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The Development of a New Instrument Comparing Teacher and Principal Perceptions of School Technology Leadership

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Garrick Grace, Student

Dr. John B. Nash, Major Professor

Dr. Margaret Bausch, Director of Graduate Studies

The Development of a New Instrument Comparing Teacher and Principal Perceptions of School Technology Leadership

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DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Education
at the University of Kentucky

By

Garrick Grace

Lexington, Kentucky

Director: Dr. John B. Nash, Professor of Educational Leadership Studies

Lexington, Kentucky

2020

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ABSTRACT OF DISSERTATION

THE DEVELOPMENT OF A NEW INSTRUMENT COMPARING TEACHER AND PRINCIPAL PERCEPTIONS OF SCHOOL TECHNOLOGY LEADERSHIP

Use of technology in education is rapidly growing in terms of dollars spent annually. With such enormous expenditures for schools, stewardship of human and capital resources via leadership feels vital. School technology leadership is a specialty area of educational leadership with a focus on how leaders address technology issues within their schools and guide others through successful implementation. As the body of research continues to grow, measurement instruments can assist researchers and practitioners in understanding the implementation and adoption of new technologies, and their relationship to leadership.

The purpose of this study was to analyze the current literature on school technology leadership, develop an instrument to measure school technology leadership, and pilot the instrument to understand its scores and make inferences. An article manuscript is presented which analyzes the current literature through a thematic review. A second article manuscript details the development and testing of an instrument to measure school technology leadership from the perspective of teachers in regard to their principals' technology leadership skills.

The findings from this study suggest instruments measuring school technology leadership should be reviewed on an annual basis to assess whether the instrument is truly measuring what it is intended to measure and whether that corresponds with the latest literature within the field. The pilot instrument showed a difference in responses between teachers and principals in three of five dimensions analyzed. Overall, the instrument functioned well, however, additional research with a larger sample could yield better insight on the five dimensions examined.

KEYWORDS: Technology integration, educational leadership, school technology leadership, principal leadership, measurement instruments, principal evaluation

Garrick Grace

05/5/2020

Date

THE DEVELOPMENT OF A NEW INSTRUMENT COMPARING TEACHER AND PRINCIPAL PERCEPTIONS OF SCHOOL TECHNOLOGY LEADERSHIP

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DEDICATION

To my wonderful family and the dreams that are yet to become realities.

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This dissertation is some of the most fulfilling work I have ever done, however, I have a large supporting cast I want to thank. First, with the full support of my wife Rachel, I was able to put many items in life on hold to focus on this dissertation. Thank you for picking up the slack. Now I shall return the favor. Second, Dr. John B. Nash was an outstanding resource for encouragement and knowledge. Dr. Jayson W. Richardson is an amazing researcher and I appreciate his work which guided my own in numerous ways. Dr. Beth Rous guided me through the final stages of my dissertation preparation and without her experience this task would be extremely daunting. Dr. Michael Toland is a statistics guru like no one I have ever met before. With his excellent ideas, the statistical analysis and study design benefited greatly. Dr. Debra Harley came on as my outside examiner and I am grateful for her help and added vision.

My family encouraged me constantly over the past five years on this journey. My mother Kyle was always there to support me mentally. My father Bernie kept encouraging me to push on. My sister Chelsea listened to all of my astonishing ideas. To the rest of my family and friends, thank you for sticking around the past five years of this intense research. Lastly, thank you to my wonderful cohort known as Upgrade 4.0. Without this cohort, the last five years would not be the same. It was a marathon, not a sprint.

Finally, thank you to all of the teachers, principals, reviewers, and experts who contributed to this dissertation. Without responses this dissertation would not exist.

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CHAPTER 1. INTRODUCTION

The merging of technology and education created an industry with worldwide spending at an estimated $19 billion annually (Dexter, Richardson, & Nash, 2016). With such enormous expenditures for schools, stewardship of human and capital resources via leadership feels vital. The fields of both educational leadership and educational technology have rich bodies of research (Kearsley & Lynch, 1992; Leithwood & Riehl, 2005). Schools and universities must make educated decisions on programming and purchases to grow human and capital resources and engage students in new learning opportunities (Cho & Littenberg-tobias, 2016; Dawson & Rakes, 2003). Therefore, understanding the research currently available in educational leadership, educational technology, and school technology leadership (STL) is a valuable backdrop for developing new tools to assist in the analysis of STL.

This multi-article style dissertation includes two manuscripts. The first manuscript provides a thematic review of the literature on STL. The second manuscript presents the development and pilot study of a new instrument to measure STL traits of principals. The instrument is designed to gather data about a principals' technology leadership skills from the perspective of teachers and data from each principal regarding their perceptions of their technology leadership skills. The second article documents the steps involved in developing the instrument along with the results of a pilot study. Lastly, a discussion of the new instrument and its implications for STL is considered, along with suggestions for future research.

The purpose of this chapter is to introduce the research problem, outline the overarching study design, highlight the theoretical framework, define terms, and

introduce the methods employed in the two manuscripts. The chapter closes with a discussion on overall study limitations and the organization of this dissertation.

1.1 Purpose and Significance of the Study

The job duties of a principal continue to evolve and technology leader is another title becoming more common (Anderson & Dexter, 2005). This study was conducted under the premise that principals hold an immense amount of power in decision-making. If a principal lacks an understanding of technology leadership, typically teachers will be less willing to push into unchartered waters within their schools (Chang, Chin, & Hsu, 2008). From another angle, if principals do not fully understand effective technology integration, teachers might feel overwhelmed and give up on the technology altogether (Brooks-Young, 2009). Principals who have higher technology leadership skills will motivate teachers to implement and embrace technology into their classrooms (Afshari, Bakar, Luan, Samah, & Fooi, 2008). With technology leadership becoming a more frequent duty for principals, this dissertation was designed to better understand STL and advance the ways in which it can be conceptualized.

1.2 Research Questions

As the use of technology in education continues to proliferate, this study adds to the body of research by providing an in-depth synthesis of current measurement instruments addressing aspects of STL followed by the development and validation of a new instrument measuring multiple dimensions on STL from the perceptions of teachers and principals. This document is comprised of two manuscripts with complementary goals. The first manuscript, Chapter 2, addresses research questions one and two. The second manuscript, Chapter 3, addresses research question three. The research questions are:

1. What instruments are currently available to measure STL?
2. Is there a need for different instruments to measure STL?
3. Can a 20-item survey adequately measure multiple dimensions of STL?

To address research questions one and two, a thematic review of the literature was conducted. The review examined multiple dimensions of STL, including theoretical underpinnings, educational leadership, and available instruments. A compilation of literature related to instrument design and use within STL is included.

Manuscript two, which addresses research question three, describes the development and pilot study of a short measurement instrument to assist in measuring STL. The instrument has two versions. The first version is completed by the principal in a self-reflection of their technology leadership skills. The second version is completed by teachers concerning their principals' technology leadership skills. Data from both versions were analyzed to understand the instrument as a whole better.

1.3 Dissertation Organization

This dissertation is written and organized in a multi-article style format. Chapter 1 provides an introduction to the dissertation and sets the stage for the two manuscripts. Chapters 2 and 3 are written as individual manuscripts for scholarly publication. Chapter 4 presents the overarching findings, a discussion of the results, and recommendations for future research.

The thematic review of the literature in Chapter 2 focuses on STL. It includes literature on educational technology, educational leadership, transformational leadership, theoretical underpinnings, and measurement instruments with a focus on STL. The

method for conducting the review utilized aspects of a protocol. The protocol is the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). PRISMA is an appropriate instrument because the protocol improves reporting throughout the systematic review of published literature on STL. Even though this was not a systematic review, aspects of PRISMA add direction and value to the thematic review. The goal of Chapter 2 is to answer the research questions about the instruments currently available to measure STL and whether future instruments are needed to measure STL.

The instrument development and pilot process are covered in Chapter 3. The development of the instrument stemmed from a review of the current instruments available to measure STL in Chapter 2. Conceptual designs from other similar instruments guided the dimensions and items. The instrument sought to examine five dimensions by exploring teacher perceptions of principals' STL traits. The five dimensions are (1) vision, planning, and management, (2) staff development and training, (3) technological and infrastructure support, (4) evaluation and research, and (5) interpersonal and communication skills. The data analysis includes three phases: first, a classical item analysis, second, a paired-samples t-test, and third, Cohen's d comparison. The goal of Chapter 3 is to answer the question: Can a 20-item survey adequately measure multiple dimensions of STL?

The conclusions and implications of the multi-article style dissertation are discussed in Chapter 4, including implications for policy, practice, and future research.

1.4 Guiding Literature

This study is guided by literature in the fields of STL, educational leadership, measurement instruments, and quantitative methods. This overview is designed to provide a general framework for understanding the underlying literature guiding this research.

1.4.1 Leadership

The term leadership has often been critiqued due to the term being a common buzz-word throughout the second half of the 1900's (Rost, 1991). Numerous leadership theorists have defined leadership in a variety of ways. In order to understand the sub-fields of leadership, an overarching definition is first needed. Leadership is defined as an influence relationship among leaders and followers with a mutual purpose to create real changes (Rost, 1991). Leadership has also been defined as simply direction and influence (Leithwood, 2007). The 21st-century definition of leadership veered away from the industrial paradigm which focused more on "good management," which was defined as an authority relationship between a manager and subordinate who coordinate their work with a focus on producing and selling goods and/or services (Rost, 1991). Additionally, effective leaders are often supportive, extraverted, charismatic, and out-of-the-box thinkers (Carlzon, 1987).

Regardless of varying definitions, organizations look for leaders with a variety of skills. Many leadership theorists analyzed organizations and fit each one into the four frames of organizations (Bolman & Deal, 2013). Within the four frames, structural, human resource, political, and symbolic, different leadership skills lend themselves to be a better fit. The structural frame focuses on formal roles and relationships among

workers. The human resource frame examines individuals' needs, feelings, and dispositions, including attitudes and beliefs. The political frame analyzes how competing groups grapple for power and scarce resources. The symbolic frame accounts for an organization's rituals, ceremonies, stories, heroes, and myths (Bolman & Deal, 2013).

Viewing leadership as a multi-frame concept and offers a more comprehensive understanding of leadership. Leaders can use skills from a combination of frames to impact an organization, which often leads to better leadership overall. Leaders who utilize a multi-frame approach have the added benefit of understanding problems from a holistic perspective (Bolman & Deal, 2013).

Leadership within educational organizations, like P-12 schools, holds many of the same values as the overall umbrella of leadership. School leaders are ranked as the second most impactful role behind teachers within schools (Leithwood, Louis, Anderson, & Wahlstrom, 2004). Educational leadership programs focus on research-based content, curriculum, internship opportunities, problem-based learning, cohorts, and coaching and collaboration opportunities between programs and schools (Hewitt, Davis, & Lashley, 2014). The curriculum in educational leadership programs lends itself to educational concepts and issues in the field of education versus business settings (Wraga, 2001; Young & Crow, 2017).

Therefore, educational leadership aligns with many of the same principles of quality leadership, period. Based on the impact educational leaders have on student learning, it is vital to adequately train future educational leaders with a focus on specific leadership traits as it relates to the field of education (Hallinger, 2013; Hewitt et al., 2014; Leithwood, 2007). To the extent that leadership plays a role in articulating the vision and

integration of technology in schools, STL provides a lens for understanding how that can be done well.

1.4.2 School technology leadership

Leaders who exhibit strong STL traits are commonly linked to innovation and are considered to be on the cutting edge of new policies, procedures, and situations (Kearsley & Lynch, 1992). Leaders of technology in schools need to understand both leadership skills and technology in order to create change (Tillman, 2014). Universities around the world are noticing the need for more educational technology courses for future teachers and are slowly adapting (Will, 2016). As schools continue to use more forms of technology, people in future leadership positions need an understanding of the technologies available (Hughes, McLeod, Garrett Dikkers, Brahier, & Whiteside, 2005; McLeod, Bathon, & Richardson, 2011; Michael, 1998).

The literature on STL is sparse (McLeod & Richardson, 2011). Researchers hypothesized there is a need for continued research on STL in order to impact the effective utilization of technology. Studies suggest leaders who understand and educate staff on technology, typically gain buy-in from teachers who are willing to try new technologies with students (Anderson & Dexter, 2005; Chang, 2012; Dawson & Rakes, 2003; Parker, 2014).

1.4.3 Measurement instruments

The studies summarized in Chapter 2 come from authors whose focus was on quantitatively measuring STL. Although there is an abundance of instruments designed to measure STL, there seems to be a gap in the overall adoption of one particular

instrument. The majority of instruments created to measure STL are based on the International Society for Technology in Education (ISTE) standards. Researchers often turn to the ISTE standards as a benchmark for quality content to develop instrument questions (CASTLE, 2009; Chang, 2002, 2012; Davis, 2008; Scott, 2005; Seay, 2004; Seneca, 2008; Shyr, 2016; Snelling, 2016; Tomei, 2002). The pilot instrument in Chapter 3 is based on previous scholarship on quantitative measurement of STL along with the ISTE standards.

The pilot instrument in Chapter 3 went through a design process that included a review from a team of educational technology experts and graduate students. The review included modifications to the instrument content and analysis techniques to lead to a sounder way of looking at teachers' perceptions of their principals' STL traits. The instrument sought to measure a principals' technology leadership skills utilizing a small number of questions, meaning less time commitment by teachers and principals.

Even though measurement instruments may contain similar questions, the design of the instrument and length tend to vary greatly. Some researchers asked over 100 questions, but only utilized half of the question responses to analyze data. Other studies seek to streamline the length of the instruments by combining questions or focusing on specific measurement points of interest of their study.

1.5 Theoretical Framework

This dissertation is guided by the theoretical framework of transformational leadership. Transformational leadership involves leaders and followers in a relationship where leaders use inspiration and idealized influence to gain the trust, respect, and willingness of followers to go beyond typical requirements in a job (Bass, 1985; Bolman

& Deal, 2013; Burns, 1978; Conger & Kanungo, 1998). Rost (1991) added to the work of Burns (1978) by saying transformation should "be the cornerstone of the postindustrial school of leadership" (p.123). Persuasion is paramount to engage active people in the influence relationship (Rost, 1991).

Guided by transformational leadership theory, the instrument developed in Chapter 3 includes questions to measure STL from a level of higher scores accounting for a more transformational leader who is trying to integrate new technology and lead teachers to follow them. In terms of transformational leadership, principals as leaders can impact teachers as followers. Regarding technology leadership, if principals utilize technology in meaningful ways, trust could be gained and teachers might be willing to try new technologies in the classroom. Principals who were transformational leaders positively impacted organizational conditions (Hipp, 1995). Organizational improvement stems from great leadership, which is defined as a combination of direction and influence (Leithwood, 2007).

School technology leadership is seated in the middle of organizational change for many schools (Kearsley & Lynch, 1992). By utilizing transformational leadership as the theoretical foundation of this dissertation, STL can be viewed from a lens focusing on the leader persuading followers about the impact technology can have in the classroom. Without effective principals leading this work, the implementation of new technologies into the classroom will have a steeper hill to climb.

1.6 Assumptions

Two assumptions underpin this dissertation. The first assumption is responses given by people who participated in the pilot study answered the questions to the best of

their knowledge. Second, the quantitative methods chosen in Chapter 3 were used to test whether or not the instrument functioned properly, and the analysis techniques utilized were the most logical to use in this study design. The pilot study and quantitative methods are discussed in more detail in Chapter 3.

1.7 Definitions

In this dissertation, STL is defined as leadership focused on the integration of new technologies into the school setting, which is the central component this dissertation seeks to measure. STL is situated between educational technology and educational leadership. The definition of STL stems from numerous researchers (Anderson & Dexter, 2000, 2005; Chang, 2002; Dexter, Richardson, & Nash, 2016; Hughes et al., 2005; Kearsley & Lynch, 1992; McLeod & Richardson, 2011; Richardson, Bathon, Flora, & Lewis, 2012; Tan, 2010).

