken on this task, it becomes clear that there is a need to define the wide range of technology activities into multiple categories of use.

Chapter 3: Method

Introduction

This chapter will first detail the instruments and intended study sample, as well as the steps for data collection, informed consent and maintaining the confidentiality of participants. It then will review the methods used to analyze the data and how they connect to each of the research questions.

Research Questions and Null Hypotheses

1. Are teacher technology use outcomes in one category associated with technology use in the other categories?

   H_0: There will be no associations between teacher technology use categories.

   $\beta_1 = 0; \beta_2 = 0$ for all $action^P$ where p = {administrative and management tasks, planning and delivery of instruction, student use}

2. Is any Pillar of Digital Leadership a stronger predictor than the others of the frequency and/or kind of technology use in the classroom?

   H_0: None of the Pillars of Digital Leadership aligned values/actions will be a statistically significant predictor of each technology use composite score.

   $$\beta_{comm}^{value} = \beta_{comm}^{action} = \beta_{pd}^{value} = \beta_{pd}^{action} = \beta_{engagement}^{value} = \beta_{engagement}^{action}$$
   $$= \beta_{environment}^{value} = \beta_{environment}^{action} = \beta_{opportunity}^{value} = \beta_{opportunity}^{action}$$

3. Does a teacher's grade level or years of experience predict technology use in any of the technology use categories?

   H_0: Grade level and years of experience will have no statistically significant effect on the frequency or kind of technology use in the classroom.

4. Does a teacher's subject area predict technology use in any of the technology use categories?

    H_0: Subject area will have no statistically significant effect on the frequency or kind of technology use in the classroom.

Instruments

Principal Leadership Survey. The Principal Leadership Survey (Appendix A) was developed by the researcher to assess the extent to which principals' technology-related values and actions are aligned with the Pillars of Digital Leadership. The survey consists of 26 total questions. There are 14 questions regarding a principal's leadership values which are on a four-point Likert scale (Strongly Disagree; Disagree; Agree; Strongly Agree). The 12 questions regarding a principal's actions are also on a four-point Likert scale (Never; Occasionally; Frequently; Very Frequently).

Communication (Pillar 1) was measured by questions 5A, 6A, 6B, 6C, 8A and 8C. Professional Growth and Development (Pillar 4) was measured by questions 4A, 4B, 6D, 7A, 7D and 9B. Student Engagement and Learning (Pillar 5) was measured by questions 5C, 5D, 7E, 10A and 10B. Learning Environments and Classroom Spaces (Pillar 6) was measured by questions 4C, 5B, 7B, 7C and 9C. Discovering Opportunity (Pillar 7) was measured by questions 4D, 7F, 8B, and 9A. The full Principal Leadership Survey is available in Appendix 1. The questions were tied to either the values or actions aligned with a Pillar, as outlined below:

1. Communication – Values (8A, 8C)
2. Communication – Actions (5A, 6A, 6C)
3. Professional Growth and Development – Values (7A, 7D, 9B)

4. Professional Growth and Development – Actions (4A, 4B, 6D)
5. Student Engagement and Learning – Values (7E, 10A, 10B)
6. Student Engagement and Learning – Actions (5C, 5D)
7. Learning Environment and Classroom Spaces – Values (7B, 7C, 9C)
8. Learning Environment and Classroom Spaces – Actions (4C, 5B)
9. Discovering Opportunity – Values (7F, 8B, 9A)
10. Discovering Opportunity – Actions (4D, 6B)

The participants were not made aware of which Pillar each question aligns with. Results from this survey provided insight into how principals' values and actions are aligned with the Pillars of Digital Leadership. Additionally, the survey contains two demographic questions, asking participants to identify if they are the principal of a high school or middle school, as well as the number of years that they have been the principal of their current building.

For the reliability of this survey, Cronbach's Alpha was .741. Further, this survey was submitted to Eric Sheninger, the author of the Pillars of Digital Leadership to review the questions and their alignment with the Pillars of Digital Leadership. Mr. Sheninger provided some feedback on the survey questions and additions were made based on his suggestions. The survey was also reviewed by a panel of five secondary principals who will participate in the data collection for this study. Based on their feedback, additions and revisions were made to the survey questions.

A copy of the final survey is available in Appendix A.

Technology Outcomes Survey. The Technology Outcomes Survey was developed by the researcher for the purposes of this study. The purpose of this study is to identify the

frequency and type of technology use by teachers in the classroom. To differentiate types of technology use, there are three sections: administrative and management tasks, planning and delivery of instruction, and student use. Teachers were asked to respond regarding the frequency with which they use technology for certain tasks on a Likert scale (Never, Occasionally, Frequently, Very Frequently). For reliability of this survey, Cronbach's Alpha was .741.

The Administrative and Management tasks section contains four questions (4A, 4B, 4C, and 4D). The sections on Planning and Delivery of Instruction and Student Use contain the same 12 questions in each section. There are also three demographics questions, asking participants to identify their grade level, years of experience and subject area. This design was modeled after the studies discussed in Chapter 2. Based on prior attempts to measure teacher technology use, the prevailing concept is that the most effective way to develop an accurate understanding of technology use is to separate the kinds of technology use into distinct categories (Bebbel, Russel, & O'Dwyer, 2004; Becker, 1999; Hogarty, Lang, & Kromrey, 2003; Russel, O'Dwyer & Bebbel, 2003). The differentiations in these studies were the basis for the categories used in the survey instrument. In all of the prior research on measuring technology use, kinds of use were separated into teacher use for instruction, teacher use for management and administrative tasks, and student use for learning, though the exact naming of these categories varied between studies.

For the reliability of this survey, Cronbach's Alpha was .756. Additionally, this survey was sent to secondary teachers and administrators from school districts that did

not participate in this study for review. Additions and revisions were made based on their suggestions.

A copy of the final survey is in Appendix B.

Procedures for Collecting and Protecting Data

Prior to distributing surveys to any teachers or principals, I contacted the Superintendent of Schools for districts that have a 1:1 program in their middle and high schools that fit the needs of this study. A letter was sent to these Superintendents detailing the purpose and the scope of the study and asking for permission to conduct this research within their school district. When permission was granted by the Superintendent, the survey was distributed electronically via Survey Monkey to principals and teachers in all secondary schools within the districts. The survey remained open for two weeks, allowing teachers and principals to respond at their convenience. Data was then be transferred from Survey Monkey to SPSS for analysis.

Participation in the study was completely voluntary. Informed consent was obtained via the opening page of the survey. Participants were given information detailing the study, scope, voluntary participation, and confidentiality of information. In order to continue with the study, participants had to acknowledge that they have read and understand the informed consent page. Any teacher or principal who did not wish to participate simply did not complete the survey. Further, participants had the ability to skip any question on the survey, if they preferred not to respond to a particular question.

