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LEADERS OF 21ST CENTURY EDUCATION: A STUDY OF SCHOOL ADMINISTRATOR PERCEPTIONS OF TECHNOLOGY IN ALABAMA

by

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
in partial fulfillment of the requirements for the degree of
Doctor of Educational Leadership

BIRMINGHAM, ALABAMA

2022

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LEADERS OF 21ST CENTURY EDUCATION: A STUDY OF SCHOOL ADMINISTRATOR PERCEPTIONS OF TECHNOLOGY IN ALABAMA

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EDUCATIONAL DOCTORATE

EDUCATIONAL LEADERSHIP

ABSTRACT

School leaders occupy a crucial position to implement new initiatives in schools. Due to advancing education technology, school administrators are expected to adjust and improve their competencies to meet the current educational technology demands. This research study aims to investigate Alabama school administrators' technological leadership behaviors based on their self-reported perceptions. Also, differences in leadership behaviors across demographics were explored. The research study involved a quantitative non-experimental research design using Schoenbart's (2019) research study approach as the study template. Participants included Alabama elementary, middle, and high school administrators. Data were collected using the online ELTS questionnaire version. Data were analyzed using both descriptive and inferential (comparative) statistics. One hundred and forty administrators, 61 (43.6%) males and 79 (55.7%) females, participated in the research study. The median age was between 40 and 49 years, the median experience was 21 to 25 years, and the median administrative serving year was five to nine. All participants had access to technology; 85.7% reported full access while 13.2% reported limited access. Based on socioeconomic status, 42.1% in-school high technology needs while 15.7% reported low need. The ELTS had a high degree of internal reliability. The majority of participants reported high-level technology leadership

roles based on ISTE-EL standards. There were no statistical differences in technology leadership behaviors across the demographics ($p > 0.05$). The research findings indicated that many Alabama school administrators demonstrated high-level technological behaviors irrespective of their demographics. The research findings cannot be generalized and are potentially biased by self-reported data. Hence, a research study involving experimental design is recommended

Keywords: educational technology; school administrator technology; Education Leaders Technology Survey; International Society for Technology in Education; instructional technology; principal perceptions

DEDICATION

First and foremost, I would like to thank my husband, Dr. David Obert. I could not ask for a better partner in life. You have been with me through this entire process and the birth of our children. Thank you for helping me at home so I could accomplish this goal. Next, I would like to dedicate this to my children, Madeline and Michael, who were both born during this writing process. May you both grow up to lead the world and serve others.

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TABLE OF CONTENTS

Page

Page

Page

Page

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CCSSO	Council of Chief State School Officers
CLAS	Council for Leaders in Alabama Schools
ELTS	Education Leaders Technology Survey
ICT	Information Communication Technology
ISLLC	Interstate School Leadership Licensure Consortium
ISTE	International Society of Technology Education
ISTE-EL	International Society for Technology in Education Standards for Education Leaders
NETP	National Education Technology Plan
NETS-A	National Education Technology Standards for Administrators
NPBEA	National Policy Board for Educational Administration
PSEL	Professional Standards for Educational Leaders
PTLA	Principals Technology Leadership Assessment
RAC	Research Authorization Committee
SOBT	School of Business Technology
TF/TL	Technology Facilitation and Technology Leadership
TSSA	Technology Standards for School Administrators

CHAPTER 1

INTRODUCTION

Researchers agree that school leaders play a pivotal role and make significant contributions to academic improvement in student achievement (Alhosani et al., 2017; Collings & Halverson, 2018; Hou et al., 2019; Karadag, 2020; Khalifa et al., 2016). School leaders play a part in implementing policies and in promoting crucial accountability polices in schools (Walker & Qian, 2018). Principal leadership quality has prompted significant attention among researchers internationally because principals are crucial for influencing effective educational initiatives in schools (Zheng et al., 2017). Education is a dynamic system that is influenced by many factors transforming school instructional programs. Among those factors, technology skills of school principals are critical to altering the educational sector, leading to changes in school leadership and preparation program requirements. Therefore, to keep up with the technological advancements in the ever-changing educational system and in instructional programming, school leaders must demonstrate competency in the use of technology to meet the requirements of the present technological demands (Gu & Johansson, 2013; McLeod et al., 2011; Zhong, 2017). To address this need, the International Society of Technology Education (ISTE) developed and released standards for education technology leadership. The ISTE standards provide comprehensive standards and indicators concerning required school leader behavior for implementing systematic adjustments that include adequate and non-discriminatory technology outcomes for every student (ISTE, 2018).