Educational technology is defined as the technology used in learning settings to complete a specific task. Tasks can include management of content, student information systems, learning management systems, curriculum, hardware, and software. Educational technology is used in nearly every part of a school building from the office staff to students and teachers in the classroom. Educational technology can assist in making processes more efficient (Januszewski & Molenda, 2008; McLeod, 2008; Office of Educational U.S. Department of Education, 2016).

A latent construct, or dimension, is a variable that cannot be observed or measured on its own (Kline, 2016). Therefore, indicators, or observed items, measure the dimensions. The pilot instrument consists of five dimensions, with four indicator items

used to measure each one. The five dimensions are designed to explain the latent construct of STL. These will be discussed in greater detail in Chapter 3.

CHAPTER 2. SCHOOL TECHNOLOGY LEADERSHIP THEORIES AND MEASUREMENT INSTRUMENTS: A THEMATIC REVIEW OF THE LITERATURE

2.1 Abstract

Purpose: This study is a thematic review of the literature published on school technology leadership (STL), including theoretical underpinnings, educational leadership, and measurement instruments available on STL. Research Methods: The protocol used to guide this review is the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Findings: This study resulted in numerous instruments being identified on STL, with a common thread being the majority of studies utilized the International Society for Technology in Education Standards. However, researchers varied their instrument designs and analytic techniques. Multiple researchers agreed on the infancy and depth of research within STL. Implications: There is still a need to validate current instruments and develop new instruments measuring STL.

(Keywords: Technology integration, educational leadership, school technology leadership, principal leadership, measurement instruments.)

2.2 Introduction

School technology leadership (STL) is an area of scholarship combining educational leadership and educational technology. The purpose of this study is to synthesize the research on STL, including a discussion on its theoretical underpinnings in educational leadership, and identify measurement instruments to assess the technology leadership skills of principals. As expenditures on educational technology in PK-12 schools grow each year, it becomes increasingly vital for decision-makers to implement technologies in thoughtful and meaningful ways. School leaders need to be well versed in

the technologies available and have the capacity to engage school staff in proper implementation techniques. Therefore, a thematic review of the literature on STL can assist researchers in understanding current lay of the land.

A number of reviews on literature in the fields of educational technology and school leadership exist. However, since the mid-1990s, technology in education continues to grow at a fast pace, meaning it is appropriate to revisit and expand on the literature currently published. Reviews of literature contribute to the growing field of STL (Anderson & Dexter, 2000, 2005; Dexter et al., 2016; Leithwood, 2007; Leithwood & Riehl, 2005; McLeod et al., 2011; McLeod & Richardson, 2011). In 2011, a search in the Education Resources Information Center (ERIC) database for *school technology leadership* returned 59 publications. This included a date range from 1997-2010 based on 1997 being considered the year when computers and the internet assumed a stronghold within PK-12 schools (Richardson et al., 2012). In early 2020, a similar search in ERIC for *school technology leadership* returned 140 publications. This comparison shows growth in the literature from 2010-2020. The search included all source types with the most returns coming from scholarly journals. However, to fully understand the literature on STL, it is important to understand the roots of where STL stems. Additionally, this review will compile instruments from a variety of educational settings worldwide to create a benchmark for the current instruments available and provide a discussion on how future instruments can collect data on STL.

2.3 Scope

Literature in this thematic review focuses on sources available within STL, educational technology, and educational leadership. Measurement instruments were

included in this article based on their focus on measuring principals' technology leadership skills. Searches began in late 2018 and extended into late 2019. The process for inclusion of sources started with the most frequently published authors in the field being highlighted, with the assumption that they are considered leading experts on the topics. Reviews of references within the literature in the frequently published authors' research identified additional sources. The goal of the research was to include as many sources as possible while staying true to the research of identifying measurement instruments and the theoretical underpinnings on STL.

2.4 Methods

Utilizing a review protocol assists researchers with a constructive framework to follow in order to best review literature. PRISMA was used as a guide to assist in the review, however, it was not followed with fidelity due to the thematic style or this review. Data were collected through the University of Kentucky libraries system. The primary databases used to locate published work was the Education Resources Information Center (ERIC), via the University of Kentucky libraries and the second database was Academic Search Complete. To locate measurement instruments, published instruments were identified through multiple resources, including journal articles, dissertations, and government studies. The references of each resource were examined. This yielded additional resources with instruments. This process was conducted until overlapping data from studies and searches occurred.

Additionally, recommendations are included by Joyner, Rouse, and Glatthorn (2013), including discussion on how the search was conducted, the theoretical literature obtained, and the empirical research found. The thematic review starts with a background

on educational technology, followed by discussion on educational leadership. Then, transformational leadership theory is discussed. Finally, literature on STL is covered, with highlights on the intersection of educational technology and educational leadership. Lastly, technology leadership measurement instruments are reviewed.

2.5 Literature Review

2.5.1 Educational technology

While researching educational technology, 22,621 academic journal results were identified in Academic Search Complete using the keywords *educational technology*. ERIC returned 61,197 results with the same criteria. From these results, relevant literature was selected from peer-reviewed journals and dissertations with a primary focus on educational technology.

Technologies in society are continually changing and advancing. Each generation sees new technologies come and go. In the early 1990's, researchers observed eight individual schools and a network of 462 schools to analyze technology implementation and usage (Means & Olson, 1995). They concluded that reform in education involving technology requires time, a commitment of resources, and teacher support. Simply putting a lab of computers and fitting them into a traditional system does not work. An entire transformation of teaching and learning needs to take place (D. K. Cohen, 1988).

Educational technology in pre-kindergarten through grade 12 (PK-12) schools is a $13 billion industry annually and expected to continue growing (Future Source, 2014). How leaders choose and implement technologies in their schools can vary greatly.

Educational technology needs to be implemented with intentional approaches (U.S. Department of Education, 2016).

New technologies continue to change the landscape of what education looks like around the world (McLeod et al., 2011). Teaching and learning are occurring online more frequently, meaning teachers and administrators have to understand which resources available best create environments for learning. Online learning exists in PK-12 schools, colleges, and business training programs. Digital devices for learning are becoming ever more prevalent in schools and colleges today (Cho, 2016). Educational technology has advanced to the point where more state standardized tests for elementary and middle school students took place online versus on paper in 2015-16 (Herold, 2016).

Dating back to the early 1990s, researchers recognized the power technology could hold in everyday tasks in schools like office work, optical test-scoring systems, registration, word processing, and software to monitor building systems like heating, food preparation, and bus routes (Means & Olson, 1995). In order for these systems to work, leaders needed to create a culture willing to change and adapt to new methods of education.

As the 21st century began, literature about technology in education became a more commonly studied subject (Dawson & Rakes, 2003). Tools used in education are expanding at a fast rate. Currently tools such as iPads, Chromebooks, and robotics are driving district purchasing. Digital curricula are also growing rapidly as many school districts have obtained the hardware to operate new learning systems. The new technologies available for students is leveling the field in terms of accessibility (U.S. Department of Education, 2017). Educational technology grew throughout the 1990's at

unprecedented levels (Michael, 1998). Since then, educational technology has continued to grow at a fast pace.

2.5.2 Educational leadership

In total, 7,861 academic journal results were identified in Academic Search Complete regarding *educational leadership*. ERIC returned 13,062 results with the same criteria. For this research I narrowed the literature only to include articles focused on educational leadership as a field of study. In this section, I cover the definition of leadership and the intersection with the field of education.

Leaders must create a culture conducive for learning and growing (Schein, 1985). It is vital to have a working definition of leadership in order to apply it to an educational setting. Rost (1991) defined leadership as "an influence relationship among leaders and followers who intend real changes that reflect their mutual purposes" (p.102). Four elements need to be present for leadership to exist (Rost, 1991). The first element is the relationship being based on influence. Influence is defined as using persuasion to impact others in a relationship (Bell, 1975). People use power resources (race, personality, interpersonal and group skills, reputation, prestige, and perception) to persuade other people.

Regarding influence, two types of relationships exist; multidirectional and non-coercive. Multidirectional relationships do not necessarily follow hierarchical patterns. This results in anyone being able to be a leader or follower since it does not call for a top-down approach. Multidirectional relationships cannot be one-sided, unidirectional, or one-on-one. Leadership defined as an influence relationship relies on behaviors that

persuade other people. Persuasion must not happen in a coercive way. Coercive behavior creates relationships of authority or dictatorial. To decide if true leadership is taking place, one must focus on influence (Rost, 1991).

The second element relates to how relationships need leaders and followers. The term "followers" has, in the past, connoted second rank or of the lesser. However, followers have always existed in society, and the word does not need to be of the lesser in the postindustrial paradigm (Rost, 1991). In the post-industrial model of leadership, followers can become leaders, and leaders can follow. This pattern can go back and forth an infinite amount of times. Followers are active agents in the relationship; they are not just recipients of the leaders' influence. Leadership is a relationship, meaning leaders must work with others. People can go between being a leader and a follower, depending on the organization and relationship. Followers can be great leaders, and leaders can be great followers. This dynamic is critical to understand since it creates a relationship. Leaders typically have more influence because they commit more power resources to the relationship (Rost, 1991).

The third element of leadership is that leaders and followers intend real changes. These changes are created in the present and intended to be implemented in the future, but do not have to be implemented. The real changes are purposeful and transformational. In comparing the postindustrial and industrial leadership paradigms, element three targets a key difference. The difference is that in the industrial paradigm, leadership needed to be effective and produce excellence, success, and results. Leadership needed to be good management (Rost, 1991). In the postindustrial paradigm, the leadership does not have to produce results to be considered a success.

The fourth element of leadership is that leaders and followers develop mutual purposes. These mutual purposes are designed in a mindset that is non-coercive and includes an influence relationship. The elements are not considered goals. The difference between a purpose and goal is the result. Goals have a direct quantification, where purposes can be more open-ended and allow for change. Leaders and followers do not realize their purposes, but rather reflect on it. Lastly, mutual purposes are agreed on by leaders and followers who engage in leadership together (Rost, 1991).

An in-depth understanding of leadership is valuable as a base knowledge for researchers because it extends our knowledge into educational leadership and STL. Educational leaders need strong skills to creatively and effectively find solutions to challenges they face. It is possible that aspiring leaders could gain these skills through graduate-level programs and professional workshops (Kearsley & Lynch, 1992). The field of educational leadership covers a broad spectrum of specialty areas. As educational leadership evolves through existing specialty areas and new specialty areas, shifts in mindset are possible. Educational leadership, more recently, is seeing a shift from top-down hierarchies to a more collaborative approach with an emphasis on curriculum and instruction (Wraga, 2001). It is the collaborative approach to educational leadership that lends itself to STL, which is discussed later.

In the context of educational leadership, Leithwood and Riehl (2005) identified four claims about school leadership; (1) school leadership has a relationship to improve student learning, (2) school leadership typically rests with the principals and teachers, but may be distributed to others, (3) basic leadership practices are valuable in nearly all contexts, and (4) student achievement, equity, and justice are present with successful

leaders in diverse schools. Educational leadership research lends well to case studies, design research, quantitative surveys, and experimental research (Riehl & Firestone, 2005). Through the previously listed methods, the authors recommend a push for quality research that moves the field forward in a similar direction, which has the ability to gain the trust of the general public for continued dedicated funding streams. A connection also needs to be made to get the research in the hands of practitioners, policymakers, research funders, and the general public (Riehl & Firestone, 2005).

2.5.3 Transformational leadership

Transformational leadership is a leadership theory utilizing inspiration and idealized influence to gain followers' trust, respect, and willingness to go beyond what is required (Bass, 1985; Bolman & Deal, 2013; Burns, 1978; Conger & Kanungo, 1998). Burns (1978) originally applied the theory to political leaders. He created two mutually exclusive terms in transformational leadership and transactional leadership.

A transactional leader promotes compliance in a rewards and punishment system for followers. Transactional leaders create work environments that are structured and lack innovation compared to transformational leaders. Transformational leaders have charisma, use inspirational motivation, provide intellectual stimulation, and recognize individual differences. Transformational leaders impact schools and studies show a significant positive effect on student engagement (Leithwood, 2007). This notion is supported by the finding that principals who exemplify transformational leadership behaviors positively impact organizational conditions of schools (Hipp, 1995).

Regarding educating the next generation of transformational leaders, there is a need to not only educate leaders of school systems, but a need to simultaneously teach future leaders how to reform and improve schools (Hewitt et al., 2014). Transformational leadership involves changing an organization within general guidelines of what already exists. A transformative leader focuses on making a school better to what it potentially can be, including equitable and just considerations (Hewitt et al., 2014).

2.5.4 School technology leadership

Forty-four academic journal results were identified in Academic Search Complete regarding *school technology leadership*. ERIC returned 171 publications in total. These results point to school technology leadership being a focused area of research with significantly fewer publications. When I used the term *educational technology leadership*, similar results appeared. However, STL results commonly focused more on PK-12 literature whereas educational technology leadership results included more higher education applications.

STL is a specialty area of educational leadership. STL is defined as "the organizational decisions, policies, or actions that facilitate effective utilization of information technology throughout the school" (Anderson & Dexter, 2000, p. 22). STL is the merging of the fields of educational technology and school leadership (McLeod & Richardson, 2011) .

Schools need to have effective leaders embracing technology who understand the impact meaningful technology integration can have on student learning (Hughes et al., 2005). Administrators are one component of schools that play a vital role in determining

the direction and climate of the building (Anderson & Dexter, 2000). Administrators, as building leaders, influence initiatives and goals in profound ways, such as technology purchases, staff development, and the creation of a culture within the school. Technology in education continues to advance, and administrators can directly impact building choices (Chang, 2012).

2.5.5 Influencers

Three stakeholder groups influence STL: students, educators, and administrators (Sheninger, 2014). In the fall of 2018, all Kindergarten through grade 12 students were born in the 21st century, and every educator was born in the 20th century. The educators are digital immigrants and need to stay connected with the latest trends. Likewise, administrators also need to stay connected to the latest trends. Administrators hold significant decision-making power in the educational system, which can impact an entire school. However, just because students are digital natives does not mean they know how to use technology appropriately. STL involves understanding best practices, and digital citizenship is a subject getting a lot of attention in recent literature (Ribble, 2015).

Students are a serious influencer in creating a climate where teachers and administrators need to continue to advance their skills forward. Administrators need to have a concrete understanding of digital literacy and digital citizenship to develop an instructional vision (Rivard, 2010). Early 1990s research found evidence that both teachers and administrators can initiate technology innovation (H. J. Becker, 1993). Innovation takes both leaders and followers. Technology in the classroom requires willing teachers to implement new initiatives for teaching and learning (Tan, 2010).

Regarding information technology (IT), policies at the school level need to make sense for users including students, educators, and administrators. As an administrator in a large school district, Wells (2010) often fielded questions regarding policies. Since administrators are the face of STL in many situations, it is best if they are part of the development team for new policies. Again, administrators play a significant role in technology initiatives and the vision of schools including professional development, policies, and budgeting decisions (Wells, 2010).

Literature surrounding STL in the last few years has pushed for more experienced and knowledgeable leaders concerning educational technology. Teachers need leaders who will move them to effectively utilize information and communication technologies resources (Ertmer & Ottenbreit-Leftwich, 2010). Teacher preparation programs also need to shift toward more educational technology-centered lessons to serve future educators better (Will, 2016). Without proper implementation of educational technologies, including a lack of vision, schools struggle to see the full benefit or possibilities for students (Herold, 2015).