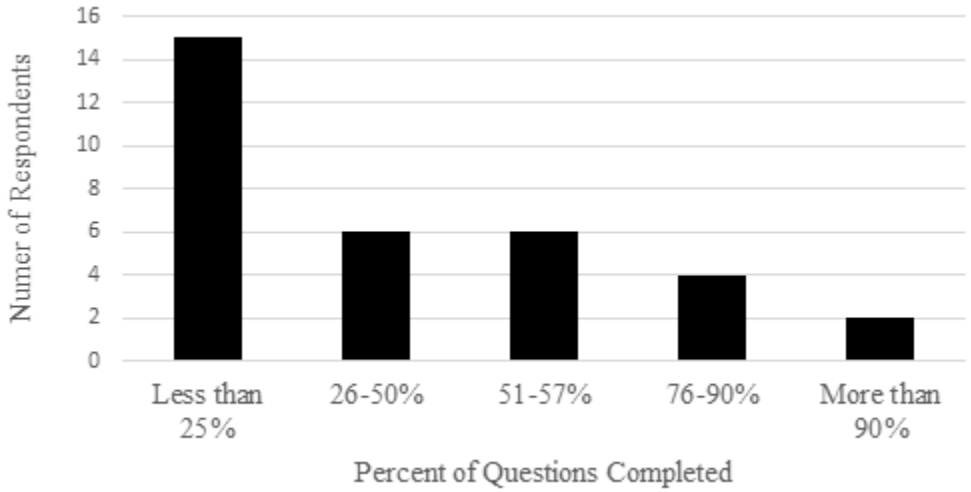
Participant confidentiality was ensured via the design of the survey distribution. Each school and principal received a unique copy of the survey and all responses were merged after the data collection period was over. For example, teachers in School A received a survey titled *Technology Outcomes – School A* and those responses were

filtered into a spreadsheet that was separate from all other schools. All of those responses were labeled as School A before being merged with the data from all other schools. The same steps were taken for each school that was participating in the survey so that no school or district names were used at any point during data collection, while also ensuring that principals and teachers could be linked together during analysis.

Sample and Population

The population for this study included all secondary teachers and principals from three participating school districts in Suffolk County, NY. The survey was emailed to 558 teachers and seven principals. All seven principals completed the survey for a 100% response rate. There were 284 teacher responses. Of those 284, 33 were removed from the sample due to incompleteness. Of the 33 entries that were excluded, 15 completed less than 25% of the survey and two completed more than 90%. Figure 1, below, shows the breakdown of survey completion for all removed entries.

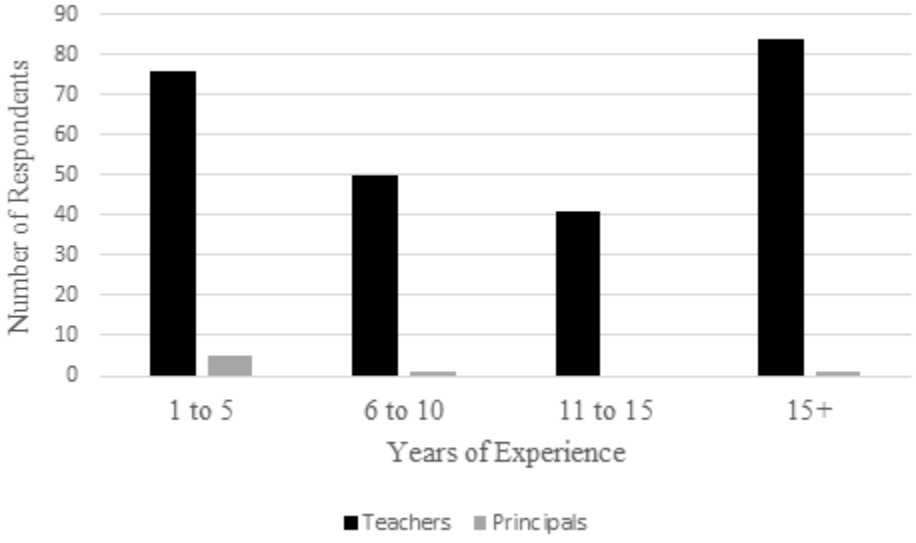
Figure 1. Removed Entries



The remaining 251 teacher responses served as the sample for the purposes of statistical analyses—a response rate of 44.98%.

Of the seven schools that participated, four were middle schools and three were high schools. 157 of the teacher responses were from middle school teachers, while 94 came from high school teachers. Respondents were asked to provide their years of experience. Five of the principals reported being at that school for between 1-5 years; one reported 6-10 years in their school; one principal reported working as the principal of the building for 15+ years. A majority of teachers reported having either 1-5 years of experience (76 responses) or 15+ years of experience (84 responses). Figure 2, below, shows the complete breakdown of years of experience as reported by teachers and principals.

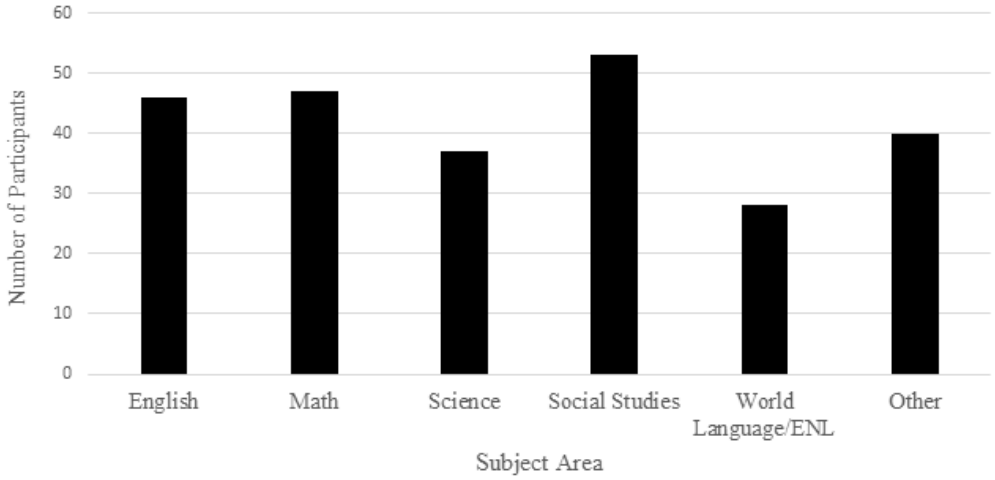
Figure 2. Years of Experience of Participants



Teacher respondents were also asked to provide their subject area. 46 reported being English teachers; 47 were Math teachers; 37 were Social Studies teachers; 53 were

Science teachers; 28 were World Language/ENL teachers; 40 teachers identified as "other" meaning they teach something that does not into any of these categories. Figure 3, below, shows the breakdown of subject areas reported for teacher respondents.

Figure 3. Subject Area of Participants



For the purposes of this study, only secondary schools from the participating districts are included. While there is certainly an increase in the use of instructional technology at the elementary level, there are fewer programs where students bring the devices home and use it the extent that they do at the secondary level. The participants for this study were all secondary principals and teachers from the school districts that are

included. All teachers from all subject areas in grades 6-12 were invited to participate in the study.

Constructing Composite Variables

From each of the surveys, I constructed a series of composite variables by averaging the appropriate item scores. I also constructed a single composite representing values alignment (the average of all the individual values composites) and a single composite representing actions alignment (the average of all individual values composites).

For the Instructional Technology Outcomes survey, I constructed a composite variable for each type of technology use. Each variable was composed of all of the questions from that section of the survey. This will result in the three dependent variables below:

1. Administrative and Management Tasks Composite
2. Planning and Delivery of Instruction Composite
3. Student Use Composite

Each row of data in the analytic file corresponded to a teacher. Surveys of teachers were matched to principal surveys as outlined in the data collection procedure.

Research Design and Data Analysis

Research question one was addressed through a bivariate correlation between all teacher outcome variables. This correlation table helped to identify if there were any relationships between the categories of teacher technology use.