This research study investigated school principal self-reported technology leadership behaviors in Alabama schools. Also, the study identified relationships between principal technology leadership behaviors and school demographics. According to Collins and Halverson (2018), school leaders should be pondering changing the school internally and linking learners to outside resources to revive and extend technological resources to their students. Similarly, Graves (2019) and Zhong (2017) posited that equipping schools technologically and ensuring school principal preparedness with access to up-to-date technology and leadership tools are crucial for the successful integration of technology into the school system.

Problem Statement

Due to technological advancements, the world is rapidly changing, and it is influencing every sector. Every area, including the education sector, is striving to keep up with the pace of technological transformation. This has resulted in a society in which a workforce lacking digital or technological skills is becoming redundant. Technology skills have become professional prerequisites for employment (García-Pérez et al., 2021). Currently, to ensure workforce digital equity, digital skills are crucial (Graves, 2019; Ragnedda & Ruiu, 2018). Hence, schools need to keep up with the current workforce requirements by integrating the teaching of current technological and digital skills into the school instructional program and engaging students in technology-embedded learning opportunities. To achieve that, schools must integrate 21st Century skills into the teaching, instruction, and curriculum development (Berger & Frey, 2017; García-Pérez et al., 2021; United States Department of Education, 2017).

In view of preparing students to acquire skills meeting the current workforce qualification demands, schools need to equip students with up-to-date digital skills. However, principal leadership is key to ensuring required technology initiatives are implemented in schools. Researchers have provided evidence regarding the significant impacts of principal technology leadership behaviors in influencing the integration of technology in schools (Graves, 2019; Raamani & Arumugam, 2018, Schoenbart, 2019). Schoenbart (2019) found there is a need to understand the knowledge and attitude of school administrators more fully regarding their role as school leaders to successfully integrate technology into the school.

Purpose of the Study

The aim of this research study was to explore technology leadership of school administrators and to identify technology leadership behaviors based on self-reported perceptions of school administrators in Alabama schools. Furthermore, this research study determined the differences in principals' self-reported perceptions and behaviors among schools and across different school demographics.

Schoenbart's (2019) study sought to understand principal technology leadership behaviors and to validate the Educational Leaders Technology Survey (ELTS), a survey used to measure educational leaders' technology skills and behaviors. I used Schoenbart's study as a template study for this current study. The research study aligned each ELTS item to specific technology leadership behaviors as identified by 2018 International Society for Technology in Education Standards for Education Leaders (ISTE-EL) standards. The five 2018 ISTE-EL standards include: (1) equity and citizenship advocate,

(2) visionary planner, (3) empowerment leader, (4) systems designer, and (5) connected learner (ISTE, 2018). An additional purpose of this research study was to re-validate ELTS by assessing the internal reliability of the tool using the current sample of Alabama school leaders.

Conceptual Framework

Technology is rapidly advancing (Muro et al., 2017), leading to rapid revolution of the educational setting and prompting technological updates in schools. Since school leaders hold the crucial position of integrating new initiatives into the school system, their role, and contributions as technology leaders to integrate technology into the school programs, cannot be overlooked. As such, school leaders are well-recognized with pivotal positions in implementing and enabling technology in their respective schools. Hence, to prepare and engage students in the present-day digital technology skills, school administrators need to adopt technology integration and be prepared to implement 21st Century technology and digital skills into the school instructional programs and curriculum (Richardson et al., 2015). Moreover, researchers have indicated that practicing effective leadership significantly contributes to the success of implementing school restructuring initiatives and enhancing student outcomes (Day et al., 2016). Thus, the philosophical concept of technology leadership regarding school leaders' crucial roles in initiating change in schools provides the framework for educational system restructuring.

The ISTE-EL education leader section supports the implementation of ISTE standards for educators and students. Furthermore, it provides the guidance for digital-

age framework. The standards focus on school leader behaviors and knowledge to empower teachers, and in turn, to make student learning more effective. In that regard, a comprehensive understanding of the ISTE-EL-based technology leadership standards constitutes an adequate framework for successfully implementing technologically enhanced instructional programs in schools (Graves & Bowers, 2018; Schoenbart, 2019). This conceptual framework targets school principal technology behaviors to empower teachers and improve student digital and technology skills through the implementation of ISTE-based standards into teaching and learning.