In recent United States government policy briefs, the Department of Education pushed for colleges and universities to better introduce and utilize technology. The push focuses on colleges and universities building capacity of educational technology in future leaders. Pre-service programs for teachers and administrators need to prepare their graduates for STL roles (U.S. Department of Education, 2016). Often, teachers take on technology leadership roles, so it is equally pertinent for teachers to be involved with technology training sessions and opportunities to gain the skills necessary for success (Twomey, Shamburg, & Zieger, 2006).

Preparing administrators to become knowledgeable in educational technologies allows for schools and universities to embed technology in meaningful ways (Hughes et al., 2005; U.S. Department of Education, 2017). Students will continue to push educators to adapt to new learning styles and technologies to better educate and engage learners. Teachers and administrators need to continue their willingness to think outside of the box and implement new strategies in regarding teaching and learning methods through experimenting (Tan, 2010). Both technology and leadership play a vital role in a 21st-century school. Specifically, principals can select and implement technologies they see best fit to influence student learning (Chang, 2002). Principals need to understand and properly implement technologies available to their schools (Chang, 2012).

2.5.6 Teaching and learning methods

Students increasingly need to be more technologically literate each year because the job market is demanding it (U.S. Department of Education, 2017). In order for students to learn the newest processes and technologies, their teachers need a robust understanding also. Yet professional development opportunities are commonly led by administrators who lack technological skills themselves (Richardson et al., 2013).

Often schools put technical personnel in IT leadership roles because technical personnel understood the technologies available. However, IT personnel often did not understand the pedagogical side of education. Over time, it became increasingly clear that the most effective IT leadership stemmed from school leaders themselves (Michael, 1998). School leaders are typically involved in nearly every aspect of the school, so they can apply IT leadership to complex growth problems and better develop new teaching methods within their school environment. Nine factors were identified for a model of IT

best practices in PK-12 schools; Access rate, leadership potential, technology planning, staff development, technical support, hardware and software, technology budget, infrastructural facilities, and technology policy and procedure (Michael, 1998). The nine factors are highlighted because 20 years later numerous studies still use a variation of the same factors when studying STL.

Data-driven decision-making advanced throughout the 2000s with additional methods for data collection. Administrators dealt with growing piles of data and needed to sort through the information available. School technology leaders are commonly involved in decisions regarding online assessments and mining of data to improve and understand student learning (Boudett, City, & Murnane, 2013). By educators understanding the data generated, adaptations and growth plans can foster new and innovative learning modalities.

With the growth of Web 2.0 applications, STL needed leaders who understood the importance of educational technology to enhance student learning and time management of teachers. The integration of new teaching modalities was the goal of Calabrese (2012). Through blogging, prospective school administrators gained an understanding of digital tools. By teaching through Web 2.0 applications, Calabrese (2012) believed the graduates would be positive technological leaders and well prepared in the future. With the ability to transform schools and be an integral part of change, administrators need to continue to enhance their skills (Bathon et al., 2017). Web 2.0 applications allowed future educators to learn by doing.

However, if technology was going to play a more significant role in education, teachers needed time to learn the new tools (Thomas, 1999). With more technology in

schools, new challenges emerged. School leaders needed preparation in technology integration. Exposing school leaders to digital technologies and the most recent trends in educational technology are instrumental in building a school leaders' skills (McLeod & Richardson, 2011).

2.5.7 Researchers shaping the current literature on STL

Two researchers who published articles on STL since 2000 are Ronald Anderson and Sara Dexter. Anderson and Dexter (2000) published a report on school leadership and the effective utilization of technology. They developed six functions for educational technology leadership decisions; "strategic planning, goal-setting, vision and vision sharing; budgeting and spending; organizational structure and process; curriculum; program evaluation and impact assessment; and external relations and ethical issues"(p. 5). The six functions are of note because subsequent researchers often use comparable functions in other research within STL.

The International Society for Technology in Education (ISTE) developed its first round of standards for educational technology use in 1998. The ISTE standards serve as a model for developing effective leaders in STL (Snelling, 2016). The standards were then known as the National Educational Technology Standards (NETS) (ISTE, 2018). In 2001, educational leaders and technologists developed NETS for administrators (NETS-A), which were widely adopted to help administrators without technology backgrounds understand effective technology integration (Brooks-Young, 2009). During the refresh of ISTE standards from 2007-2009, all standards were updated from being known as NETS to ISTE Standards (Herold, 2015) . In 2018, ISTE updated the standards for education

leaders by adding foci on equity, citizenship advocacy, visionary planning, empowering leadership, systems design, and fostering connected learners (ISTE, 2018).

Technology integration in education grew ever since the modernization of the classroom through the 1970s and 1980s (Cuban, 1986). However, research in the area of technology leadership in schools was sparse during the same period. Educational leadership involving technology gained momentum in the literature during the late 1980s and 1990s with the intent of examining what factors "are associated with the exemplary use of technology in schools " (Kearsley & Lynch, 1992, p. 1). Before the expanded field of research on technology in schools, typically technology adoption was an individual agenda or idea by an administrator. Without the development of STL, it would be difficult to adequately prepare teachers and administrators to take on leadership roles involving instruction, technology, and learning (Kearsley & Lynch, 1992).

The literature on STL grew in the first decade of the 21st century. A shift seemed to occur with greater emphasis on pre-service leadership programs and the need to produce more candidates with the skills necessary for success in STL. There are three domains commonly used in educational leadership literature to study STL (McLeod et al., 2011). First, research focused on the usage of digital technologies to teach traditional educational leadership content. The second domain emphasized training school administrators on how to use digital technologies better. Richardson et al. (2013) acknowledged that "the third domain focuses on how to prepare school administrators to be better technology leaders" (p. 147). However, they also noted that the third domain lacked research in the literature, considering it was the most important of the three domains (McLeod et al., 2011).

In the second decade of the 21st century, STL literature continued to expand. Publications about STL and educational technology use grew with a significant focus on software and 1:1 computing. Learning in new ways was taking shape, and a new generation of students was going to experience education where technology played a more significant role (McLeod, 2008). One study reviewed the literature and content analysis techniques to gain a better understanding of how school technology leadership had been addressed to that point in conference programs and professional journals (McLeod & Richardson, 2011). A secondary goal of the research by McLeod and Richardson (2011) was to identify themes about issues discussed in STL literature. Using data from 1997 to 2009, the researchers coded and categorized presentations from three of the largest conference programs: The American Educational Research Association (AERA), the University Council for Educational Administration (UCEA), and the National Council of Professors of Educational Administration (NCPEA). They concluded the field of technology leadership has room to grow using studies with a higher degree of methodological rigor. However, their study is a first and a purposeful starting place for others.

Additionally, their study uncovered the limited amount of literature on STL throughout the 1990s and 2000s. This leads to the realization that without enough high-quality research, it is not practical to assume what effective technology leadership is in PK-12 education. Another conclusion is the understanding of the role administrator's play in education. Innovation in schools does not take shape from presentations at conferences or publications by educational leadership scholars (McLeod & Richardson, 2011). Technological innovation often takes place at the school level.

In a systematic review of literature, Dexter et al. (2016) categorized STL research publications into five domains of the unified model of an effective leader (Hitt & Tucker, 2016): establishing vision, facilitating student learning, building professional capacity, supporting the organization, and partnering with external stakeholders. The authors concluded that educational leadership programs need to better educate school leaders about the power educational technology holds in impacting teaching, learning, and leading (Dexter et al., 2016).

2.6 Technology Leadership Measurement Instruments

Unlike STL and educational leadership, identifying measurement instruments involved a variety of methods. Both Academic Search Complete and ERIC resulted in no results being identified when searching for the term *school technology leadership measurement instruments*. Therefore, I utilized the previous search results and sifted through sources to identify studies containing measurement instruments. After identifying studies containing measurement instruments, I utilized their references to identify more results.

In order to further understand STL, measurement instruments combined with different measurement techniques can gather data to be used to analyze the field. Technology in education changes the way students learn and is growing at a rapid rate with 1:1 initiatives and bring-your-own-device plans (Richardson et al., 2013). Understanding the impact of technology in schools and the leadership associated with it gives us insight to what the rapid implementation means.

Having reviewed broad literature on STL, I noted that researchers used both quantitative and qualitative methods to analyze data collected through instruments.

Quantitative methodology in STL can include questionnaires for teachers and administrators. Some early STL researchers analyzed the integration of technology using data from the 1998 Teaching, Learning, and Computing survey (Anderson & Dexter, 2000). The researchers analyzed technology leadership concerning demographic variables and eight technology leadership attributes. The study linked STL to "decision-making about technology goals, policies, budgets, committees and other structural supports for improving technology's role in learning" (Anderson & Dexter, 2000, p. 17). The results of the study showed a link between leadership and outcomes or success of technology programs. The researchers summarized a "technology learning organization" as a distributed leadership model with stakeholders including administrators, teachers, students, and parents. Technology learning organizations have great potential for advancing school technologies to improve learning (Anderson & Dexter, 2000).

This secondary analysis of data from an existing instrument eventually morphed into the development of instruments solely collecting data through the lens of STL. Other researchers used the NETS-A in combination with data from the 1998 Teaching, Learning, and Computing nationwide survey to evaluate STL (Anderson & Dexter, 2005). The results highlighted the importance of technology leadership being paramount over technology infrastructure. Without properly utilizing the technologies available, resources go to waste (Anderson & Dexter, 2005).

To understand STL better, the development of new instruments with sound reliability and validity surfaced during the 2000s. One instrument was the Principals Technology Leadership Assessment (PTLA) (CASTLE, 2009). Data from the PTLA can help educators with decision-making regarding leadership training and professional

development programming (CASTLE, 2009). The PTLA was based on the original NETS-A, and was psychometrically validated by the American Institutes for Research (AIR). The AIR development team used the data from the seventy-four principals to test the reliability of the instrument. Internal reliability testing resulted in the PTLA being highly reliable and measuring the desired construct of STL (CASTLE, 2009).

Numerous other instruments were developed over the past 20 years including the Technology Leadership Questionnaire by Chang (2002), the Principal Technology Leadership Competencies Survey by Scott (2005), the Technology Facade Checklist by Tomei (2002), the K-12 Technology Leadership Survey by Seneca (2008), the Survey of Principal Technology Leadership Competency Indicators by Shyr (2016), and the Education Technology Leadership Assessment by Davis (2008). The Technology Leadership Questionnaire (TLQ), was designed to understand further the technology habits about leadership and implementation of a given leader (Chang, 2002). The TLQ utilizes the perceptions of teachers to assess their principals' technology leadership. The study addressed two salient issues. First, the domains of effective technology leadership were identified. Second, data were analyzed to determine if the domains perceived to be important to effectiveness were common across individuals (Chang, 2002). The researcher used a single level analytical method, structural equation modeling (SEM), to examine the data.

A 2004 study in Texas included a new 4-part survey based on the National Educational Technology Standards for Administrators (NETS-A) (Seay, 2004). The survey was created because, at the time, no instruments existed to measure technology

leadership using the NETS-A (Seay, 2004). The survey included 58 items and included yes or no questions, Likert-style prompts, and open-ended response items.

The Principal Technology Leadership Competencies Survey was developed to fill a void related to understanding technology leadership competencies (Scott, 2005). This mixed-methods survey consisted of open-ended questions along with 25 Likert-style questions. Despite filling a perceived void in the instrument space for STL, no published use of the instrument exists outside of the report of its initial development.

The instruments reviewed that measure STL seem to be used by the researcher exclusively. This section highlighted a variety of instrument designs and analysis techniques. Overall, a common thread among the instruments is the use of NETS-A standards. These quantitative studies used a variety of analysis techniques.

2.7 Discussion

Leadership surrounding technology in schools is vital due to the impact on student learning along with the financial investment schools continue to make globally in the multi-billions of dollars (Dexter et al., 2016). Significant time and research on different measurement instruments lend to a better understanding of STL. STL combines educational leadership and educational technology to focus the lens on how leaders embrace technology to impact learning. Traditional methods of teaching and learning are meeting new techniques through online options. Digital devices are utilized in schools and colleges more frequently than in past generations (Cho, 2016).

Leadership as a whole is defined as “an influence relationship among leaders and followers who intend real changes that reflect their mutual purposes” (Rost, 1991, p.

102). Educational leadership improves student learning, typically rests with principals and teachers, assumes basic leadership practices, and incorporates student achievement, equity, and justice in diverse schools (Leithwood & Riehl, 2005).

Utilizing transformational leadership theory in STL research is fitting due to the inspiration and idealized influence to gain followers' trust, respect, and willingness to go beyond what is required (Bass, 1985; Bolman & Deal, 2013; Burns, 1978; Conger & Kanungo, 1998). Technologies frequently change and new tools are introduced. Transformational leadership is a theory used for leaders who embrace change and use change to impact others positively.

The published research presented in this thematic review is limited in terms of the number of studies reviewed. Although a large amount of research was reviewed, by applying other search parameters, numerous studies could be analyzed similarly. The goal was to identify and include the most relevant research to the proposed objective of identifying STL and the instruments available to assess principals' leadership skills regarding technology.

Based on the literature reviewed, there are opportunities for more thoroughly developed instruments to measure technology leadership and assess principals' technology leadership capacity. There is a dearth of STL studies that rely on quantitative methods with numerous researchers recommending further quantitative research within STL (Anderson & Dexter, 2005; Cakir, 2012; McLeod & Richardson, 2011; Tan, 2010). Although instruments exist to measure STL, many of the instruments lack thorough testing. Future researchers can use a variety of current instruments available to test reliability and validity. There is also room for the development of new instruments due to

the rapid growth in the specialty area of STL. Proper measurement of STL, along with a variety of measurement techniques, can add to the current body of literature, which leads to a greater understanding of the field of education as a whole.

CHAPTER 3. THE DEVELOPMENT OF A NEW INSTRUMENT COMPARING TEACHER AND PRINCIPAL PERCEPTIONS OF SCHOOL TECHNOLOGY LEADERSHIP

3.1 Abstract

Schools are continually integrating more instructional technology each year and principals often hold decision-making power to select and implement new technologies into their school buildings. Thus, since teachers are the frontline workers utilizing the technologies, it is important to understand whether a principals' school technology leadership skills impact teachers within their school building. Data collection from teachers provides a perspective allowing teachers to evaluate their principal directly. This paper describes the development and inferences of the *Impact of School Technology Leadership* instrument from a pilot study of 60 teachers and 21 principals. The results suggest that principals and teachers typically have different perceptions of principals' technology leadership skills. Overall, data collected from the survey instrument demonstrated that most of the dimensions were reliable; however, sample size could be a factor for the low performance on two of the five dimensions.

(Keywords: Technology integration, educational leadership, school technology leadership, principal leadership, measurement instruments, principal evaluation.)

3.2 Introduction

For over forty years, the integration of instructional technology into the P-12 curriculum continues unabated. Worldwide, schools are currently spending an estimated $19 billion annually on educational technology (Future Source, 2014). With the continued integration of technologies designed to enrich learning in schools, one area of growing interest is the role principals play in leading technology integration in their

schools. A growing field of research, referred to as school technology leadership (STL), strives to understand the role all leaders can and should play in leading schools and teachers through a transformation of instructional technology (Afshari et al., 2008; Hughes et al., 2005). Because not all leadership preparation programs provide the technology leadership skills principals need to be a strong school technology leader (Dexter, Richardson, Nash 2016), the professional development of principals related to STL gains importance. By assessing the technology leadership skills of principals one can create a benchmark for principal professional development. Professional development can include utilizing their skills to implement new technology initiatives with their teachers. This change in education takes time and principals often need time to facilitate that change. Adequate time for teacher adoption is also necessary, especially when it relates to new and innovative processes (Dawson & Rakes, 2003).