Research question two was addressed through a series of eighteen mixed model regressions. Each outcome variable (Administrative and Management Tasks Composite; Planning and Delivery of Instruction Composite; Student Use Composite) was regressed

on each Pillar of Digital Leadership individually. The results of these regressions identified the Pillars of Digital Leadership that are the strongest predictors of each type of teacher technology use. A sample hierarchical regression equation is shown below:

$$composite_{ij}^{x} = \alpha_{0j} + \mathbf{X_i A} + \epsilon_{ij}$$

$$\alpha_{0j} = \beta_0 + \beta_1\left(action_i^p\right) + \beta_2(value_i^p) + e_j$$

$$\epsilon_{ij} \sim N(0,1); e_j \sim N(0,1)$$

where $composite_i^x$ is the teacher use composite for use *x* (administrative/management, planning/delivery, student), $\mathbf{X_i}$ is a vector of teacher characteristics (years of experience, grade level, etc.), $action_i^p$ is the Pillar *p* action composite score, and $value_i^p$ is the Pillar *p* value composite score for teacher *i* and principal *j*.

A saturated model, including all variables, was not used because the data was not sufficient to support it. Due to the low number of principals involved in the study, multicollinearity could not be ruled out and so a saturated model could not be sustained.

Research question three was addressed through three additional hierarchical regressions. I regressed each teacher outcome variable (Administrative and Manage Tasks Composite; Planning and Delivery of Instruction Composite; Student Use Composite) on years of experience and grade level. The results from these regressions identified the relationship that years of experience and grade level had with technology use in each category.

Research question four was addressed through three more hierarchical regressions. Each outcome variable (Administrative and Manage Tasks Composite; Planning and Delivery of Instruction Composite; Student Use Composite) was regressed

on subject area. The results from these regressions identified if a particular subject area is a better predictor of technology use.

Chapter 4: Results

Introduction

This chapter will review the results of the statistical analyses as laid out in the previous chapter. Findings of the statistical analyses will be discussed, in the context of each research question.

The results of the survey provided a sense of the amount of technology being used by teachers and principals. The minimum score that a teacher or principal could receive in each category is 1.00, while the maximum was 4.00.

On average, the Administrative and Management Tasks category showed the highest use of technology, with a mean score of 2.61. Teachers scored the lowest in the Student Use category ($\bar{x}$ = 2.36).

For principals, the Communication pillar ($\bar{x}$ = 3.43) had the highest mean sore. Generally, the principals scored higher than the teachers. The mean of each pillar, besides Student Engagement ($\bar{x}$ = 2.78), was higher than 3, suggesting that principals were, on average, closely aligned to the Pillars of Digital Leadership. Table 4, below, shows full descriptive statistics for the survey results.

Table 4. Descriptive Statistics of All Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Administrative	251	1.00	4.00	2.6135	.60582
Planning	251	1.00	3.92	2.4771	.45068
Student Use	251	1.00	4.00	2.3622	.52949
Communication	7	2.92	3.84	3.4306	.32870
Professional Learning	7	2.84	4.00	3.2253	.37300
Learning Environments	7	3.00	4.00	3.2870	.31941
Discovering Opportunity	7	2.17	4.00	3.1145	.56579
Student Engagement	7	2.42	3.50	2.7890	.41708

Note: Administrative stands for Administrative and Management Tasks. Planning stands for Planning and Delivery of Instruction. Professional Learning stands for Professional Learning and Growth. Learning Environments stands for Learning Environments and Classroom Spaces. Student Engagement stands for Student Engagement and Learning

Research Question 1

Bivariate correlations were estimated in order to identify any associations between teacher technology use categories. All of the teacher technology-use variables are significantly positively correlated (Table 5). Teachers' use of technology for administrative and management tasks was moderately correlated with their use of technology for planning and delivery of instruction (r=.351, p=.001), but only weakly correlated with their use of technology with students (r=.252, p=.001). Use of technology for planning and delivery of instruction was strongly correlated with teachers use of technology with students, r=.516, p=.001. Table 5, below, shows the full correlation table.

Table 5. Correlation Table Among Teacher Technology Outcomes

Correlations

		Administrative	Planning	Student Use
Administrative	Pearson Correlation	1	.351**	.252**
Planning	Pearson Correlation	-	1	.516**
Student Use	Pearson Correlation	-	-	1

Note: **p<.01. Administrative stands for Administrative and Management Tasks. Planning stands for Planning and Delivery of Instruction.

Practically speaking, these correlations indicate that a teacher who uses technology for one purpose is more likely to use it for other purposes, as well. There was a higher correlation between planning and delivery of instruction and student use than any other combination of teacher use categories. This may result from the integrated nature of these two tasks: when teachers use technology for planning their instruction, they may be more likely to create learning experiences that also require students to use technology, perhaps incorporating many of the instructional technology tools that are used to plan the lesson.

Research Question 2

Research question two explored the predictive power of each Pillar of Digital Leadership for teachers' technology use. This was tested through a series of 6 mixed model regressions per technology use variable (Administrative and Management Tasks; Planning and Delivery of Instruction; Student Use), where teachers are nested in principals. Each teacher outcome variable was regressed on each principal technology variable, which was an average of all values and actions associated with each pillar, (Communication, Professional Growth and Development, Student Engagement and Learning, Learning Environments and Classroom Spaces, and Discovering Opportunity)

separately (five models), and then a single model was estimated, including all of the principal variables together.

Administrative and Management Tasks

Teachers use of technology for administrative and management tasks varied significantly among teachers within (τ_1 =.320) and among schools (τ_2 =.067). These values tell us that even though there are differences between schools, there is even greater variation within schools, meaning that even within a particular school there is significant variation between how teachers are using technology.

The mixed model analysis of this pillar showed no significant relationships with teacher technology use in this category. That is, no pillar was a significant predictor of teachers using technology for administrative and management tasks. The full results of this analysis are displayed in Table 6, below.

Table 6. Mixed Model Analysis of Administrative and Management Tasks with the Pillars of Digital Leadership

	M1	M2	M3	M4	M5	M6
Intercept	2.593***	2.660	2.252	1.225	2.474	1.71
	(.105)	(1.386)	(1.026)	(.970)	(.659)	(.710)
Communication		-.019				
		(.397)				
Professional Learning			.104			
			(.312)			
Learning Environments				.416		
				(.293)		
Discovering Opportunity					.037	
					(.204)	
Student Engagement						.314
						(.250)
Variance of the Intercept	6.7%					
Relative R^2		20.3%	17.3%	5.6%	19.3%	6.1%

Note: ***p <.001. Professional Learning stands for Professional Learning and Growth. Learning Environments stands for Learning Environments and Classroom Spaces. Student Engagement stands for Student Engagement and Learning

Planning and Delivery of Instruction

Teachers use of technology for planning and delivery of instruction varied significantly among teachers within (τ_1 =.188) and among schools (τ_2 =.026). Again, there is much higher variability within schools rather than between them. Although, the between school variance is non-negligible (12% of the total variance in between schools).

The regressions of Planning and Delivery of Instruction showed no statistically significant relationships with any of the Pillars of Digital Leadership. There is no predictive ability of any of the Pillars of Digital Leadership in terms of teacher technology use in the Planning and Delivery of Instruction category. The full results of this analysis are displayed in Table 7, below.