Research Questions

This research study addressed the following research questions:

1. What is the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?
2. To what extent are school administrators demonstrating technology leadership behaviors?
3. To what extent do principal technology leadership behaviors differ across demographic groups of gender identity, age, and experience?
4. To what extent do principal technology leadership behaviors differ across the school demographic groups of school type, size, community technology access, socioeconomic status, and location?

Method

The quantitative methodological approach for this research study is non-experimental; therefore, a non-random sampling technique was used. In this section, I describe sampling techniques, data collection, and data analysis applied to the study.

Sample

A convenience sampling approach, based on pre-existing and easily accessible participants, was used in this study. Participants were school principals from elementary, middle, and high schools in Alabama. The selected schools included schools from which the required information for this research study could be conveniently accessed.

Data Collection

Data were collected using the online version of ELTS questionnaire adapted by Schoenbart (2019) (See Appendix A). The school administrators' email addresses were obtained from a directory provided by the Council for Leaders in Alabama Schools (CLAS). CLAS is a professional organization of school leaders in Alabama, representing over 4,000 members. The CLAS organization is an umbrella organization of 12 different affiliate organizations representing each type of school administrator in the state of Alabama. The survey questionnaire was sent to the school administrators via their respective email using the Alabama CLAS directory.

Data Analysis

Data analysis involved both descriptive and inferential data analysis. Data analysis involved a quantitative approach using Qualtrics software.

Descriptive Data Analysis. Descriptive data analysis focused on Research Question 2 to assess principal technology leadership behaviors in their respective schools. The descriptive statistics summarized participant technology leadership behavior regarding each of the ISTE-EL standards for each principal. Descriptive statistics included frequencies, mean, standard deviation, skewness, and kurtosis for each survey item.

Comparative or Inferential Data Analysis. Comparative or inferential data analysis was used to determine whether principal technology leadership behaviors were statistically different, based on (a) their demographic characteristics of age, gender, and experience; and (b) the school demographic analysis including size, community technology access, socioeconomic status, and location. Inferential statistics included frequency data for principal and school demographic characteristics concerning each ELTS item.

Data analysis included quantitative validation procedures for assessing internal reliability of the ELTS questionnaire. Data that addressed Research Question 1 were analyzed following the quantitative approach used by Schoenbart (2019) to validate the instrument. Hence, internal reliability was assessed using Cronbach's alpha test (Cronbach, 1951) using Qualtrics.

Definition of Key Terms

For this study, the following definitions of terms applied:

21st Century skills: refer to problem-solving ability, innovativeness, and effective collaboration of member of diverse disciplines and fields, often from different geographical locations (United States Department of Education Office of Educational Technology, 2013).

Educational technology: describes the study and the ethical practice of enhancing learning and improving learning performance through the creation, use, and management of appropriate technological resources and processes (Januszewski & Molenda, 2008).

Digital equity: refers to individual and community information technology capacity needed to fully participate in United States society and economy (Digital Equity Act of 2019).

Digital divide: refers to the gap existing between students that have access to the internet and digital devices at home and school and the students that do not have access to them (U.S. Department of Education, 2017).

Digital skills: refer to computer literacy, including the ability and capacity of using and navigating the computer to search for information and manage online contents. It includes the awareness of potential of the internet for engaging in self-promotion and increasing social and cultural relevance (Ragnedda, 2017).

ISTE-EL Standards: refer to Education Leaders ISTE standards released in 2018. The standards focus on the behaviors and knowledge that education leaders need

for empowering teachers and making student learning possible (ISTE, 2018). This is the technology leadership framework for education leaders.

School administrator: is defined in this study as school principals and assistant principals serving in Alabama elementary, middle, and high schools.

School socioeconomic status: is the percentage of students eligible to receive free and subsidized lunch in each school.

Technology: refers to the digital devices such as computers, cell phones, computers, and any other communication devices, and the related software (Schoenbart, 2019).

Technology leadership: refers to the behaviors and practices of leaders applying technology to support effective teaching and learning based on ISTE-EL standards (Schoenbart, 2019).

Assumptions of the Researcher

A research paradigm entails four assumptions including ontological, epistemological, methodological, and axiological assumptions. The following philosophical assumptions have been made by the researcher in the design and conduct of the study (Creswell, 2013).