Principals must also understand that technology integration is not about a particular piece of technology, it is about leading change in education through levers like transformational leadership, influence, and inspirational motivation (Afshari et al., 2008; Cakir, 2012). Schools of education are pushing educational technologies to future generations of teachers and leaders. However, for the current teachers in the profession, the decision to implement new technologies in their school building is often left to the principal (Will, 2016). Even though teachers may have a choice in their classrooms regarding instructional design, technologies are not always leveraged to their maximum capacities (Cho, 2016; Ertmer & Ottenbreit-Leftwich, 2010). To be a leader in a 21st-century school, building leaders must understand and develop a vision for technology implementation and use (Kozloski, 2006; Tan, 2010).

Therefore, understanding the technology leadership of principals through the eyes of the teachers who work under them presents a unique perspective. This purpose is to compare principal intentions related to technology leadership and how teachers perceive their technology leadership.

3.3 The Purpose of the Study

The purpose of this study is to develop and pilot an instrument to assess principals' technology leadership skills from the perspective of the teachers. The primary question addressed in this study is; can a 20-question survey adequately measure multiple dimensions of STL? Research findings suggest that technology leadership can significantly impact technology utilization by staff (Anderson & Dexter, 2005; Inkster, 1998; Kozloski, 2006). This study seeks to honor the work of researchers in the field of STL by acknowledging the impact technology leadership has, and advance the field with the development of a functional instrument that can assess multiple dimensions of STL.

3.4 Literature Review

The goal of this literature review is to highlight what is currently understood about STL and review the measurement instruments available. This literature review addresses research within the field of STL I identified through a thematic review using guidance from a protocol called the Preferred Reporting Item for Systematic Reviews and Meta-Analyses (PRISMA). I included studies published within the past twenty years by reputable STL scholars and instruments focused primarily on STL. The past twenty years is the timeline examined in STL because the late 1990's is the time when computers and the internet took hold within schools (Richardson et al., 2012).

3.4.1 School technology leadership

School technology leadership is defined as effectively using information technology to facilitate organizational decisions, policies, or actions within a school (Anderson & Dexter, 2000). STL incorporates both educational technology and school leadership (Januszewski & Molenda, 2008; McLeod & Richardson, 2011). Research suggests that having effective leaders who embrace technology can result in meaningful outcomes for student learning and have an impact on building choices regarding instructional technology (Chang, 2012; Hughes et al., 2005).

Additionally, teachers need leaders who understand technology resources and can share that knowledge (Bathon et al., 2017; Ertmer & Ottenbreit-Leftwich, 2010). Today's schools require leaders who understand information and instructional practice, including technology (Chang, 2012; Kozloski, 2006). Schools that integrate technology effectively tend to be led by a principal with in-depth knowledge in STL (Langran, 2006). It is through effective STL that teachers participate in technology integration within their classrooms (Dawson & Rakes, 2003; Tan, 2010; Tillman, 2014; Twomey et al., 2006). Technology integration includes instructional technology impacting teaching and learning models and curriculum design.

There is a recent shift from focusing on the implementation of technology initiatives in schools to district-level leaders moving toward supporting teaching and learning models that naturally utilize digital technologies (Richardson & Sterrett, 2018). The recent shift relies on new teaching and learning models to change classroom instruction. To analyze new trends, utilizing data makes it possible to make informed decisions on the impact of new educational strategies (Boudett et al., 2013). Regarding

STL, data-driven decision making can assist in understanding how technology meshes with teaching and learning models. School leaders need to understand what successful implementation means and utilize standards to gauge integration (Brooks-Young, 2009). One way to understand the impact of new teaching and learning models that incorporate technology naturally is through the collection of data from teachers.

Principals, as technology leaders, need teachers who are willing to integrate technology into their classrooms (Tan, 2010). Principals with strong technology leadership skills can connect with their teachers who can engage students in a variety of meaningful ways with new technologies (Babell & O'Dwyer, 2010; McLeod, 2008). Examining STL behaviors through the perceptions of teachers gives principals a critical view of their impact on teacher adoption of technology integration. Teacher perceptions are influenced by their principal which can create changes in their teaching methods (Ertmer & Ottenbreit-Leftwich, 2010). By teachers assessing principals on STL skills, teachers can share their experiences interacting with administrators concerning technology, which can advance the knowledge of principals on their perceived skills (Cakir, 2012).

3.4.2 Current instruments available

Instruments that measure STL vary in popularity and ease of use. For example, the self-assessment of the Principals Technology Leadership Assessment (PTLA) developed by the Center for the Advanced Study of Technology Leadership in Education (CASTLE), was cited and used in a handful of dissertations throughout the 2010s (Bobbera, 2013; Holland, 2015; Melton, 2015). Given the rapid changes in the field of STL, revisions to this instrument are needed (CASTLE, 2009).

The PTLA, and other instruments like it, are based on standards of the International Society for Technology in Education (ISTE) (ISTE, 2018). ISTE first developed standards in 1998, then known as the National Educational Technology Standards for Administrators (NETS-A). Standards were also developed for teachers and students. Based on the focus of the field of STL on leadership qualities, STL instruments often use the standards for administrators. The most recent target of standards includes students, educators, educational leaders, and coaches (ISTE, 2018). The standards were written by members of ISTE and stakeholders in the field of educational technology (Snelling, 2016). ISTE members typically include leaders in the field of educational technology. Since members are knowledgeable of educational technology, it is the main reason they assist in the development and refinement of standards. With the ISTE standards continually being updated and new categories being added, newer instruments with better alignment might also change how STL is measured. This supports the recent shift in leadership toward supporting teaching and learning models that naturally incorporate digital technologies (Richardson & Sterrett, 2018).

Other instruments measuring STL include the Technology Leadership Questionnaire by Chang (2002), the Technology Facade Checklist by Tomei (2002), the Principal Technology Leadership Competencies Survey by Scott (2005), the K-12 Technology Leadership Survey by Seneca (2008), the Education Technology Leadership Assessment by Davis (2008), and the Survey of Principal Technology Leadership Competency Indicators by Shyr (2016). Again, many of the instruments are based on the ISTE standards, including Seay (2004), who created an ISTE standards-based survey to self- report principals' technology skills in Texas.

Each instrument discussed above was developed to measure a unique aspect of STL. The Technology Leadership Questionnaire was designed to identify domains of effective technology leadership and evaluate survey results utilizing structural equation modeling. The results showed the domains of vision, planning, and management, in-service training, interpersonal and communication skills, ethical and legal issues, technological support and infrastructure, and evaluation defined technology leadership well. The domain of integrating technology leadership into curriculum and learning did not perform well (Chang, 2002). A critique of the study is that the instrument had 64 questions, which is one of the lengthier instruments from the list reviewed. In contrast, the Technology Façade Checklist includes 20 questions, but lacked the same rigor of analysis that the Technology Leadership Questionnaire included. The Technology Façade Checklist was designed to assist school leaders in the selection of appropriate technology for their schools, including human factors, financial investment, commitment of resources, and instructional strategy (Tomei, 2002).

Another instrument designed to measure STL was the Principal Technology Leadership Competencies Survey, which focused on investigating educator perceptions of STL skills. The results showed that principals and teachers did not agree on the requisite competencies of principals (Scott, 2005). The sample population was geographically limited to three districts in Southwest Oklahoma. Since this study was the only study found to utilize the instrument, the results could be different in a different setting. The Survey of Principal Technology Leadership Competency Indicators was designed with a similar research goal as the Principal Technology Leadership Competencies Survey, to create an instrument that included competency indicators to

measure the STL of principals. The instrument was developed with a hand-picked expert panel of 18 participants (Shyr, 2016). Both studies lack a more thorough analysis using larger samples.

Similarly, K-12 Technology Leadership Survey was minimally utilized, except in the dissertation , to investigate the essential skills needed to become an effective e-leader (Seneca, 2008). The 77-item mixed-methods instrument included six open-ended questions and 73 multiple choice questions, which was one of the longest instruments reviewed. Another instrument developed as part of a dissertation was the Education Technology Leadership Assessment (ETLA), which was based on the ISTE standards for technology leadership (Davis, 2008). The instrument utilized the same design as the PTLA, but included 38 questions. A noticeable difference of the ETLA is the focus on question responses aimed at assessing the technology leadership of schools as a whole versus the individual building principal.

Another instrument utilizing ISTE standards is the Technology Leadership Survey, which included 55 questions, with four open-ended questions for participants of a leadership academy. The Technology Leadership Survey is a self-evaluation used by principals regarding their technology leadership (Seay, 2004). There is no teacher input.

Different instrument designs and analysis techniques were common among the instruments reviewed. Each instrument had areas of success and areas for further development. The instrument developed and piloted in this study, the *Impact of School Technology Leadership Instrument*, is unique in that it seeks to blend the perspectives of principals and teachers. This offers an opportunity to determine how principals' technology leadership skills are received and understood by teachers in their school.

Teachers can provide a new angle of insight within this instrument which is different from other instruments reviewed.

3.5 Conceptual Framework

The conceptual framework of this study is guided by research from Chang (2002), which focused on the teacher perceptions of their principals. His research focused on dimensions of leadership a principal should possess in order to be a capable technology leader. The dimensions are considered core tasks of principals "in dealing with teaching, learning, and administrative operations that involve technology in their schools" (p.330). They are; (1) vision, planning, and management, (2) staff development and training, (3) technological and infrastructure support, (4) evaluation and research, and (5) interpersonal and communication skills. Chang (2012) developed the dimensions by reviewing numerous studies in technology leadership (Anderson & Dexter, 2000; Inkster, 1998; ISTE, 2018; Kearsley & Lynch, 1992). Vision, planning, and management are deemed the most vital foundation for technological leadership. An effective principal understands trends in technology development, can apply the trends to potential uses within the classroom, can maintain a vision utilizing technology. Staff development and training are necessary to educate others on the latest trends deemed appropriate. Technological and infrastructure support is necessary to provide staff members with assistance to preserve equal access, which is a necessary skill of principals who are technology leaders. Evaluation and research essential to quantify the technology skills of instructors. By identifying where instructors are, principals can develop a plan for professional development and continue to push instructors to implement technologies that improve student achievement. Lastly, interpersonal and communication skills are crucial

because a technology leader needs to be competent in providing support on new technologies, which is even more important than the technology skills themselves (Chang, 2012).

3.6 Theoretical Framework

This paper investigates principals' technology leadership through the theory of transformational leadership. Transformational leadership theory utilizes inspiration and idealized influence to gain followers' trust, respect, and willingness to go beyond what is typically required (Bass, 1985; Bolman & Deal, 2013; Burns, 1978; Conger & Kanungo, 1998). Burns (1978) theorized that leaders and followers both raise each other to higher levels of motivation and morality. Research suggests principals who are transformational leaders positively impact organizational conditions and student engagement (Hipp, 1995; Leithwood, 2007).

Transformational leadership theory manifests itself in the instrument through the item design, which focuses on assessing principals' technology leadership skills through the perceptions of teachers. Additionally, analysis of the results found in this study assumes principals who score higher on the instrument typically are deemed more transformational in their leadership based on their teacher's perceptions versus principals who score lower based on the teacher's perceptions. It is through the lens of transformational leadership this research focuses on the impact principals have on STL. Based on transformational leadership theory, by collecting the perceptions of teachers regarding their principals' technology leadership skills, statistical analysis can help measure the level to which a principal might incorporate transformational leadership skills into their overall leadership style. The instrument developed in this study functions

under the premise that each item helps measure a dimension that can quantify whether a principal is positively impacting the school as a transformational leader.

3.7 Methods

The following section describes instrument development, characteristics of the pilot sample, and the results.

3.7.1 Instrument development

The goal of this study was to develop an instrument to assess the perceptions of teachers in relation to their principals' technology leadership skills. When principals are armed with information about how teachers perceive their technology leadership skills, principals can expand their own skills to better serve teachers within their school. Items were developed by reviewing previously published instruments addressing domains within STL (CASTLE, 2009; Chang, 2002, 2012; Chang et al., 2008; Davis, 2008; Scott, 2005; Seay, 2004; Seneca, 2008; Shyr, 2016; Tomei, 2002). After reviewing the literature of other researchers who utilized multiple dimensions in their instrument designs, I selected the five dimensions of Chang's research for their similarities in overall study design, and for the purpose of measuring the STL skills of principals through the perceptions of teachers (Chang, 2002, 2012; Chang et al., 2008). This study identifies STL as the overall latent factor with five dimensions explaining it. Items serve as indicators for each dimension.

All items in the instrument designed in the present study used a four-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." Items were then reviewed for content and clarity by 24 technology coaches from school districts throughout

Minnesota who suggested adjustments. The 24 full-time technology coaches are members of a consortium who gather monthly to discuss technology integration. Since the technology coaches hold full-time positions in the field of STL, they were knowledgeable of the content. An additional meeting took place with graduate students and a professor from the Department of Educational, School, and Counseling Psychology at the University of Kentucky. The meeting was an opportunity to gather more feedback and recommendations on the study design and analysis techniques.

The pilot instrument had 20 items based on Chang (2012). Items were modified using instrument design resources including question design, overall instrument design, and data collection methods (Fowler Jr., 2009; Krosnick, 1999; Patten, 2001). Listed below are the pilot instrument items grouped by dimension for the teacher version, including the corresponding question number and a variable code. The coding begins with a "t" for teachers versus a "p" for principals. The variable codes are used in the data analysis in order for SPSS to see each item. The coding also helps with identifying each dimension and item. Each dimension is assigned a letter (A, B, C, D, and E) and each item under those dimensions is assigned an identifying letter. For example, on the teacher version the first item under dimension A (vision, planning, and management) is tAA (principal shares the school technology vision with me). The entire instrument follows the same coding pattern.

- Vision, planning, and management (tA)
    - Principal shares the school technology vision with me (1, tAA)
    - Principal promotes a school culture of technology use (2, tAB)
    - Principal advocates for technology-rich resources for me (3, tAC)
    - Principal encourages technology usage to manage administrative operations (4, tAD)
- Staff development and training (tB)
    - Principal hosts staff development sessions focused on technology implementation (5, tBA)
    - Principal allocates time for technology implementation (6, tBB)
    - Principal modifies professional development based on my needs (7, tBC)
    - Principal includes feedback on technology integration in observations of me (8, tBD)
- Technological and infrastructure support (tC)
    - Principal advocates for technology support (9, tCA)
    - Principal ensures equal access to technology resources for me (10, tCB)
    - Principal ensures timely repair of classroom technology equipment (11, tCC)
    - Principal ensures access to a variety of software applications for me (12, tCD)
- Evaluation and research (tD)
    - Principal implements evaluation procedures for me in regard to technology (13, tDA)

- Principal is open to new ideas in regard to technology if I bring them forward (14, tDB)
- Principal evaluates technology use in instructional programs (15, tDC)
- Principal includes me in researching new technologies for the school (16, tDD)

- Interpersonal and communication skills (tE)
  - Principal communicates with me weekly through technology (17, tEA)
  - Principal posts weekly on social media related to our school (18, tEB)
  - Principal encourages me to take risks in regard to technology (19, tEC)
  - Principal accepts failure as part of growth when I utilize new technologies (20, tED)

The second version of the instrument is the principal version. The principal version of the instrument is in the same order; however, the wording is modified to reflect a self-evaluation by the principal. In the principal version, the same Likert style scale exists for responses. Again, coding exists so SPSS can properly read the data. For example, pAA is the item "as principal, I share the school technology vision with teachers," which is under the dimension vision, planning, and management on the principal version of the instrument.