Table 7. Mixed Model Analysis of Planning and Delivery of Instruction with the Pillars of Digital Leadership

	M1	M2	M3	M4	M5	M6
Intercept	2.455***	2.483	2.088	1.642	2.162**	1.971*
	(.061)	(.805)	(.586)	(.970)	(.363)	(.424)
Communication		-.008				
		(.231)				
Professional Learning			.112			
			(.178)			
Learning Environments				.247		
				(.170)		
Discovering Opportunity					.092	
					(.113)	
Student Engagement						.172
						(.149)
Variance of the Intercept	2.0%					

Relative R^2	23.1%	16.7%	1.6%	9.1%	2.0%

Note: *p < .05, **p < .01, ***p <.001. Professional Learning stands for Professional Learning and Growth. Learning Environments stands for Learning Environments and Classroom Spaces. Student Engagement stands for Student Engagement and Learning.

Student Use

Teachers use of technology for student use varied significantly among teachers within (τ_1 =.274) and among schools (τ_2=.009). Relative to variance within schools, there is hardly any variance between them (only 3% of the total variance is between schools).

The analysis of student use showed no statistically significant relationships with any of the Pillars of Digital Leadership. There is no predictive ability of any of the Pillars of Digital Leadership in terms of teacher technology use in the planning and delivery of instruction category. The full results of this analysis are displayed in Table 8, below.

Table 8. Mixed Model Analysis of Student Use with the Pillars of Digital Leadership

	M1	M2	M3	M4	M5	M6
Intercept	2.357***	2.648	2.546**	2.033	2.196***	2.296**
	(.046)	(.579)	(.444)	(.484)	(.278)	(.355)
Communication		-.084				
		(.166)				
Professional Learning			-.058			
			(.135)			
Learning Environments				.098		
				(.146)		
Discovering Opportunity					.051	
					(.087)	
Student Engagement						.021
						(.125)
Variance of the Intercept	0.6%					
Relative R^2		33.4%	33.6%	25.0%	25.0%	40.0%

Note: *p < .05, **p < .01, ***p <.001. Professional Learning stands for Professional Learning and Growth. Learning Environments stands for Learning Environments and Classroom Spaces. Student Engagement stands for Student Engagement and Learning.

Summary

The Pillars of Digital Leadership do not appear to predict any instances of teacher technology use. Across all of the analyses for this question, no pillar showed any significant relationships with any teacher technology outcomes.

Research Question 3

Research question three was designed to explore the effect that grade level and/or years of teaching experience might have on teachers use of technology in the classroom. To do this, three additional regressions were conducted, using the null model and each teacher technology use variable. Table 9, below, shows the full results of this analysis.

Table 9. Mixed Model Analysis of Teacher Technology Use with Grade Level and Years of Experience

	Administrative and Management Tasks	Planning and Delivery of Instruction	Student Use
Intercept	2.893	2.459***	2.282***
	(.144)	(.108)	(.098)
1-5 Years	-.104	-.004	.091
	(.092)	(.071)	(.085)
6-10 Years	-.138	.152	.163
	(.101)	(.077)	(.093)
11-15 Years	-.294**	.152	.175
	(.108)	(.083)	(.100)
Middle School	-.326	-.062	-.028
	(.178)	(.133)	(.113)
Variance of the Intercept	6.7%	2.0%	0.6%
Relative R^2	4.3%	16.7%	53.9%

Note: **p < .01, *** p <.001. 15+ Years is the omitted category. High School is the omitted category.

When analyzing the relationship between years of experience and grade level on teacher technology use, there appeared to be only one statistically significant predictor.

When looking at the Administrative and Management Tasks category, teachers with between 11-15 years of experience had lower scores for use (B= -.294, p=.007). That is, a teacher between 11-15 years of experience was likely to have a lower score in Administrative and Management Tasks than teachers who fell outside of this range of experience. In the other categories of technology use, Planning and Delivery of Instruction and Student Use, none of the levels of years of experience was a significant predictor of technology use.

Additionally, grade level did not significantly predict technology use in any of the teacher technology use categories. There appeared to be no significant difference between teachers in the middle school and high school levels, in terms of their composite scores in the categories of technology use.

Research Question 4

The final research question looked to identify a relationship between subject area and teacher technology use outcomes. In order to identify if subject area was a predictor of technology use, three mixed model regressions were performed. Table 10, below, shows the results of these analyses.

Table 10. Mixed Model Analysis of Teacher Technology Use with Subject Area

	Administrative and Management Tasks	Planning and Delivery of Instruction	Student Use
Intercept	2.761***	2.328***	2.276***
	(.131)	(.088)	(.087)
English	-.160	-.008	-.015
	(.126)	(.095)	(.114)
Math	-.152	.220	.033
	(.124)	(.093)	(.113)
Science	-.207	.156	.098
	(.129)	(.098)	(.119)
Social Studies	-.185	.187	.227
	(.119)	(.090)	(.110)

World Language/ ENL	-.357 (.140)	-.212 (.106)	.139 (.129)
Variance of the Intercept	6.7%	2.0%	0.6%
Relative R^2	6.0%	2.0%	0.4%

Note: *** p <.001. Other is the omitted category.

Subject area was not a statistically significant predictor of technology use in any of the teacher technology use categories. That is, a teacher was not any more or less likely to use technology in any of the categories based on the subject area that he/she teaches.

Conclusion

The results of these tests identified relationships between teacher technology use variables, demonstrating that a teacher who uses technology for any one category is likely to also use technology in the other categories. The Pillars of Digital Leadership appear to show no predictive ability. None of the pillars were statistically significant predictors of any of the categories of teacher technology use.

A significant relationship was found between years of experience and Administrative and Management Tasks. Teachers with between 11 and 15 years of teaching experience were likely to score lower in this category than their counterparts whose experience fell outside of this range. No other significant relationships were found between years of experience and technology use categories.

Finally, grade level and subject area were also not found to be statistically significant predictors of technology use in any of the teacher use categories.

The next chapter will discuss the implications of these results, both in terms of practical application and in conversation with the field of literature. It will also include suggestions for future research as well as a discussion on limitations of this study.

Chapter 5: Discussion

Introduction

As instructional technology continues to grow in schools, it is incumbent upon principals to take on a leadership role in the implementation of that technology. The difficulty arises in the fact that principals are, generally, unprepared to become technology leaders for two reasons: there is no clear definition of what it means to be a technology leader (Gurr, 2004) and there is no guidance on best practices for technology leaders (McLeod & Richardson, 2011).

This study sought to examine the relationship between the Pillars of Digital Leadership, one proposed definition of technology leadership, and teachers use of technology in their classrooms. A significant correlation was found among categories of technology use. This finding suggests that a teacher who uses technology in one category, is more likely to use it in another area of their practice. If a principal can identify technology users, this might be an area in which he/she can leverage teacher abilities to expand technology use. However, the results found that the Pillars of Digital Leadership did not significantly predict technology use in any of the teacher technology use categories. Grade level, years of experience, and subject area did not consistently, significantly predict a teacher's likelihood of bringing technology into their practice in any way.

Implications of Findings

The theoretical framework for this study was the Fullan's (2004) culture change principal, which argued that that long-term, sustainable change is possible only when a principal is other-directed, focused on the betterment of the people who make up the organization. The results of this study show that the Pillars of Digital Leadership do not appear to be an effective model for a culture change principal who is hoping to undertake

technology-based change in his/her school. A principal hoping to bring about technological change, then, would be better served to look at other models of technology leadership.