Ontological Assumption

To clarify the ontological assumption that was used in this research study, it is crucial to define ontology. According to Crotty (2003), ontology is the study of being. It concerns the kind of world being investigated, including the existence of nature within

the structure of reality. Ontological assumptions seek to discover the nature of reality. As the researcher, I assumed the world to be a place inhabited by human beings with distinct thoughts, meanings, and interpretations (Ahmed, 2008; Oral, 2019). Applying this worldview to the study, I assumed that principal perceptions of technology leadership and their behavior based on their distinct thoughts, feelings, and interpretations would differ. I assumed that principal technology leadership behaviors would differ among the school administrators and across school demographics. Also, I assumed that school administrators do not adequately implement technology leadership behaviors in compliance with the 2018 ISTE-EL standards. Based on these assumptions, I used the survey questionnaire, ELTS, to explore principal technology leadership behaviors.

Epistemological Assumption

Epistemology refers to a way to understand and explain how humans acquire a particular knowledge. The nature of knowing is essential in individual perspectives, while evidence is gathered based on individual views. Therefore, knowledge can be acquired from individual experiences (Bourgeois, n.d.; School of Business Technology [SOBT], n.d.). Epistemological assumptions indicate that genuine knowledge is quantifiable (SOBT, n.d.). Furthermore, an epistemological assumption shows that using information technology is an objective process that can be quantified and measured. Therefore, based on epistemological assumption, I assumed that the evidence regarding principal technology leadership behaviors can be gathered through individual views and experiences. Thus, I used the ETLS to gather participant experiences to understand their technology leadership behaviors.

Axiological Assumption

In research, axiology deals with ethical issues that a researcher needs to consider while conducting research. Axiological assumption involves value-laden research approach seeking to answer the question regarding the role of values. It refers to how research values are expressed by the researcher. Therefore, it entails evaluating, understanding, and identifying the wrong and right behaviors associated with the conduct of a research study. Based on the axiological assumption, the researcher considers the ethical issues (Khatri, 2020). Therefore, the researcher tries to minimize or avoid risks, but also makes the right decisions regarding informed consent from the participants to ensure legal protection and ethical treatment of human subjects.

Methodological Assumption

Methodological considerations in research entail a paradigm of considering the research participants, the data collection instruments, data measures, and data analysis approach by which knowledge can be acquired concerning the research problem. The assumption guides the research on how to answer the research question (Khatri, 2020). Therefore, it requires determination, measurement, and analysis of objective data. Thus, the methodological assumption for this research study led to the development of methodological (research) questions stated above. These questions informed the use of quasi-experimental approach to gather objective data regarding principal technology leadership behaviors and analysis of the data.

Limitations and Delimitations of the Study

The limitations to this study include the conditions the researcher cannot control. The following are the potential limitations and delimitations of this research study:

1. Since self-reported data were collected, data collection bias is possible while the participants may over-report or under-report their technology leadership behaviors.
2. The potential bias in data collection may undermine the generalizability of the research findings.
3. A delimitation of the study includes the fact that technology leadership behaviors were measured by ELTS items, which are based on ISTE-EL standards only, the generalizability of the research findings may be limited since other technology leadership standards were not considered in this research study.
4. A second delimitation involves convenience sampling approach which may lead to under-representation or over-representation of the population. This may result in biased data collection and limit the generalizability of the research findings.

Significance of the Study

Researchers have provided evidence regarding the crucial role of education in addressing the problem of inequality in the United States (Collins & Halverson, 2018; OXFAM [formerly Oxford Committee for Famine Relief], 2019). Since school leaders play a critical role in integrating and implementing technology in education, their role as

technology leaders in schools will increase access for students to educational technologies and help to ensure a more equitable education. Therefore, by exploring and understanding principal technology leadership behaviors, findings from this study may contribute to successful implementation and integration of technology into educational programs and help bridge the gap of education inequality in the United States. Also, it will help equip students with up-to-date technological and digital skills to meet the currently demanding workforce qualifications.

Few research studies have investigated principal technology leadership in the United States. Therefore, I hope that this research study will make significant contributions to the body of research knowledge regarding technology leadership approaches in the United States. The knowledge gained from this study may provide valuable information for stakeholders and decision makers in education to improve technology integration in the school system and equip students with 21st Century digital skills that can move the nation forward (Muro et al., 2017). At the state level, findings from this research study can be useful for the education stakeholders, policymakers, and the Alabama State Department of Education to reform the education sector and promote the implementation of technology initiatives in all schools across the state.

Conclusion

To conduct this study, I used Schoenbart's (2019) research approach as a template for research study design. Furthermore, the methodological approach was convenient to recruit participants and obtain the required information. There is paucity of information regarding principal technology leadership behaviors in Alabama schools and across the

United States. Therefore, findings from this research study may contribute to successful implementation of educational technology in the schools. Despite the identified limitations and delimitations to the study, the findings may help understand principal technology leadership behaviors and inform decision-making and policymaking concerning the integration of technology into school educational programs.