- Vision, planning, and management (pA)
  - As principal I share the school technology vision with teachers (1, pAA)
  - As principal I promote a school culture of technology use (2, pAB)
  - As principal I advocate for technology-rich resources for teachers (3, pAC)

    - As principal I encourage technology usage to manage administrative operations (4, pAD)
- Staff development and training (pB)
    - As principal I host staff development sessions focused on technology implementation (5, pBA)
    - As principal I allocate time for technology implementation (6, pBB)
    - As principal I modify professional development based on needs of teachers (7, pBC)
    - As principal I include feedback on technology integration in observations for teachers (8, pBD)
- Technological and infrastructure support (pC)
    - As principal I advocate for technology support (9, pCA)
    - As principal I ensure equal access to technology resources for teachers (10, pCB)
    - As principal I ensure timely repair of classroom technology equipment (11, pCC)
    - As principal I ensure access to a variety of software applications for teachers (12, pCD)
- Evaluation and research (pD)
    - As principal I implement evaluation procedures for teachers in regard to technology (13, pDA)
    - As principal I am open to new ideas in regard to technology if a teacher brings them forward (14, pDB)

    - As principal I evaluate technology use in instructional programs (15, pDC)
    - As principal I include teachers in researching new technologies for the school (16, pDD)
- Interpersonal and communication skills (pE)
    - As principal I communicate weekly through technology (17, pEA)
    - As principal I post weekly on social media related to our school (18, pEB)
    - As principal I encourage teachers to take risks in regard to technology (19, pEC)
    - As principal I accept failure as part of growth when teachers utilize new technologies (20, pED)

The survey instrument included items covering demographic information of gender, age, years teaching, years working under the current principal being evaluated, and educational level. Additional questions collected data on the participants' school building, school level, and school location. This data was important in order to align the corresponding teachers to principals. to verify which principal is being analyzed.

Due to the wide variety of principal duties including managers of information, instructional coach, and building leaders (Kozloski, 2006), a question is included to assess the degree at which a principal actually deals with instructional involvement related to technology. This question adds value to the instrument and the research because it assists in disambiguating instructional and non-instructional activities in which leaders engage. Some districts rely on assistant principals or curriculum directors for professional development. So, by deciphering the duties of the principal being assessed ensures those taking the survey engage, as a part of their day, STL-related activities.

These might include student and teacher device selection, digital curriculum planning, software decisions, overall building guidance on decisions regarding technology. By collecting this data, patterns might emerge in correlation with the evaluation of the principal.

3.7.2 Data collection and sample

An email including an introduction to the survey, a consent to participate, and the survey instrument was sent to every public-school principal in the state of Minnesota per the Minnesota Department of Education principal email list found on their website for the school year of 2018-2019 (MN Department of Education, 2020) (N=1,423). There were 57,262 teachers in Minnesota during the same period. Principals were asked to do two things: a) take the survey, and b) forward a section of the email which included a link to a teacher survey to their teachers. The teacher email included an introduction to the survey, a consent to participate, and the survey instrument. Teachers were assured of their responses would not be seen by or shared with their building principal. In order to analyze survey results, teachers and principals filled out identifying school information to link their surveys. On the back end, the surveys were coded after submission so no identifying information of teachers, principals, or locations were maintained.

The response rate for principals was 1.48 percent and the response rate for teachers was 0.10 percent totaling 60 teachers and 21 principals. Of the 21 principals who responded, only 12 principals had at least one teacher respond who worked within their school. This means I could only use the data of teachers' perceptions on 12 of the principals since the other principals only had data on the self-assessment and no teachers to compare their responses with. Ideally, an entire teaching staff would respond to rate

each principal. With only one teacher responding under a principal, the results can be skewed. However, when analyzing the functionality of the instrument overall, survey data for all 21 principals was included since that part of the analysis did not include a comparison between principal and teacher perceptions. Table 3.1 displays the demographic and job-related information of teachers. Not all categories equal 100 percent due to the rounding of numbers. Table 3.2 displays the demographic and job-related information of the 21 principals who responded to the pilot survey.

Table 3.1

Frequency and Percent of Teacher Respondents

Demographics	Frequency	Percentage
Gender		
Male	10	16.7
Female	50	83.3
Age		
20-30	8	13.0
31-40	24	40.0
41-50	15	25.0
51-60	7	12.0
61-70	6	10.0
Educational Level		
B.A. or B.S.	17	28.3
M.A. or M.S.	41	68.3
M.Ed.	1	1.7
E.Ds.	1	1.7
Ph.D. or Ed.D.	0	0
Years Teaching		
0-10	16	26.7
11-20	28	46.7
21-30	16	26.7
School Location		
Rural	30	50.0
Suburban	26	43.3
Urban	4	6.7
School Level		
Elementary	23	38.3
Middle	23	38.3
High	14	23.3

Table 3.2

Frequency and Percent of Principal Respondents

Demographics	Frequency	Percentage
Gender		
Male	13	61.9
Female	8	38.1
Age		
20-30	0	0
31-40	4	19.0
41-50	9	42.9
51-60	8	38.1
61-70	0	0
Educational Level		
B.A. or B.S.	0	0
M.A. or M.S.	7	11.7
M.Ed.	1	1.7
E.Ds.	11	18.3
Ph.D. or Ed.D.	2	3.3
Years as a Principal		
0-10	10	47.6
11-20	9	42.9
21-30	2	9.5
School Location		
Rural	12	57.1
Suburban	8	38.1
Urban	1	4.8
School Level		
Elementary	8	38.1
Middle	4	19.0
High	9	42.9

The majority of teachers were female (83.3%), while principals were mostly male (61.9%). The age and educational level of both teachers and principals shows principals are older with more education compared to the teachers. More respondents came from rural that urban or suburban schools. The school level for principals shows high school principals responding the most, however, teachers typically were elementary and middle school teachers. This means in the statistics used for the 12 data points of principals who had at least one teacher also complete the instrument, most of the data is from elementary and middle schools. Additionally, data from high school principals was typically not included because they did not have teachers in their building respond to the pilot survey. This accounts for the difference between teacher and principal school level responses. Since the study design included an email to the principal who was then supposed to forward the teacher version to their teachers, many principals answered the instrument, but did not have teachers participate.

3.7.3 Data analysis

The study was originally developed with an anticipated sample size to support Multilevel Exploratory Factor Analysis (EFA). EFA was selected because the overall latent construct of STL was hypothesized to not be directly observable. Indicators, or items, can assist with collecting data to develop a factor model explaining the latent construct of STL. The anticipated ramification of using Multilevel EFA is the ability to test the hypothesized structure model, including path analysis of indicators on factors. This process can validate the structure of the instrument.

To meet the assumptions of multilevel EFA I would need a minimum of 200 principals (Kline, 2016) to respond to the survey, which was not reached. The larger

sample size is needed due to the relatively few indicators per factor, since the goal was to craft a short instrument. Each factor, or dimension, included five indicators, or items. There is no set amount of items needed per factor, but larger numbers of items allows for more statistical precision (Kline, 2016). Additionally, at the teacher level, each principal would need 10 or more teachers to respond who work with them to properly pursue a Multilevel analysis (Kline, 2016). Without enough input data, statistical precision will suffer. With a low response rate, the likeliness that data becomes skewed is greater. Based on the response rate, Multilevel EFA was not appropriate as an analysis technique. Therefore, other techniques were employed to analyze the existing data.

Data analysis took place in three phases: first, a classical item analysis, second, a paired-samples t-test, and third, Cohen's d comparison. The analysis techniques used are based on previous literature and input from instrument development experts. The first priority was ensuring internal consistency was reliable and free from measurement errors

3.7.3.1 Classical item analysis

Classical item analysis assists with evaluating the strength of items within each dimension, along with the overall dimension scores. It includes viewing each item's scale mean, scale variance, and Cronbach's Alpha. The classical item analysis also includes reviewing the impact of deleting each item based on the scale mean, scale variance, and Cronbach's Alpha. If Cronbach's Alpha for a dimension has a value greater than .70, it is usually considered good (Tavakol & Dennick, 2011; UCLA, 2017). Coefficients above .70 indicate a substantial reliability of measurement and coefficients below .70 highlight items with considerable error, which may be eliminated. Corrected Item-Total Correlation shows the correlation between items and the scale score with each item

removed from the scale. Negative item-total correlations typically signify bad items (UCLA, 2017). Classical item analysis is used for the dimensions on both the teacher and principal responses. Table 3.3 summarizes the analysis criteria for this study (BrckaLorenz, Chiang, & Nelson Laird, 2013).

Table 3.3

Internal Consistency Criteria for This Study

Reliability Statistics	Criteria for a Good Scale
Cronbach's Alpha	Greater than or equal to .70
Range of inter-item correlations	Between .15 and .85
Average inter-item correlation	Between .15 and .50
Range of corrected item-total correlations	Greater than or equal to .50
Range of Cronbach's alpha's if item deleted	Deleting any item would decrease alpha

3.7.3.2 Paired-samples t-test.

The paired-samples t-test assists in comparing responses between teachers and principals in the dataset based on each dimension. Based on the information from the paired-samples t-test, Cohen's d is calculated using an online calculator developed by Dr. L. A. Becker (2000).

3.7.3.3 Cohen's d.

Cohen's d is used to compare the means of teachers and principals to assess the effect size. To calculate the difference between the two groups, principal scores were subtracted from the teacher scores and then divided by the standard deviation of the population. The effect size gives us the magnitude of the relationship between principals

and teachers. If the effect size is greater, the groups have larger mean differences in standard deviation units for the scale of interest (J. Cohen, 1988).

3.7.4 Results

The model developed in the study is a five-dimension model explaining the overall latent construct of STL. The first dimension is vision, planning, and management (A). The second dimension is staff development and training (B). The third dimension is technological and infrastructure support (C). The fourth dimension is evaluation and research (D). The fifth dimension is interpersonal and communication skills (E). Table 3.4 displays the item analysis of each item in the five dimensions for teachers. By viewing Table 3.4, the impacts of deleting each item are listed. The data for teachers was aggregated under the 12 principals.

Table 3.4

Item Analysis of Each Dimension for Teachers

Dimension	Item	Scale Mean	Scale Variance	(N=60)	Cronbach's Alpha
tA Total Score		12.597	2.911		.911
		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
	tAA	9.538	1.692	.847	.869
	tAB	9.362	1.419	.899	.849
	tAC	9.604	1.820	.656	.933
	tAD	9.289	1.812	.830	.879
tB Total Score		11.298	2.810		.858
	tBA	8.430	1.836	.849	.791
	tBB	8.487	1.648	.740	.804
	tBC	8.363	1.781	.721	.816
	tBD	8.613	1.356	.654	.880
tC Total Score		12.277	3.212		.897
	tCA	9.176	2.110	.823	.864
	tCB	9.120	1.704	.845	.838
	tCC	9.217	1.419	.828	.872
	tCD	9.317	2.242	.749	.889
tD Total Score		11.804	5.050		.940
	tDA	9.030	2.639	.951	.890
	tDB	9.001	2.921	.915	.905
	tDC	8.617	3.396	.703	.966
	tDD	8.766	2.634	.885	.915
tE Total Score		12.920	2.687		.805
	tEA	9.958	1.555	.436	.882
	tEB	9.508	1.750	.793	.710
	tEC	9.538	1.720	.639	.751
	tED	9.757	1.413	.764	.680

An initial inspection of the items shows most items perform well. The initial inspection includes reviewing reliability statistics of Cronbach's Alpha (greater than or equal to .70), the range of inter-item correlations (between .15 and .85), the average inter-item correlation (between .15 and .50), the range of corrected item-total correlations

(greater than or equal to .50), and the range of Cronbach's Alpha's if items were deleted (decreasing Alpha below .70). Item tEA (my principal communicates with me weekly through technology) is the most suspect item with a corrected item-total correlation of .436. Inter-item correlation examines the extent of an item relating to another item within the same dimension (Clark & Watson, 1995). If they are lower than .15, it shows the item may not represent the dimension. If they are higher than .50, it signals the item might be capturing only a small amount of the dimension (Cronbach, 1951). The inter-item correlations for tA (vision, planning, and management) range from .511 to .810, for tB (staff development and training) the range is .519 to .741, for tC (technological and infrastructure support) the range is .670 to .815, for tD (evaluation and research) the range is .604 to .934, and for tE (interpersonal and communication skills) the range is .226 to .787. Cronbach's alpha for the teacher dimensions ranged from .805 to .940, which indicates the dimensions were substantially reliable, however each dimension was on the higher end of inter-item correlation ranges. This means items were particularly intercorrelated and could consist of a narrower range of the dimension.

Table 3.5 displays the item analysis for principals. The inter-item correlations for pA (vision, planning, and management) range from .329 to .661, for pB (staff development and training) the range is .301 to .578, for pC (technological and infrastructure support) the range is .374 to .598, for pD (evaluation and research) the range is .026 to .511, and for pE (interpersonal and communication skills) the range is -.212 to .691. The inter-item correlations were better situated in the ideal range for the principal version, however, some outliers were still present, such as pD (evaluation and research) which was on the lower end at .026.

Table 3.5

Item Analysis of Each Dimension for Principals

Dimension	Item	Scale Mean	Scale Variance	(N=21)	Cronbach's Alpha
pA Total Score		13.905	3.090		.779
		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
	pAA	10.762	1.690	.571	.739
	pAB	10.381	1.848	.705	.669
	pAC	10.286	1.814	.585	.724
	pAD	10.286	2.114	.503	.764
pB Total Score		12.857	3.629		.759
	pBA	9.952	2.148	.595	.682
	pBB	9.619	2.048	.544	.715
	pBC	9.476	2.662	.443	.759
	pBD	9.524	1.962	.669	.637
pC Total Score		13.619	2.948		.784
	pCA	9.952	1.848	.660	.704
	pCB	10.286	1.514	.617	.726
	pCC	10.333	2.033	.530	.762
	pCD	10.286	1.714	.595	.729
pD Total Score		12.762	2.590		.583
	pDA	10.000	1.200	.587	.292
	pDB	9.667	1.533	.431	.457
	pDC	9.048	2.248	.093	.671
	pDD	9.571	1.657	.369	.509
pE Total Score		14.095	2.190		.348
	pEA	11.286	1.114	.007	.750
	pEB	10.429	1.357	.533	-.032
	pEC	10.286	1.714	.298	.225
	pED	10.286	1.814	.198	.295

Based on the results of the item analysis in table 3.5, dimensions pD (evaluation and research) and pE (interpersonal and communication skills) did not perform well compared to dimensions pA (vision, planning, and management), pB (staff development and training), and pC (Technological and infrastructure support). Item pEB (as principal I

post weekly on social media related to our school) showed a negative value due to a negative average covariance among items, which alpha can never be negative. Some of the low ratings could be attributed to the small sample size. For further analysis, item pEA (I communicate with teachers weekly through technology) was removed due to the negative impact on dimension E (interpersonal and communication skills) for principals. Cronbach's alpha for the principal dimensions ranged from .583 to .784, which indicates four of the five dimensions were reliable with pD (evaluation and research) being below the .70 threshold.

Next, a paired-samples t-test was done on dimensions A (vision, planning, and management), B (staff development and training), C (technological and infrastructure support), D (evaluation and research), and E (interpersonal and communication skills). In order to properly compare dimensions, item tEA (my principal communicates with me weekly through technology) was removed to align with the principals' dimension of E (interpersonal and communication skills) where pEA (I communicate with teachers weekly through technology) was removed. Statistically, this test compares how the teachers answered the questions and how the principals answered the questions. Table 3.6 shows the results from the paired-samples t-test.