In terms of teacher use, this study found that teachers who use technology for one type of activity are more likely to use it in other categories, which the strongest correlation being between Planning and Delivery of Instruction and Student Use. This suggests that teachers who use technology to plan their teaching are more likely to bring that technology to students, taking advantage of the digital tools and resources that they use in planning. A principal could leverage this knowledge to encourage technology use, by identifying the teachers who use technology the most and encouraging them to expand their use into other categories or by trying new tools and resources.

Relationship to Prior Research

While the theory being examined, the Pillars of Digital Leadership, had commonalities with the previous definitions of technology leadership, it was also very different from those ideas. Of all of the definitions explored in Chapter 2, the Pillars of Digital Leadership were the most prescriptive, offering explicit examples of actions and values that a principal could take in order to promote technology use in his/her school. In this study, the Pillars of Digital Leadership were not predictive of teacher technology use in any category.

One of the major issues facing principals as they take on technology leadership is that there is no clear definition of what makes a principal an effective technology leader (Gurr, 2004). The findings of this study, unfortunately, do not suggest the Pillars of Digital Leadership should be that definition. The results of this study did not differentiate the Pillars of Digital Leadership from the other existing definitions of technology

leadership in any significant way, in terms of their ability to promote teachers using technology.

Limitations of the Study

One potential limitation comes from the similarity of the districts that participated in this study. All of the school districts participating in the study are from Suffolk County, NY, meaning that results might be generalizable to the rest of the county, but might not be as relevant in other counties or states. Moreover, the schools that participated are in districts that have already made significant investments in instructional technology. Because of this investment, teachers have instructional technology readily available to them and may be more likely to use it, regardless of the leadership of the building principal.

The way in which teachers' subject area was measured is another potential limitation for this study. Teachers were presented with the choices: English, Math, Science, Social Studies, World Language/ENL, Other. These choices should have included an option for Special Education to allow for a more precise breakdown. Many teachers identified as "other" since there was no option for a Special Education teacher.

A final limitation of this study is the sample size of principals involved. While the response rate was 100%, that was still limited to just seven principals, one from each school that participated. This small sample of principals makes it difficult to check for multicollinearity between variables and could affect the results of the statistical analysis.

Recommendations for Future Practice

The results of this study produce few recommendations for future practice. This study demonstrated that the Pillars of Digital Leadership do not predict teacher technology use. This finding suggests that principals should be hesitant to adopt the

Pillars of Digital Leadership as a means of encouraging technology use by the teachers in his/her building.

While teacher demographics were unrelated to their technology use, there was clear evidence that teachers who are more likely to use technology in one category are also more likely to use it another category. A principal who understands this relationship, might be able to leverage a teacher's proclivity to use technology for one activity into trying technology in other ways (e.g., as a new classroom resource).

Recommendations for Future Research

There are several recommendations to guide future research in this area. Future research should consider replicating this study with some key changes. First, include a wider range of schools. Extension should consider adding geographically diverse schools; adding elementary schools; and adding schools without a 1:1 program. Schools that do not yet have a 1:1 program might have different expectations for teacher technology use than those that have made the significant investment to develop such a program.

Future research should also try to understand the network of technology leadership within school buildings. In some instances, particularly when a principal is uncomfortable with technology, someone else could take on that role, whether it is an assistant principal, technology director or a teacher-leader or a staff developer. First identifying the person who fills the role of technology leader in a building could help to more accurately assess the relationship between their leadership and technology use.

Conclusion

These results leave principals in a similar place to where they were prior to the study. The Pillars of Digital Leadership are one of many definitions of technology leadership, though it is lacking in providing any ability to predict that teachers will use

more technology if a principal were to adhere to it. While this study revealed that teachers who reported use in any of the technology use categories were more likely to use technology in other categories, these results do not provide principals with any clarity on what it means to be an effective technology leader or how to exploit this knowledge. Instead, there is still a lack of consensus on how principals should approach becoming technology leaders. The results of this study suggest that a principal who is looking to encourage more technology use would be best served to leverage teachers who are already using technology in their practice. Involving more voices in this conversation, such as teachers, technology directors and students, may help to bring clarity to what they need from a technology leader, and thus help to define technology leadership.

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Appendix A: Principal Leadership Survey

Principal Leadership Survey

Dear Participant,

You have been invited to take part in a research study to learn more about the relationship between a principal's leadership and the ways that teachers use instructional technology in the classroom. This study will be conducted by Justin Lander, School of Education, Administration and Supervision, St. John's University, as part of his doctoral dissertation. His faculty sponsor is Dr. Erin Fahle.

If you agree to to participate in this study, you will be asked to complete an online questionnaire regarding your leadership values and actions. Participation in this study will involve approximately 5-10minutes to complete the questionnaire.

There are no known risks associated with your participation in this research beyond those of everyday life. Although you will receive no direct benefits, this research may help the investigator understand the relationship between a principal's leadership and how teachers use instructional technology in their classroom.

Confidentiality of research records will be strictly maintained by using codes to refer to schools, so that specific schools and/or districts are distinguishable from each other, but not identifiable as any particular school or district. Participants IP addresses, email addresses and other personally identifiable information will not be recorded when the questionnaire is completed. Participants will not be asked to provide their name or the school in which they work. Participation in this study is voluntary. You may refuse to participate or withdraw at any time without penalty. While completing the questionnaire, you have the right to skip any questions that you prefer not to answer.

If you have any questions or wish to report a research-related problem, you may contact Justin Lander at (516) 459-7042 or justin.lander17@stjohns.edu, or his faculty sponsor, Dr. Erin Fahle, at fahlee@stjohns.edu. For questions about your rights as a research participant, you may contact the University's Institutional Review Board, St. John's University, Dr. Raymond DiGiuseppe, Chair at digiuser@stjohns.edu. or 718-990-1955 or Maria Nitopi, IRB Coordinator at nitopim@stjohns.edu or718-990-1440.

* 1. I have read the letter above and understand that my participation in this research is completely voluntary and that my responses will be anonymous.

- ◯ I agree

1

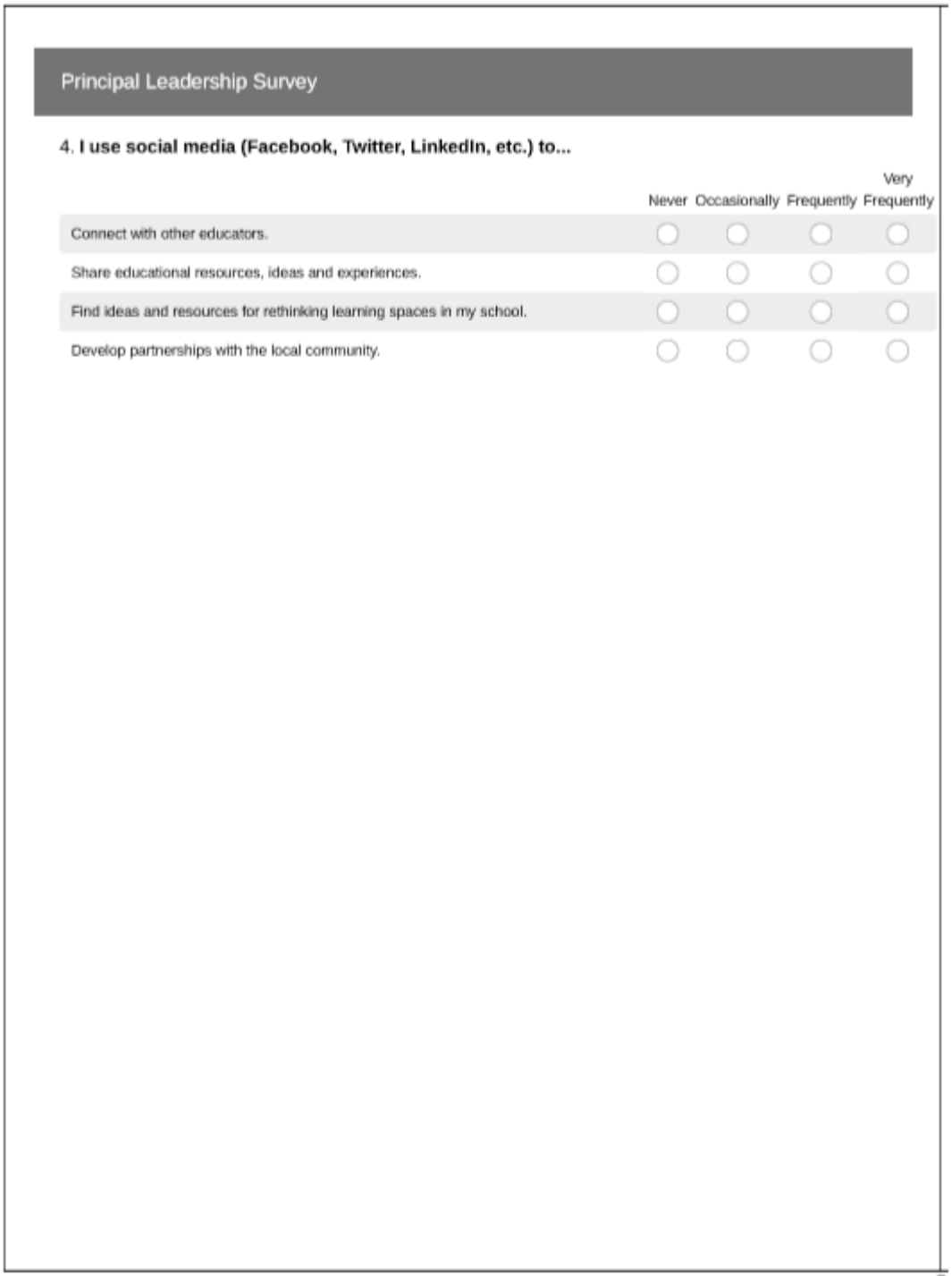
Principal Leadership Survey

2. Please indicate how many years you have been the principal of this school.

- 1 - 5 years
- 6 - 10 years
- 11 - 15 years
- More than 15 years

3. Please indicate the level of the building in which you work.

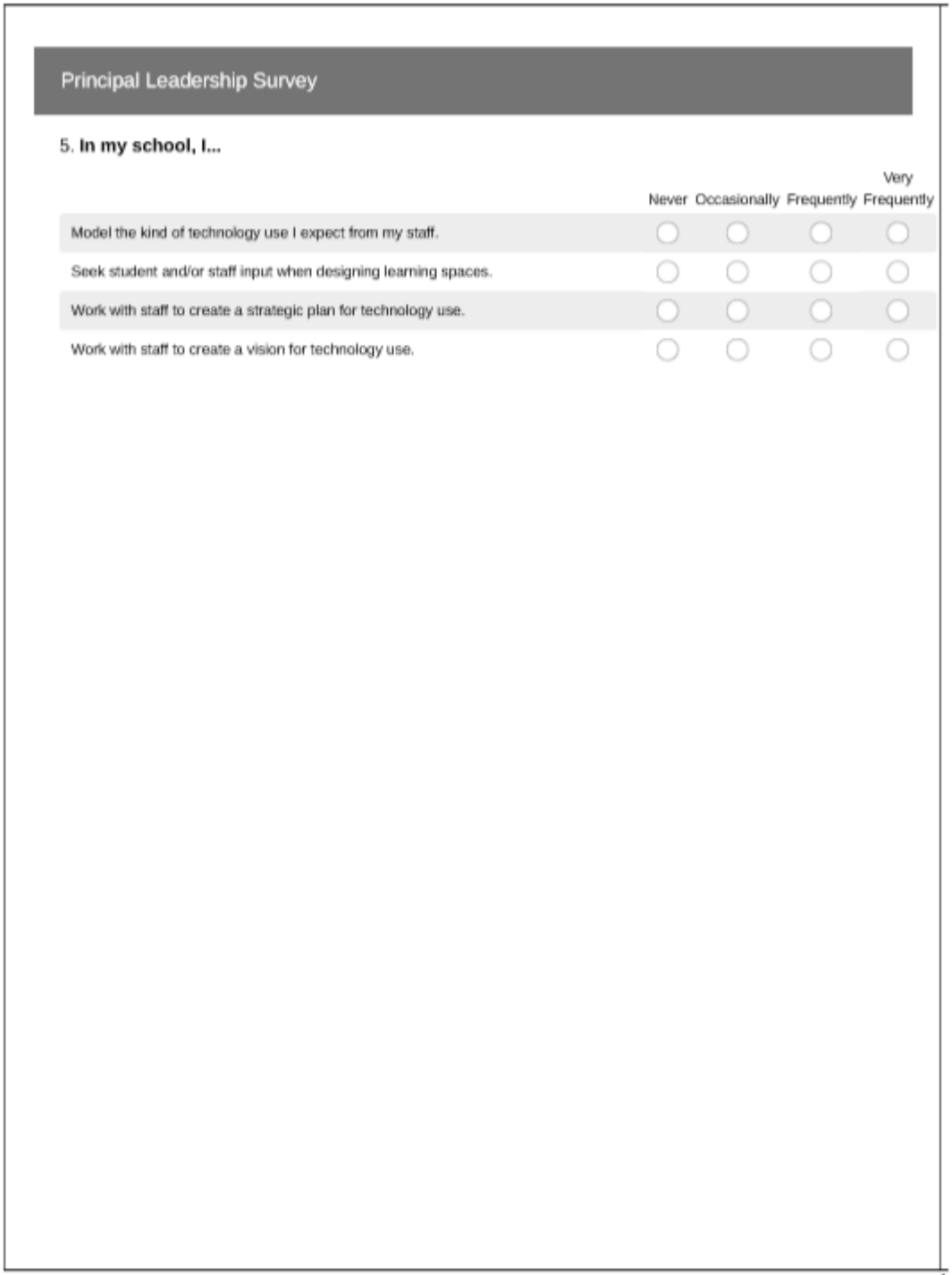
- Middle School
- High School



Principal Leadership Survey

4. **I use social media (Facebook, Twitter, LinkedIn, etc.) to...**

	Never	Occasionally	Frequently	Very Frequently
Connect with other educators.	○	○	○	○
Share educational resources, ideas and experiences.	○	○	○	○
Find ideas and resources for rethinking learning spaces in my school.	○	○	○	○
Develop partnerships with the local community.	○	○	○	○