Table 3.6

Paired-Samples T-Test

				95% Confidence Interval of the Difference				(N=12)
Scale	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 pA-tA	.309	.452	.130	.022	.596	2.370	11	.037
Pair 2 pB-tB	.467	.492	.142	.155	.780	3.292	11	.007
Pair 3 pC-tC	.306	.536	.155	-.035	.646	1.977	11	.074
Pair 4 pD-tD	.153	.544	.157	-.193	.499	.975	11	.351
Pair 5 pE-tE	.348	.474	.137	.047	.648	2.542	11	.027

There was a significant difference in scores for pA (vision, planning, and management) (mean = 3.459, standard deviation = .411) and tA (vision, planning, and management) (mean = 3.145, standard deviation = .427) conditions; t(11) = 2.370, p = .037. There was also a significant difference in scores for pB (staff development and training) (mean = 3.291, standard deviation = .437) and tB (staff development and training) (mean = 2.824, standard deviation = .419) conditions; t(11) = 3.292, p = .007. There was not significant difference in scores for pC (technological and infrastructure support) (mean = 3.375, standard deviation = .483) and tC (technological and infrastructure support) (mean = 3.070, standard deviation = .448) conditions; t(11) = 1.977, p = .074. There was not a significant difference in scores for pD (evaluation and

research) (mean = 3.104, standard deviation = .376) and tD (evaluation and research) (mean = 2.951, standard deviation = .562) conditions; t(11) = .975, p = .351. There was a significant difference in scores for pE (interpersonal and communication skills) (mean = 3.667, standard deviation = .402) and tE (interpersonal and communication skills) (mean = 3.319, standard deviation = .416) conditions; t(11) = 2.542, p = .027.

The results suggest that principals scored themselves differently than how teachers perceived them on dimensions A (vision, planning, and management), dimension B (staff development and training), and dimension E (interpersonal and communication skills), but scored similarly on dimensions C (technological and infrastructure support) and D (evaluation and research). Lastly, the effect sizes using Cohen's d was calculated. The formula to calculate Cohen's d is the mean of the experiment group minus the mean of the control group divided by the standard deviation (J. Cohen, 1988). The results are 0.738 for pair 1 (vision, planning, and management), 1.091 for pair 2 (staff development and training), .657 for pair 3 (technological and infrastructure support), .320 for pair 4 (evaluation and research), and .850 for pair 5 (interpersonal and communication skills). The results show pairs 1 and 3 have medium effect sizes, pairs 2 and 5 have large effect sizes, and pair 4 has a small effect size. This means teachers and principals had similar responses on pair 4 and the least similar responses on pairs 2 and 5. The larger effect size signifies a greater difference in responses between teachers and principals (Lakens, 2013).

3.8 Discussion

The following section reviews the study limitations and provides conclusions and implications.

3.8.1 Findings

The purpose of this research was to develop an instrument to assess a principals' technology leadership skills from the perceptions of teachers working under them. The instrument consisted of 20 items within five dimensions. The dimensions are vision, planning, and management (A), staff development and training (B), technological and infrastructure support (C), evaluation and research (D), and interpersonal and communication skills (E).

Based on the teacher survey results, tA (vision, planning, and management), tB (staff development and training), tC (technological and infrastructure support), tD (evaluation and research), and tE (interpersonal and communication skills) performed well in the item analysis. On the item analysis for principals, pD (evaluation and research) and pE (interpersonal and communication skills) did not perform well. Item pEA was eliminated to strengthen the dimension. pD (evaluation and research) was used in analysis as is. For the paired-samples t-test, pair 1 (vision, planning, and management), pair 2 (staff development and training), and pair 5 (interpersonal and communication skills) all showed a significant response difference between teachers and principals. Pair 3 (technological and infrastructure support) and pair 4 (evaluation and research) showed similar responses between principals and teachers. One pair had a low effect size (.320), two pairs had medium effect sizes (.738 and .657), and two pairs had large effect sizes according to Cohen's d (1.091, and .850). Based on these results, the instrument

performed well on four of the five dimensions, but teachers' perceptions of their principals and principals' perceptions of themselves were statistically significantly different for three of the five dimensions that were compared. On average, principals rated themselves slightly higher on each dimension.

3.8.2 Study limitations

Questions involved wording that could have led to confusing responses because of wording like "weekly". Frequency could have been asked as its own question versus putting timelines within individual questions. The response structure led to closed responses with little room for flexibility. Additionally, the responses were sample dependent on the principals and teachers who responded, meaning different principals and teachers will have different answers to the questions.

Study participation was low, which impacted the types of statistical analyses that could be used to analyze the data. The low sample size impacted the ability to conduct any multilevel factor analysis, which could have yielded further analysis of the latent structure of STL in regard to the instrument. Future research should strive for a greater sample size to provide the opportunity to run other analysis types. One factor contributing to low participation could have been the timing of the pilot instrument distribution. The instrument was given during the final five weeks of the school year. It is important principals and teachers participate later in the school year since it is a key component that teachers understand what their principal does. If the instrument is administered too early in the school year, data could be skewed due to the short time of principals and teachers working together. However, if the instrument is given late in the school year, it is can be difficult to gain participation due to the bevy of competing activities taking place in the

last six weeks of a school year including state testing, summer preparation, staff burnout, and job movement. A different study design could include direct email contact with teachers within buildings versus the scaffold of going through building principals. Lastly, by utilizing solely quantitative measures to understand STL, only certain assumptions about the data could be made. Different methods for collection and analysis could result in a different understanding of STL.

3.8.3 Conclusions and implications

Overall, the instrument functioned well on four of the five dimensions comprising the construct of STL. Those dimensions functioned well because they appeared reliable in regard to internal consistency criteria. However, more research needs to be done in order to test for reliability and validity of all dimensions. The instrument also showed a difference in ratings between principals and teachers on three of the dimensions; A (vision, planning, and management), B (staff development and training), and E (interpersonal and communication skills). Further research is needed to verify the dimensions utilized and a reflection of newer ISTE standards could create other dimensions to assess. Principals responded differently from how their teachers perceived them in regard to their STL traits. Principals possess decision making in regard to STL (Babell & O'Dwyer, 2010; H. J. Becker, 1993; Cakir, 2012; Dawson & Rakes, 2003; Parker, 2014), and can make decisions that support their schools and teachers in the future. Transparent decision-making, or lack thereof, could account for some of the variation in responses between teachers and principals (Kozloski, 2006; Langran, 2006), which should be studied further. Teachers do not always see the day to day operations of their principals or might not have the same insight as their principals do when decisions

are made. By providing an instrument to help principals understand how their teachers perceive their technology leadership skills, principals can develop a plan to effectively implement technology in their school settings.

Future research could include additional dimension analysis, updating and modifying questions within each dimension, and utilizing different methods of statistical measurement to analyze data. Establishing external validity on this instrument may be another step for future researchers. This study built on previous literature of measurement instruments in STL. Future researchers can add this study to their list to create a more wholesome understanding of instruments, measurement techniques, and content in regard to STL. As international organizations update their views of technology leadership, developing tools to measure STL through new lenses can add to the literature.

3.8.4 Implications for theory

Research on the field of STL is constantly growing and this study adds to the body of research. As aspects of education change, developing an understanding of what is happening is vital. Empirical studies can add rich knowledge to the literature. This study was guided by transformational leadership theory. The results of this study contributed to transformational leadership theory from the perspective of teachers perceiving actions by their principals in terms of technology leadership. Some principals scored higher overall on the instrument than others, meaning teachers perceived them as a more transformational leader. The findings affirmed my belief that principals who utilize technology in schools typically are more transformational in their leadership approach, based on principal and teacher responses to instrument items. Principals who scored higher on the instrument tended to have qualities described as transformational including

being a forward-thinker. However, in regard to this study, teachers also had to perceive their principals with these qualities in order for the principal to score higher on the instrument. Future literature can create new paths for measurement to better understand STL and transformational leadership theory. This study adds to the current literature by providing another study with dimensions explaining STL and providing a template for how to measure principals' technology leadership skills.

3.8.5 Implications for conceptual framework

The conceptual framework of this study relied on the five dimensions developed by Chang (2012). Most of the dimensions functioned well for this study based on the statistical analysis. Two of the dimensions functioned poorly; D (evaluation and research) and E (interpersonal and communication skills), but by removing item pEA (I communicate with teachers weekly through technology), dimension E functioned better. This research struggles supporting the dimensions developed by Chang (2012) because more analysis is needed. Based on the response rate, limited statistical analyses were possible. By gaining more participants, additional statistical analysis methods could yield different results. Since the framework is based heavily on the early 2000's NETS-A standards, creating new dimensions based on the latest ISTE standards is worth examining.

CHAPTER 4. CONCLUSION

This chapter summarizes the contributions of each previous chapter to the fields of STL and educational leadership. Limitations of the study are discussed. Chapter 4 also includes the implications for leadership policy and practice. Lastly, this chapter outlines final conclusions and recommendations for future research.

4.1 Overview

4.1.1 Chapter 1

The introduction chapter covered the backstory of this dissertation as a whole, discussed the significance of the problem, presented the research questions and study design, and delineated the main components of this dissertation. Chapter 1 included a discussion on the purpose of the study, which was to research STL survey instruments and develop a new instrument. Next, the theoretical framework of transformational leadership was defined and considered. Definitions and overall assumptions were examined with the guiding literature defined through leadership, STL, measurement instruments, and quantitative methods. Lastly, study limitations were summarized including data on sample size, response rate, generalizability of research findings, instrument design, and limitations.

4.1.2 Chapter 2

The purpose of Chapter 2 was to critically review the literature available on STL, educational leadership, and measurement instruments within STL. By utilizing a systematic review tool (PRISMA), the study was strengthened by following an organized method. Even though PRISMA was not followed with complete fidelity, the guidance

toward reviewing literature helped narrow the focus of the thematic review. Chapter 2 focused on the answers to two research questions. The first question asked what instruments are currently available in STL. The second question asked if there was a need for different instruments to measure STL.

In order to answer the first question, instruments were identified from a variety of sources worldwide. Search results showed a growing body of research on the field of STL. Once instruments were identified in the literature, the resources of each study were used to locate more instruments with similar traits until a point was reached where the crossover between references in each study was abundant. It was particularly useful to start with other research syntheses from known experts in STL and branch out from their collective references and review of the field (Dexter et al., 2016; McLeod & Richardson, 2011; Richardson et al., 2012).

Prior to the narrowed focus on STL, literature was reviewed in educational technology and educational leadership, which are the two areas where STL is rooted (Anderson & Dexter, 2005). Educational technology and educational leadership had larger bodies of literature available for review. Since STL grew out of these two areas, some early literature on STL was identified and reviewed. Next, STL was discussed in depth related to the history, main researchers, how teaching and learning methods are used, and the influencers. The influencers consist of students, teachers, and administrators. Each party plays an integral role in implementing STL into the classroom (Babell & O'Dwyer, 2010; Herold, 2015). Leadership from principals can impact teachers who are the direct connection to students in the classroom (Tillman, 2014). As students become comfortable with new technologies in the classroom, teachers can continue

modifying instruction which drives administrators to acknowledge different professional development opportunities and budgeting methods. The cycle continues between levels of administrators, teachers, and students.

The second question asked whether there was a need for new instruments to measure STL. The answer was formulated by identifying current instruments available to measure STL (CASTLE, 2009; Chang, 2002; Davis, 2008; Scott, 2005; Seneca, 2008; Shyr, 2016; Tomei, 2002). After identifying numerous quantitative and qualitative measurement instruments, discussion of their designs was offered to better understand the complexion of each instrument. While instruments varied greatly in length, their collective content tended to use the ISTE standards for a design framework.

In summary, given the unabated rate of technology adoption in schools, , additional research should be conducted to assess what is working and how STL fits into the improvement of education (Dexter et al., 2016; McLeod & Richardson, 2011). Chapter 2 concluded there is room for additional instruments to measure STL with a focus on similar content as other instruments, but a shorter version in order to accommodate the busy schedules of principals and teachers. School technology leadership is a field in need of more research in order to better understand the impact school leaders have in regard to technology in education. By developing another quantitative instrument, further measurement can be conducted. This literature synthesis led to the design and pilot of a new survey instrument in Chapter 3.

4.1.3 Chapter 3

The development and pilot of an instrument was described in Chapter 3. The study design relied on previous studies in STL, which were thematically reviewed in Chapter 2. By analyzing other research, the instrument designed in Chapter 3 included design decisions based on the results, methods, and recommendations of other studies. Without the thematic review conducted in Chapter 2, it would be tough to understand what current instruments measure, which could lead researchers to develop redundant instruments. Many instruments reviewed in this dissertation had between 40 to 80 questions, which can take considerable time for respondents to answer. After reviewing the literature, it was determined that a new instrument measuring STL in a short format through the perceptions of teachers and principals had relevancy and could be useful.

Chapter 3 started with a definition of the purpose of the study, with a focus on identifying critical information related to the duties of a principal as a technology leader. Principals play a vital role impacting technology usage of teachers in the classroom (Anderson & Dexter, 2005), therefore a survey for both teachers and principals on the principals' technology leadership skills creates a better understanding for future professional development opportunities. Principals hold a self-perception of how they think they are doing related to technology leadership. Teachers also hold a perception. By giving a similar survey to both teachers and principals, the responses can be compared to gain better insight into how principals are truly leading.

Conceptually, Chapter 3 followed five dimensions, which were; (1) vision, planning, and management, (2) staff development and training, (3) technological and infrastructure support, (4) evaluation and research, and (5) interpersonal and

communication skills. The five dimensions come from empirical literature in early research (Chang, 2002, 2012; Chang et al., 2008). The dimensions of most research reviewed was similar with a foundation in the International Society for Technology in Education (ISTE) standards. However, the standards continue to evolve (Snelling, 2016), meaning it is valuable to assess whether new instruments should evolve or current methods properly measure STL.

Utilizing an appropriate theoretical framework provides a focused lens for viewing STL. Transformational leadership was the framework used in Chapter 3 because STL typically relies on a shift in how people do things with new technologies and implementation. With transformational leadership, inspiring leaders gain followers' trust and respect to create higher levels of motivation and morality (Rost, 1991).

Based on previous literature, the pilot instrument included five dimensions with four Likert style items within each dimension. Demographic information was also collected. The instrument was written in two formats. One format was written for teachers and another format was written for principals. The two instruments were identical, except for how the questions were written for the audience of teachers or principals. In total, 32 different points of data comprised the instrument. The survey design phase included meeting with 24 technology integration specialists from a consortium in Minnesota to review content. An additional meeting took place with graduate students and a professor from the Department of Educational, School, and Counseling Psychology at the University of Kentucky. The second meeting was an opportunity to get feedback and recommendations on the study design and methodology.

Following the design of the study and methodology, data collection took place in the state of Minnesota by sending the instrument to all public-school principals, which totaled 1,423. The principals received instructions which included a link to the principal survey and directions to copy and paste in an email to their licensed teachers. In total, 57,262 teachers worked under the 1,423 principals at the time the survey was sent. Responses included 21 principals and 60 teachers. Teacher respondents were overwhelmingly female with the majority holding a B.A., B.S., M.A., or M.S. Degree. Most of the responses came from rural or suburban schools, which could be because urban districts seemed to have more policies in place blocking teachers and principals from participating in research studies without school board approval. For principal respondents, the majority were male. Principal respondents were nearly all in rural or suburban districts. As one would expect, all principal respondents held a graduate degree.

Item analysis results in Chapter 3 showed most items performed well for teachers, but not as well for principals. Therefore, dimension E (interpersonal and communication skills) had item pEA (As principal I communicate with teachers weekly through technology) removed. Additionally, item tEA (my principal communicates with me weekly through technology) was removed so each dimension aligned for analysis. The paired-samples t-test resulted in a significant difference in scores between teachers and principals for dimensions A, B, and E. Dimensions C and D resulted in similar responses between teachers and principals. Pair 4 (dimension D) had a small effect size, pair 1 (dimension A) and pair 3 (dimension C) had a medium effect size, and pair 2 (dimension B) and pair 5 (dimension E) had large effect sizes. Larger effect sizes signify a larger gap in differences between teacher and principal responses on each dimension. Based on the

analysis, principals typically rated themselves higher on each dimension versus how teachers rated them.