Principal Leadership Survey

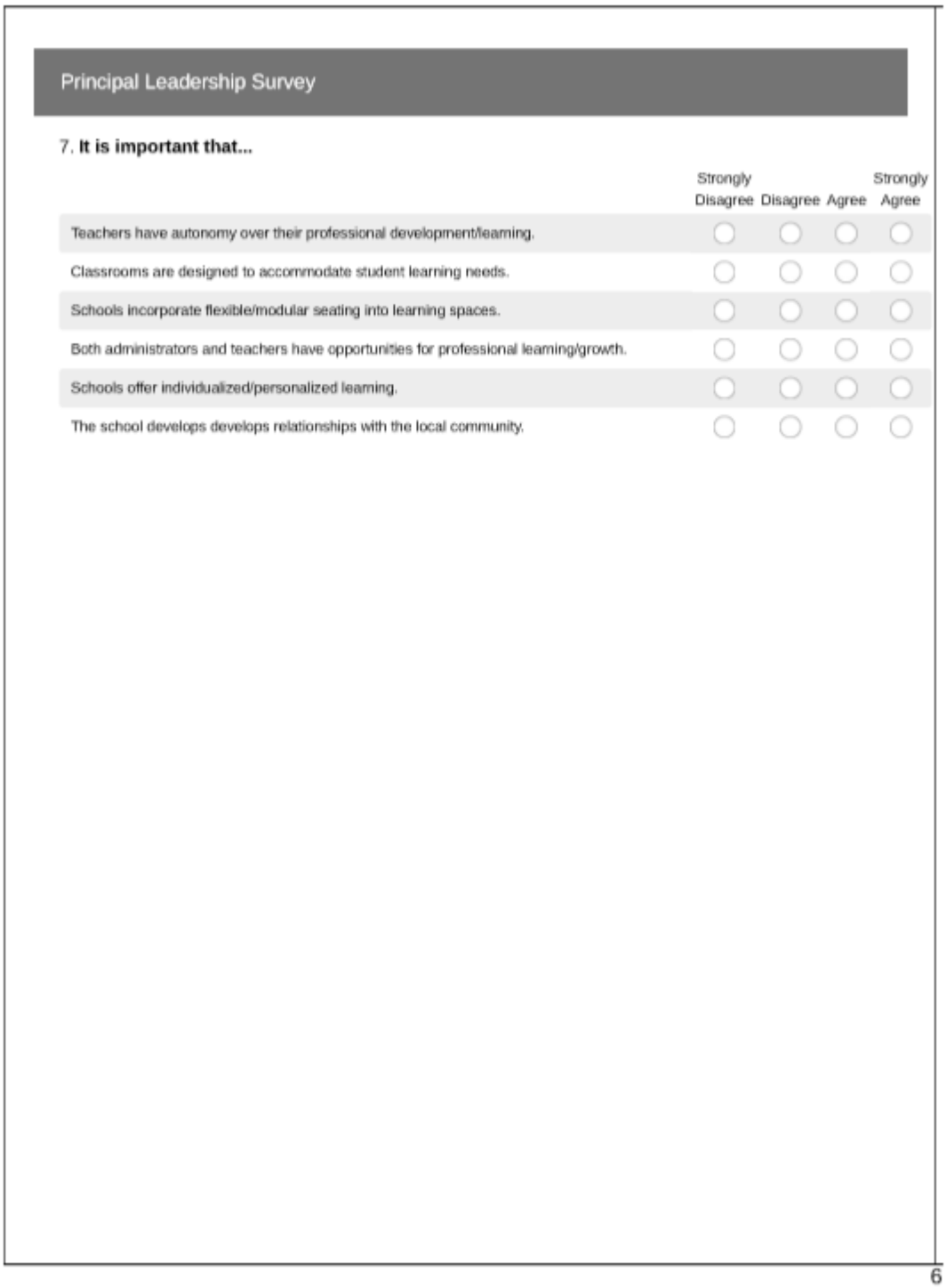
5. **In my school, I...**

	Never	Occasionally	Frequently	Very Frequently
Model the kind of technology use I expect from my staff.	○	○	○	○
Seek student and/or staff input when designing learning spaces.	○	○	○	○
Work with staff to create a strategic plan for technology use.	○	○	○	○
Work with staff to create a vision for technology use.	○	○	○	○

Principal Leadership Survey

6. **I use technology (Facebook, Twitter, School Website or App, Remind) to...**

	Never	Occasionally	Frequently	Very Frequently
Communicate with parents.	○	○	○	○
Communicate with the community.	○	○	○	○
To share student and teacher success stories.	○	○	○	○
Participate in professional learning/development.	○	○	○	○



Principal Leadership Survey

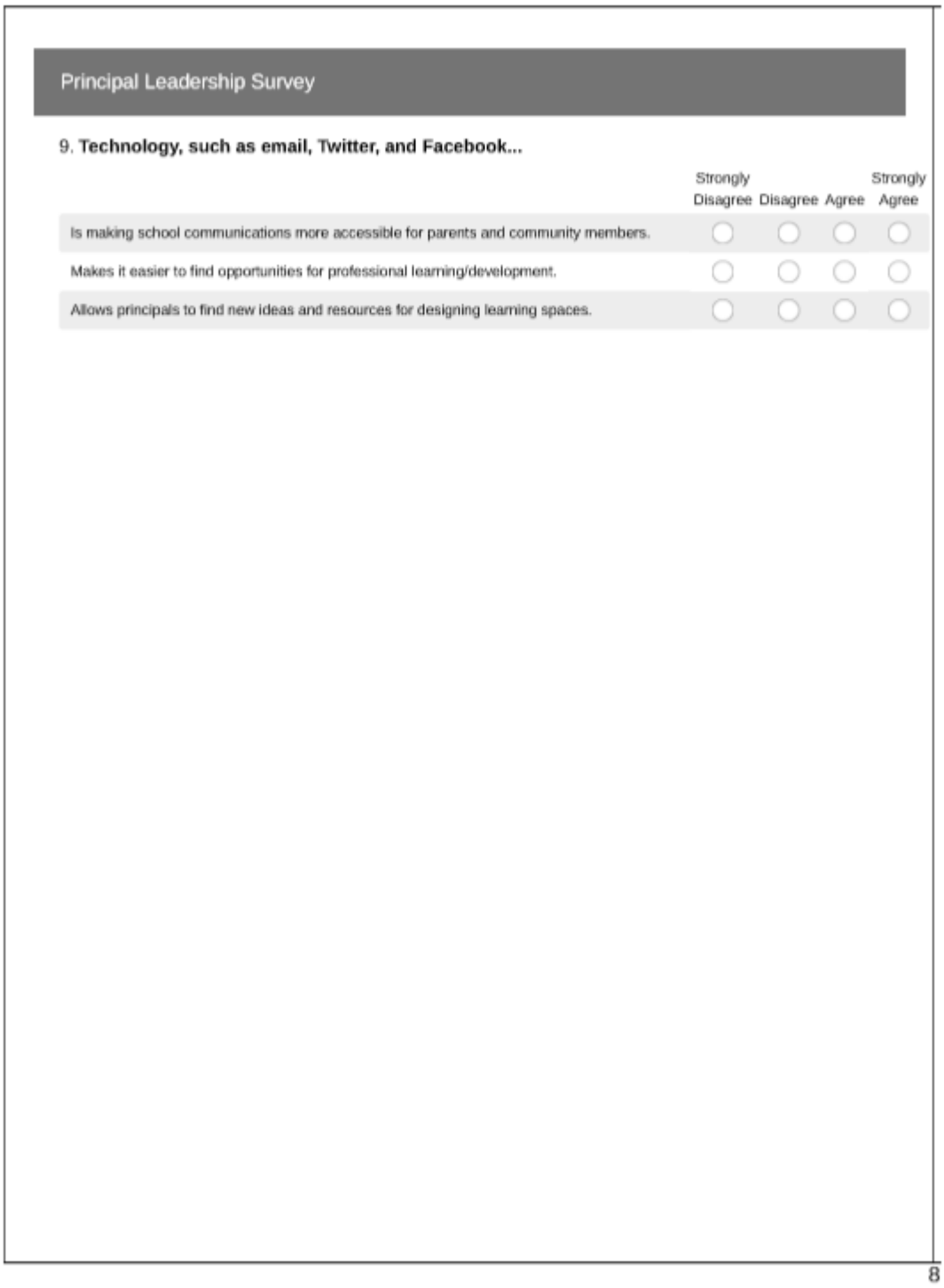
7. **It is important that...**

	Strongly Disagree	Disagree	Agree	Strongly Agree
Teachers have autonomy over their professional development/learning.	○	○	○	○
Classrooms are designed to accommodate student learning needs.	○	○	○	○
Schools incorporate flexible/modular seating into learning spaces.	○	○	○	○
Both administrators and teachers have opportunities for professional learning/growth.	○	○	○	○
Schools offer individualized/personalized learning.	○	○	○	○
The school develops develops relationships with the local community.	○	○	○	○

Principal Leadership Survey

8. **Communication with...**

	Strongly Disagree	Disagree	Agree	Strongly Agree
Parents is important to the success of the school.	○	○	○	○
The community is important to the success of the school.	○	○	○	○
The community should use the community's preferred communication methods.	○	○	○	○



Principal Leadership Survey

9. **Technology, such as email, Twitter, and Facebook...**

	Strongly Disagree	Disagree	Agree	Strongly Agree
Is making school communications more accessible for parents and community members.	○	○	○	○
Makes it easier to find opportunities for professional learning/development.	○	○	○	○
Allows principals to find new ideas and resources for designing learning spaces.	○	○	○	○

8

Principal Leadership Survey

10. **Instructional technology allows teachers...**

	Strongly Disagree	Disagree	Agree	Strongly Agree
To focus on teaching skills rather than content.	○	○	○	○
To connect with resources outside of the classroom.	○	○	○	○

Appendix B: Instructional Technology Outcomes Survey

Instructional Technology Outcomes Survey

Dear Participant,

You have been invited to take part in a research study to learn more about the relationship between a principal's leadership and the ways that teachers use instructional technology in the classroom. This study will be conducted by Justin Lander, School of Education, Administration and Supervision, St. John's University, as part of his doctoral dissertation. His faculty sponsor is Dr. Erin Fahle.

If you agree to participate in this study, you will be asked to complete an online questionnaire regarding the frequency and ways in which you use technology in the classroom. Participation in this study will involve approximately 10 minutes to complete the questionnaire.

There are no known risks associated with your participation in this research beyond those of everyday life. Although you will receive no direct benefits, this research may help the investigator understand the relationship between a principal's leadership and how teachers use instructional technology in their classroom.

Confidentiality of research records will be strictly maintained by using codes to refer to schools, so that specific schools and/or districts are distinguishable from each other, but not identifiable as any particular school or district. Participants IP addresses, email addresses and other personally identifiable information will not be recorded when the questionnaire is completed. Participants will not be asked to provide their name or the school in which they work.

Participation in this study is voluntary. You may refuse to participate or withdraw at any time without penalty. While completing the questionnaire, you have the right to skip or not answer any questions that you prefer not to answer.

If you have any questions or wish to report a research-related problem you may contact Justin Lander at (516) 459-7042 or justin.lander17@stjohns.edu, or Dr. Erin Fahle, at fahlee@stjohns.edu.

For questions about your rights as a research participant, you may contact the University's Institutional Review Board, St. John's University, Dr. Raymond DiGiuseppe, Chair at digiuser@stjohns.edu or 718-990-1955 or Maria Nitopi, IRB Coordinator at nitopim@stjohns.edu or 718-990-1440.

* 1. I have read the letter above and understand that my participation in this research is completely voluntary and that my responses will be anonymous.

- ◯ I agree

1

Instructional Technology Outcomes Survey

2. Please indicate how many years you have been teaching in this school.

- ◯ 1 - 5 years
- ◯ 6 - 10 years
- ◯ 11 - 15 years
- ◯ More than 15 years

3. Please indicate which level you primarily teach.

- ◯ Middle School
- ◯ High School

4. Please indicate the subject area you teach.

- ◯ English
- ◯ Math
- ◯ Science
- ◯ Social Studies
- ◯ World Language / English as a New Language
- ◯ Other

Instructional Technology Outcomes Survey

Administrative and Management Tasks

5. Please indicate the frequency with which you use the following technologies to complete administrative and management tasks.

	Never	Occasionally	Frequently	Very Frequently
Email	○	○	○	○
Website Creation/Management, i.e. Google Sites, Weebly, Wix	○	○	○	○
Document Sharing, i.e. Google Drive, OneDrive, DropBox	○	○	○	○
Social Media, i.e. Twitter, Facebook, LinkedIn	○	○	○	○
Digital Record Keeping, i.e. Infinite Campus, eSchool, PowerSchool	○	○	○	○

Instructional Technology Outcomes Survey

Planning and Delivery of Instruction

6. Please indicate the frequency with which you use the following technologies for the planning and delivery of instruction.

	Never	Occasionally	Frequently	Very Frequently
Word Processing Software, i.e. Microsoft Word, Google Docs	○	○	○	○
Presentation Software, i.e. Microsoft PowerPoint, Google Slides	○	○	○	○
Spreadsheet Software, i.e. Microsoft Excel, Google Sheets	○	○	○	○
Communication Software, i.e. Skype, Facetime	○	○	○	○
Search Engines or Online Encyclopedias	○	○	○	○
Online Textbooks, i.e. McGrawHill ConnectEd, Discovery Education Techbook	○	○	○	○
Presentation Devices, i.e. Projector, Interactive Whiteboard	○	○	○	○
District-issued or Personal Mobile Computing Device	○	○	○	○
Social Media, i.e. Twitter, LinkedIn	○	○	○	○
Interactive Digital Tools, i.e. Nearpod, Kahoot!	○	○	○	○
Digital File Management, i.e. Google Drive, OneDrive, Dropbox	○	○	○	○
Online Assessment Tools, i.e. Castle Learning, IXL, GoFormative	○	○	○	○

Instructional Technology Outcomes Survey

Student Use

7. Please indicate the frequency with which your students use the following technologies to complete assignments.

	Never	Occasionally	Frequently	Very Frequently
Word Processing Software, i.e. Microsoft Word, Google Docs	○	○	○	○
Presentation Software, i.e. Microsoft PowerPoint, Google Slides	○	○	○	○
Spreadsheet Software, i.e. Microsoft Excel, Google Sheets	○	○	○	○
Communication Software, i.e. Skype, Facetime	○	○	○	○
Search Engines or Online Encyclopedias	○	○	○	○
Online Textbooks, i.e. McGrawHill ConnectEd, Discovery Education Techbook	○	○	○	○
Presentation Devices, i.e. Projector, Interactive Whiteboard	○	○	○	○
District-issued or Personal Mobile Computing Device	○	○	○	○
Social Media, i.e. Twitter, LinkedIn	○	○	○	○
Interactive Digital Tools, i.e. Nearpod, Kahoot!	○	○	○	○
Digital File Management, i.e. Google Drive, OneDrive, Dropbox	○	○	○	○
Online Assessment Tools, i.e. Castle Learning, IXL, GoFormative	○	○	○	○

Vita

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