In order to properly evaluate the pilot instrument, continued testing with a larger sample size was recommended. A larger sample size would also allow for different types of analysis, which could help to further evaluate the instrument as a whole (Kline, 2016). The study design seemed to function well for the responses that were received. As national standards are updated (Snelling, 2016), the dimensions and content of the items should be reviewed to make sure the instrument is assessing current and accurate information. The pilot instrument in Chapter 3 appeared to measure STL as intended, however additional research could validate the instrument further.

4.2 Limitations

After conducting this research, there are a few clear limitations to the study overall. This dissertation includes several limitations associated with sample size, response rate, generalizability of research findings, and instrument design. To avoid error, Chapter 2 utilizes a protocol to better analyze available research. The literature reviewed in Chapter 2 included the majority of research available, however, it is difficult to identify every piece of literature published. Second, new research continues to be published. The thematic review conducted in Chapter 2 is only as good as the research published before the review was conducted. As new research becomes available, additional thematic and systematic reviews could be useful.

In Chapter 3, the survey was designed based on previous literature and instruments in STL. By using other instruments as a framework, the pilot instrument was created while considering the limitations and recommendations of numerous other

studies. As STL advances, instruments used to measure STL will likely change. The design of the survey in this study utilizes the current literature available within STL. The survey was sent to 1,423 principals, with a design of principals taking one version of the survey and forwarding another version to their teachers. Of the 1,423 principals, 21 (1.5%) responded to the survey. A total of 60 teachers responded to the teacher survey about their principal. The low response rate impacted the types of data analysis, which impacted the generalizability of research findings. As a pilot study, the instrument has room for growth.

4.3 Implications for Educational Leadership

4.3.1 Leadership policy

Based on the results from the thematic review of literature, technology in schools is an area growing in value in terms of dollars spent each year (Dexter et al., 2016). It is vital for people in positions of school leadership to understand the pros and cons of effective technology usage and also how to properly implement technology into schools. Therefore, it is important to review policies related to STL and possibly develop and implement new policies based on the findings.

This study reported principals and teachers do not always perceive technology leadership in the same view within schools. Setting a clear vision can create a plan for growth in terms of technology implementation and leadership. On a larger scale, state governments might find value in setting policies for training and funding. Unified standards can be reviewed and incorporated into leadership preparation programs. Continued research on STL can provide additional recommendations for developing and implementing new policies at the state level.

4.3.2 Leadership practice

Implementing new technologies into schools is not an easy endeavor. Based on the results of this dissertation, there is room for more research on STL and methods for moving schools forward in terms of technology integration. Leadership preparation programs continue to expand and integrate more resources for students to better prepare them for a changing education system. Transformational leaders have an ability to gather followers and make strides toward new goals. By conducting surveys for principals and teachers, an assessment of current practice can shed light on possible beneficial modifications in schools.

4.4 Conclusions

Within this dissertation, three research questions were analyzed. The first question gathered information on the instruments currently available within the specialty area of STL. It is apparent, based on the thematic review, that researchers believe the specialty area of STL needs continued attention on more in-depth research. The second question assessed the need for the development of different instruments to properly measure STL. Based on the results, it was decided that additional instruments to measure STL could be useful. The instrument developed in Chapter 3 focused on the third question which was to try and develop a short, twenty question survey to adequately measure STL. The instrument performed well overall, but there were areas of concern which future research and analysis should address.

Principals possess the job position necessary to implement new programs and initiatives within their schools. As technology usage grows in schools, more principals will need the skills to handle implementation. For future principals going through

leadership preparation programs, hopefully they will gain the skills necessary. For current principals, an instrument like the one developed and piloted in this dissertation could provide insight into the perceptions of their teachers. The insight can better help principals plan their own professional development and review their leadership qualities. Both the thematic review and the development and pilot of the instrument led to useful results in the field of STL, however additional research could support the field

4.5 Recommendations

Future research opportunities are apparent after completing this dissertation. The pilot instrument needs additional testing for validity and reliability. The instrument performed well, but without a large response rate, analysis techniques were limited. By conducting additional research with a larger response rate, all five dimensions could be evaluated again, which might yield strengthened results. Developing different methods for conducting the principal and teacher instruments might also result in better participation. Offering incentives for participation could increase the response rate. Even though the research questions were answered in this dissertation, there is room to go deeper on whether a shorter instrument has significant benefits over longer versions of instruments that measure STL. Furthermore, after principals and teachers take the survey, a manual with recommended steps based on the results could be useful so schools have a guide toward success, which should be a component of future research.

Lastly, as standards change and technology further develops, the dimensions and items used to measure STL might shift as well. Technology in schools is growing rapidly and leadership preparation programs are catching up to the pace of change. Finding new methods for assessing STL is important based on the growth. As the body of literature

grows, future thematic or systematic reviews will be beneficial to analyze the information available, which can provide input for measurement techniques and future research methods. Doing a comparative analysis between this instrument and other similar instruments might advance the research on useful measurement techniques within STL. The intent of this dissertation was to add to the current research and provide future researchers with another resource in the field of STL. The instrument developed also adds to the literature on STL.

APPENDICES

APPENDIX 1. ORIGINAL STUDY IRB APPROVAL FORM

University of Kentucky. | Office of Research Integrity
IRB, RDRC

XP Initial Review

Approval Ends:	IRB Number:
5/25/2020	51328

TO: Garrick Grace, M.S.
Educational Leadership Studies
PI phone #: 8436854913

PI email: garrick.grace@gmail.com

FROM: Chairperson/Vice Chairperson
Non Medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol

DATE: 5/28/2019

On 5/26/2019, the Non Medical Institutional Review Board approved your protocol entitled:

School Technology Leadership: The Development and Pilot Study of a New Survey Instrument

Approval is effective from 5/26/2019 until 5/25/2020 and extends to any consent/assent form, cover letter, and/or phone script. If applicable, the IRB approved consent/assent document(s) to be used when enrolling subjects can be found in the "All Attachments" menu item of your E-IRB application. [Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.] Prior to the end of this period, you will be sent a Continuation Review (CR)/Administrative Annual Review (AAR) request which must be completed and submitted to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions and requirements. The research procedures should be implemented as approved in the IRB protocol. It is the principal investigator's responsibility to ensure any changes planned for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to eliminate apparent hazards to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinuing a study or completion of a study is considered a change in the protocol's status and therefore the IRB should be promptly notified in writing.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" available in the online Office of Research Integrity's IRB Survival Handbook. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI's web site. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at 859-257-9428.

APPENDIX 2. RECRUITMENT EMAIL

Recruitment for Research Study

Subject line- Survey instrument research- Help a graduate student!

Information for the principal

Your school has been selected to participate in research to assist a Ph.D. candidate at the University of Kentucky with the pilot study of an instrument to assess a principals' technology leadership skills. This is an end of year survey and will take under five minutes to answer. The survey window is open for three weeks from today. The goal is to have the principal take the self-assessment survey and the teachers underneath the same principal take a teacher version of the survey. Neither teachers nor principals are identified in the data. Data will be correlated and coded based on the location and school building. Principals can request copy of final study and overall results to use in evaluating their technology leadership skills, along with recommendations for professional development. The greatest reward is knowing you personally contributed to data necessary to develop a new survey instrument for the researcher. More information and the principal self- assessment survey can be found at the URL https://tinyurl.com/STLprincipalversion

Or, CLICK HERE to access the principal self-assessment survey. One last step is needed below!

For principals to email to their teachers or share at a meeting (copy and paste works)

Hello teachers,

Your school has been selected to participate in a research study to assess principal technology leadership skills. This is an end of year survey and takes under five minutes. The survey is completely voluntary and there is no penalty for not participating. This request for study information is being forwarded by your principal as an accommodation to me, the researcher; your principal will not know whether or not you participate nor how you respond to the survey. Data will not be seen be the principal, only the researcher. Once you go to the survey link, additional information is available. The principal will not have access to the individual results and all results will be coded in the final report. No identifying information of individuals is collected. More information and the teacher survey can be found at the URL https://tinyurl.com/STLteacherversion

Or, CLICK HERE to access the teacher survey. Thank you for your help and participation!

The principal investigator in charge of this study is Garrick Grace, a Ph.D. candidate at the University of Kentucky, Department of Educational Leadership, College of Education. If you have questions, suggestions, or concerns regarding this study or you want to withdraw from the study, his contact information is: grgr225@g.uky.edu, 843-685-4913. If you have any questions, suggestions or concerns about your rights as a volunteer in this research, contact staff in the University of Kentucky (UK) Office of Research Integrity (ORI) between the business hours of 8am and 5pm EST, Monday-Friday at 859-257-9428 or toll free at 1-866-400-9428. The advisor for this study is Dr. John Nash. His email is John.nash@uky.edu and the phone number he can be reached at is 859-257-7848.

Again, thank you for your consideration and time!

APPENDIX 3. TEACHER CONSENT FORM AND INSTRUMENT

School Technology Leadership Instrument- Teacher Version

KEY INFORMATION: This document is asking you to choose whether or not to volunteer for a research study to rate the technology leadership skills of your principal. You do not have to participate in this study. You may stop taking the survey at any time. If you do decide to participate, we will treat your answers confidentially. Reports will only discuss answers by groups of participants, and your personal information will not be shared. This page is to give you key information to help you decide whether to participate. If you have questions at any time, the contact information for the primary research investigator is below.
This study is being conducted by Principal Investigator (PI) Garrick Grace, a Ph.D. candidate at the University of Kentucky. Dr. John Nash, an associate professor at the University of Kentucky, is the committee chair providing guidance on this study.

WHAT IS THIS STUDY ABOUT AND HOW LONG WILL IT LAST? The purpose of this study is to develop and pilot an instrument to assess a principals' technology leadership skills. This study will take under five minutes.

WHAT ARE THE KEY REASONS YOU MIGHT CHOOSE NOT TO VOLUNTEER FOR THIS STUDY? There are no anticipated risks, and no reasons not to participate in this study except that you choose to do so. There are no penalties for not participating.

DO YOU HAVE TO TAKE PART IN THE STUDY? If you decide to take part in the study, it should be because you want analyze technology leadership and help the researcher gain usable data. You will not lose any services, benefits, or rights you would normally have if you choose not to volunteer.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS OR CONCERNS? The PI in charge of this study is Garrick Grace, a student at the University of Kentucky, Department of Educational Leadership, College of Education. If you have questions, suggestions, or concerns regarding this study or you want to withdraw from the study, his contact information is: grgr225@g.uky.edu, 843-685-4913. If you have any questions, suggestions or concerns about your rights as a volunteer in this research, contact staff in the University of Kentucky (UK) Office of Research Integrity (ORI) between the business hours of 8am and 5pm EST, Monday-Friday at 859-257-9428 or toll free at 1-866-400-9428.

WHO WILL SEE THE INFORMATION THAT YOU GIVE? Your answers will be confidential and displayed as a whole group with other participants. All demographic data will be combined into one database with all participants. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. Your responses are stored on a secure server and will be saved in password-protected computers. Every effort will be made to safeguard your data, but as with anything online, we cannot guarantee the security of data obtained via the internet. Google Forms, a secure online survey software, hosts this survey. You may review the Google terms of service and privacy/security policies at policies.google.com/?hl=en. The PI will retain the data for IRB records for at least six years after

study closure.

CAN YOU CHOOSE TO WITHDRAW FROM THE STUDY EARLY? You can choose to leave the study at any time. You will not be treated differently if you decide to stop taking part in the study. If you choose to leave the study early, data collected until that point will remain in the study database and may not be removed. If you do not want to be in the study, there are no other choices except not to take part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY? You will not receive any rewards or payment for taking part in the study. The greatest reward is knowing you personally contributed to data necessary to develop a new survey instrument for the PI.

WILL YOUR INFORMATION BE USED FOR FUTURE RESEARCH? Your answers might be used in future research, but with the same stipulations as stated previously in this document. The data may be used, upon request, by other researchers without your additional informed consent.
* Required

1. BY CONTINUING WITH THE SURVEY YOU CONSENT TO PARTICIPATE IN THIS STUDY. I have read the above information. I have had the opportunity to ask questions and have my questions answered. By clicking the button below, I acknowledge that my participation in the study is voluntary, I am 18 years of age, and that I am aware that I may choose to terminate my participation in the study at any time and for any reason. *

   Mark only one oval.

   - ◯ I consent, begin the study
   - ◯ I do not consent, I do not wish to participate

Technology refers to digital technology used to facilitate learning. This includes both hardware and software.

2. What position do you hold?

   Mark only one oval.

   - ◯ Teacher
   - ◯ Principal

3. What is the name of the school you work in (e.g., Bridgewater Elementary)?

4. What town or city is your school located in (e.g., West Fork)?

5. Select the state or U.S. territory your school is located in.

Mark only one oval.

- Alabama
- Alaska
- American Samoa
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia (DC)
- Florida
- Georgia
- Guam
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska

- [ ] Nevada
- [ ] New Hampshire
- [ ] New Jersey
- [ ] New Mexico
- [ ] New York
- [ ] North Carolina
- [ ] North Dakota
- [ ] Northern Marianas Islands
- [ ] Ohio
- [ ] Oklahoma
- [ ] Oregon
- [ ] Pennsylvania
- [ ] Puerto Rico
- [ ] Rhode Island
- [ ] South Carolina
- [ ] South Dakota
- [ ] Tennessee
- [ ] Texas
- [ ] Utah
- [ ] Vermont
- [ ] Virginia
- [ ] Virgin Islands
- [ ] Washington
- [ ] West Virginia
- [ ] Wisconsin
- [ ] Wyoming

6. What is the school level you primarily work in?

Mark only one oval.

- ◯ Elementary school
- ◯ Middle school
- ◯ High school

7. What type of school do you work in?

Mark only one oval.

- ◯ rural
- ◯ suburban
- ◯ urban

8. How many years have you taught under your current principal (e.g., 1, 3, 7)?

_____

9. How many years have you taught total (e.g., 1, 3, 7)?

_____

10. How old are you in years (e.g., 35, 50)?

_____

11. What is your highest educational level?

Mark only one oval.

- ◯ B.A. or B.S.
- ◯ M.A. or M.S.
- ◯ Ed.S.
- ◯ Ph.D. or Ed.D.
- ◯ Other: _____

12. To which gender identity do you most identify?

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Transgender Female
- ◯ Transgender Male
- ◯ Gender Variant/Non-Conforming
- ◯ Prefer Not to Answer
- ◯ Other: _____

13. What is the level of instructional involvement in your school that your principal has related to technology? Example- If you have an assistant principal or curriculum director that does all the professional development on technology, then your primary principal would rate "none" or "minimal".

Mark only one oval.

- ◯ none
- ◯ minimal
- ◯ somewhat involved
- ◯ total involvement

For the following statements we would like you to respond by indicating your level of agreement with each statement as it pertains to the principal at the primary building you work as a teacher.

14. My principal...

Mark only one oval per row.

	Strongly agree	Agree	Disagree	Strongly disagree
shares the school technology vision with me				
promotes a school culture of technology use				
advocates for technology-rich resources for me				
encourages technology usage to manage administrative operations				
hosts staff development sessions focused on technology implementation				
allocates time for technology implementation				
modifies professional development based on my needs				
includes feedback on technology integration in observations for me				
advocates for technology support				
ensures equal access to technology resources for me				

For the following statements we would like you to respond by indicating your level of agreement with each statement as it pertains to the principal at the primary building you work as a teacher.

15. My principal...

Mark only one oval per row.

	Strongly agree	Agree	Disagree	Strongly disagree
ensures timely repair of classroom technology equipment				
ensures access to a variety of software applications for me				
implements evaluation procedures for me in regard to technology				
is open to new ideas in regard to technology if I bring them forward				
evaluates technology use in instructional programs				
includes me in researching new technologies for the school				
communicates with me weekly through technology				
posts weekly on social media related to our school				
encourages me to take risks in regard to technology				
accepts failure as part of growth when I utilize new technologies				

This content is neither created nor endorsed by Google.

Google Forms

APPENDIX 4. PRINCIPAL CONSENT FORM AND INSTRUMENT

School Technology Leadership Instrument- Principal Version

KEY INFORMATION: This document is asking you to choose whether or not to volunteer for a research study to rate the technology leadership skills of you, the principal. You do not have to participate in this study. You may stop taking the survey at any time. If you do decide to participate, we will treat your answers confidentially. Reports will only discuss answers by groups of participants, and your personal information will not be shared. This page is to give you key information to help you decide whether to participate. If you have questions at any time, the contact information for the primary research investigator is below.
This study is being conducted by Principal Investigator (PI) Garrick Grace, a Ph.D. candidate at the University of Kentucky. Dr. John Nash, an associate professor at the University of Kentucky, is the committee chair providing guidance on this study.

WHAT IS THIS STUDY ABOUT AND HOW LONG WILL IT LAST? The purpose of this study is to develop and pilot an instrument to assess a principals' technology leadership skills. This study will take under five minutes.

WHAT ARE THE KEY REASONS YOU MIGHT CHOOSE NOT TO VOLUNTEER FOR THIS STUDY? There are no anticipated risks, and no reasons not to participate in this study except that you choose to do so. There are no penalties for not participating.

DO YOU HAVE TO TAKE PART IN THE STUDY? If you decide to take part in the study, it should be because you want analyze technology leadership and help the researcher gain usable data. You will not lose any services, benefits, or rights you would normally have if you choose not to volunteer.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS OR CONCERNS? The PI in charge of this study is Garrick Grace, a student at the University of Kentucky, Department of Educational Leadership, College of Education. If you have questions, suggestions, or concerns regarding this study or you want to withdraw from the study, his contact information is: grgr225@g.uky.edu, 843-685-4913. If you have any questions, suggestions or concerns about your rights as a volunteer in this research, contact staff in the University of Kentucky (UK) Office of Research Integrity (ORI) between the business hours of 8am and 5pm EST, Monday-Friday at 859-257-9428 or toll free at 1-866-400-9428.

WHO WILL SEE THE INFORMATION THAT YOU GIVE? Your answers will be confidential and displayed as a whole group with other participants. All demographic data will be combined into one database with all participants. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. Your responses are stored on a secure server and will be saved in password-protected computers. Every effort will be made to safeguard your data, but as with anything online, we cannot guarantee the security of data obtained via the internet. Google Forms, a secure online survey software, hosts this survey. You may review the Google terms of service and privacy/security policies at policies.google.com/?hl=en. The PI will retain the data for IRB records for at least six years after

study closure.

CAN YOU CHOOSE TO WITHDRAW FROM THE STUDY EARLY? You can choose to leave the study at any time. You will not be treated differently if you decide to stop taking part in the study. If you choose to leave the study early, data collected until that point will remain in the study database and may not be removed. If you do not want to be in the study, there are no other choices except not to take part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY? You will not receive any rewards or payment for taking part in the study. The greatest reward is knowing you personally contributed to data necessary to develop a new survey instrument for the PI.

WILL YOUR INFORMATION BE USED FOR FUTURE RESEARCH? Your answers might be used in future research, but with the same stipulations as stated previously in this document. The data may be used, upon request, by other researchers without your additional informed consent.
* Required

1. BY CONTINUING WITH THE SURVEY YOU CONSENT TO PARTICIPATE IN THIS STUDY. I have read the above information. I have had the opportunity to ask questions and have my questions answered. By clicking the button below, I acknowledge that my participation in the study is voluntary, I am 18 years of age, and that I am aware that I may choose to terminate my participation in the study at any time and for any reason. *

   Mark only one oval.

   - ◯ I consent, begin the study
   - ◯ I do not consent, I do not wish to participate

Technology refers to digital technology used to facilitate learning. This includes both hardware and software.

2. What position do you hold?

   Mark only one oval.

   - ◯ Teacher
   - ◯ Principal

3. What is the name of the school you work in (e.g., Bridgewater Elementary)?

4. What town or city is your school located in (e.g., West Fork)?

5. Select the state or U.S. territory your school is located in.

Mark only one oval.

- Alabama
- Alaska
- American Samoa
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia (DC)
- Florida
- Georgia
- Guam
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska

- [ ] Nevada
- [ ] New Hampshire
- [ ] New Jersey
- [ ] New Mexico
- [ ] New York
- [ ] North Carolina
- [ ] North Dakota
- [ ] Northern Marianas Islands
- [ ] Ohio
- [ ] Oklahoma
- [ ] Oregon
- [ ] Pennsylvania
- [ ] Puerto Rico
- [ ] Rhode Island
- [ ] South Carolina
- [ ] South Dakota
- [ ] Tennessee
- [ ] Texas
- [ ] Utah
- [ ] Vermont
- [ ] Virginia
- [ ] Virgin Islands
- [ ] Washington
- [ ] West Virginia
- [ ] Wisconsin
- [ ] Wyoming

6. What is the school level you primarily work in?

Mark only one oval.

- ◯ Elementary school
- ◯ Middle school
- ◯ High school

7. What type of school do you work in?

Mark only one oval.

- ◯ rural
- ◯ suburban
- ◯ urban

8. How many years have you been in your current principal position (e.g., 1, 3, 7)?

_____

9. How many years have you been a principal in total (e.g., 1, 3, 7)?

_____

10. How old are you in years (e.g., 35, 50)?

_____

11. What is your highest educational level?

Mark only one oval.

- ◯ B.A. or B.S.
- ◯ M.A. or M.S.
- ◯ Ed.S.
- ◯ Ph.D. or Ed.D.
- ◯ Other: _____

12. To which gender identity do you most identify?

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Transgender Female
- ◯ Transgender Male
- ◯ Gender Variant/Non-Conforming
- ◯ Prefer Not to Answer
- ◯ Other: _____

13. What is the level of instructional involvement in your school that you contribute to related to technology? Example- If you have an assistant principal or curriculum director that does all the professional development on technology, then your response would rate "none" or "minimal".

Mark only one oval.

- ◯ none
- ◯ minimal
- ◯ somewhat involved
- ◯ total involvement

For the following statements we would like you to respond by indicating your level of agreement with each statement as it pertains to your role as principal at the primary building you work.

14. As principal...

Mark only one oval per row.

	Strongly agree	Agree	Disagree	Strongly disagree
I share the school technology vision with teachers				
I promote a school culture of technology use				
I advocate for technology-rich resources for teachers				
I encourage technology usage to manage administrative operations				
I host staff development sessions focused on technology implementation				
I allocate time for technology implementation				
I modify professional development based on needs of teachers				
I include feedback on technology integration in observations for teachers				
I advocate for technology support				
I ensure equal access to technology resources among teachers				

For the following statements we would like you to respond by indicating your level of agreement with each statement as it pertains to your role as principal at the primary building you work.

15. As principal...

Mark only one oval per row.

	Strongly agree	Agree	Disagree	Strongly disagree
I ensure timely repair of classroom technology equipment				
I ensure access to a variety of software applications for teachers				
I implement evaluation procedures for teachers in regard to technology				
I am open to new ideas in regard to technology if a teacher brings them forward				
I evaluate technology use in instructional programs				
I include teachers in researching new technologies for the school				
I communicate with teachers weekly through technology				
I post weekly on social media related to our school				
I encourage teachers to take risks in regard to technology				
I accept failure as part of growth when teachers utilize new technologies				

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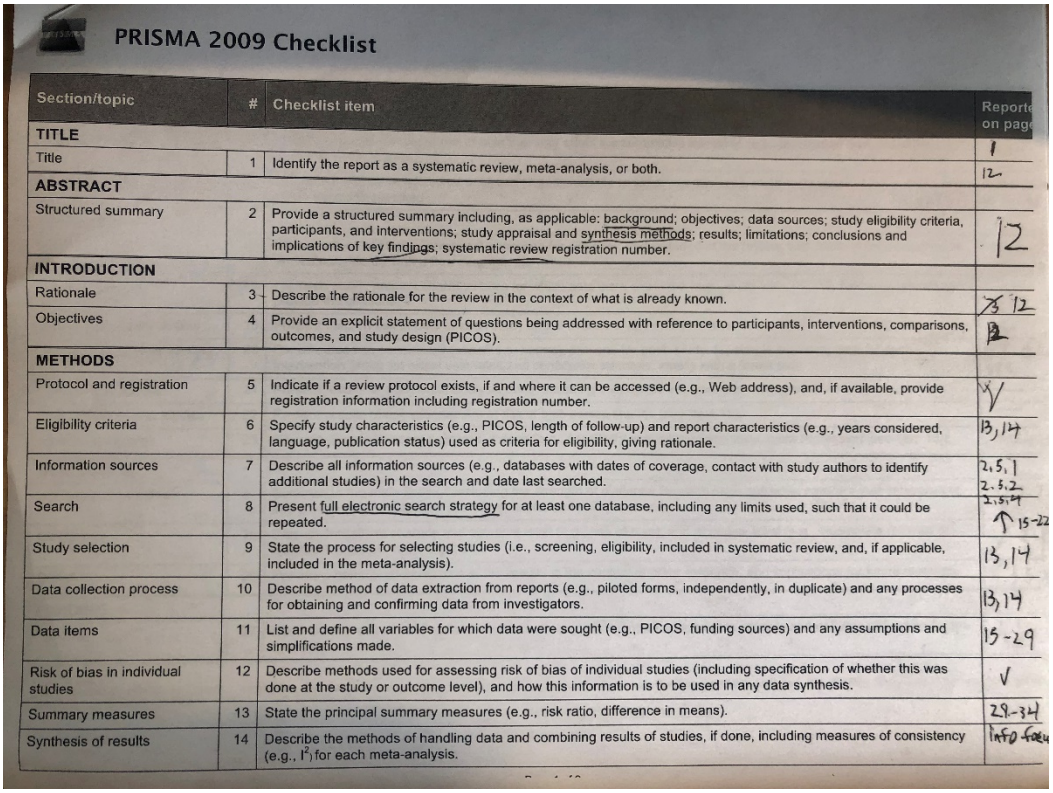
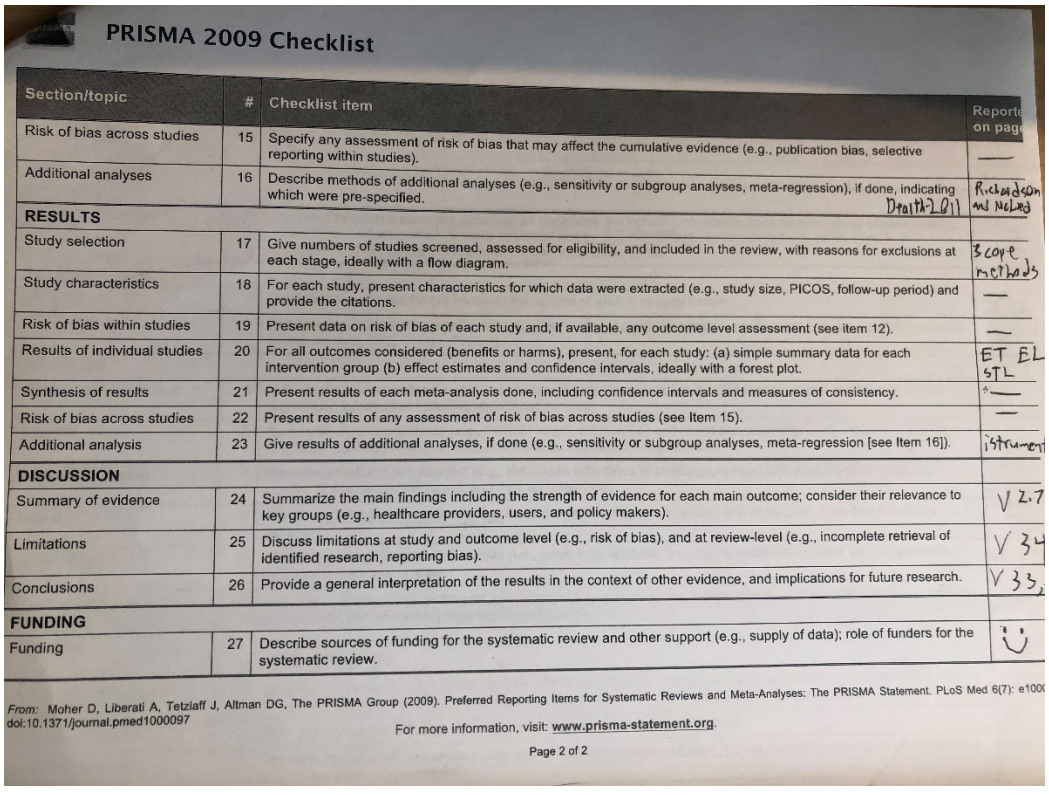
Google Forms

APPENDIX 5. PRISMA CHECKLIST



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	12
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	12
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	2
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	V
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	13, 14
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	2.5.1 2.5.2
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	2.5.4 ↑ 15-22
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	13, 14
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	13, 14
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	15-29
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	V
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	29-34
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Info from



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	—
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. Deeks 2011	Richardson and Mclead
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Scope methods
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	—
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	—
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	ET EL STL
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	—
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	—
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Instrument
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	V 2.7
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	V 34
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	V 33,
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	☺

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e100
doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

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VITA

EDUCATIONAL INSTITUTIONS ATTENDED

Saint Cloud State University, Saint Cloud, MN
M.S. Geography 2013
Thesis: Potential Sites For Ski Resorts: A Comparative Analysis Between Colorado And The Altay Mountains

Minnesota State University, Mankato, Mankato, MN
B.S. Social Studies 5-12 Education 2009
Honors: Graduated Magna Cum Laude,

Minnesota State University, Mankato, Mankato, MN
B.S. Geography 2009
Honors: 4.0 GPA
Gamma Theta Upsilon- International Geographic Honor Society

PROFESSIONAL POSITIONS HELD

Paynesville School District, Paynesville, MN
District Technology Integration Specialist 2016-Current

South Junior High School, Saint Cloud, MN
Career and College Exploration Teacher 2014-2016

Talahi Community School, Saint Cloud, MN
Technology Integration Specialist 2013-2014

Foley High School, Foley, MN
Social Studies Teacher grades 9-12 2009-2012

Catholic University of Daegu, South Korea 2008
English Teaching Assistant ages 18-40

SCHOLASTIC AND PROFESSIONAL HONORS

UCEA Graduate Campus Ambassador	2018-2019
UCEA Graduate Student Summit Member	2018
David L. Clark National Graduate Student Research Scholar- UCEA, AERA	2018
John Edwin Partington and Gwendolyn Gray Partington Scholarship	2017-2018
Paynesville Bulldog Outstanding Teacher Award	2017
John Edwin Partington and Gwendolyn Gray Partington Scholarship	2016-2017
TIES Teacher of the Year Award	2015
Cora P. Sletten Scholarship, Geography, MSU, Mankato, MN	2007–2008
Who's Who Among Students in American Universities and Colleges	2009
The National Scholars Honor Society, MSU, Mankato, MN	2009
George J. Miller Scholarship, Geography, MSU, Mankato, MN	2008–2009
Agnes and Rhea McCarthy Scholarship, Education, MSU, Mankato, MN	2008–2009

PPROFESSIONAL PUBLICATIONS

Retooling Schooling: Leadership, Technology, & a Deeper Learning Culture	2018
Potential Sites for Ski Resorts: A Comparative Analysis Between Colorado and the Altay Mountains	2013