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to review the empirical literature for information regarding technology leadership standards for school leaders, including the evolution of leadership standards and technology leadership standards, the digital divide, and principal school leadership and technology leadership. The review includes a presentation of the ISTE-based technology leadership standards and the research studies that examined school leadership and the impacts on student academic achievements, school leadership, technology leadership frameworks, technology initiative implementation in schools, and the impact on student outcomes. Also, this literature review identifies relevant themes including gaps in previous research studies concerning school principal leadership and technology leadership roles in implementing technology in schools.

Furthermore, this chapter identifies factors challenging successful implementation and integration of technology in schools and the school leadership behaviors contributing to the success of technology integration in schools. From this literature review, four specific themes were identified including leadership standards/technology leadership standards, technology in education, digital divide, and leadership/technology leadership in education. The review is organized according to these four themes. The section addressing leadership standards and technology leadership standards focuses on the evolution of leadership standards and the technology leadership standards based on ISTE standards for school leaders. The review of educational technology leadership identifies

the introduction of technology into the education system and its significance to the student. Regarding the digital divide, the focus is on social equity in the access to and application of technology. Finally, this chapter reviews school leadership impact on technology integration and student achievement.

Evolution of Leadership Standards

In 1996, the Council of Chief State School Officers (CCSSO) established the Interstate School Leadership Licensure Consortium (ISLLC) and charged this group to develop the first set of standards for school leaders. These standards, known as the *ISLLC Standards* (CCSSO, 2008), quickly gained wide acceptance as a founding document to guide the "preparation, certification, professional development, and performance evaluation of school leaders across the United States" (Lindle et al., 2004, p. 2). The original set of standards, developed in 1996, and in the updated revisions (CCSSO, 2008), stated (in Standard 1) that school leaders were expected to facilitate the "development, articulation, implementation, and stewardship of a vision of learning that is shared and supported by all stakeholders" (CCSSO, 2008, p. 14). Other standards included: (2) nurturing a school culture based on learning, (3) managing resources to support learning, (4) collaborating and responding to a diverse community, (5) acting with integrity and fairness, and (6) influencing the political and cultural context of the school (CCSSO, 2008).

More recently, the National Policy Board for Educational Administration ([NPBEA], 2015), in conjunction with nine national and international, professional organizations, again updated the *ISSLC Standards*, renaming them the *Professional*

Standards for Educational Leaders (PSEL). It is interesting to note that neither the ISLLC Standards, nor the PSEL Standards included a dedicated standard addressing technology leadership for school leaders, specifically. However, indicators for PSEL Standard 4: *Curriculum, Instruction, and Assessment* and Standard 9: *Operations and Management* state that educational leaders should "promote the effective use of technology in the service of teaching and learning" (p. 12), and "employ technology to improve the quality and efficiency of operations and management" (p. 17), respectively.

Technology Leadership Standards

With the guidance of the International Society for Technology in Education (ISTE) and 12 other national- and state-level professional, educational organizations, the Collaborative for Technology Standards for School Administrators (TSSA Collaborative) promulgated the first set of technology leadership standards in November of 2001. The TSSA Collaborative worked to develop a national consensus around what P-12 school administrators should know and be able to do to facilitate the integration of technology into the teaching and learning process, stating "The Collaborative's standards…focus on the role of leadership in enhancing learning and school operations through the use of technology" (p. 5). The TSSA standards comprise a list of six general areas of competency, including: (1) *Leadership and Vision*; (2) *Learning and Teaching*; (3) *Productivity and Professional Practice*; (4) *Support, Management, and Operations*; (5) *Assessment and Evaluation*; and (6) *Social, Legal, and Ethical Issues*. Each standard includes a general statement of what a school leader should know, followed by a list of five or six indicators of what a school leader should be able to do to demonstrate

proficiency in each standard. The TSSA Collaborative clearly explicated these standards, dividing them into three areas of foci, including the technology leadership roles of school district superintendents, district-level program directors, and building-level school administrators (TSSA Collaborative, 2001).

Also, in the fall of 2001, ISTE developed the *Technology Facilitation and Technology Leadership* (TF/TL) *Standards* (Williamson & Redish, 2007). Rather than district- and building-level, formal, school leaders, the *TF/TL Standards* were directed toward "PK-12 coordinators, specialists, or directors who lead technology programs at the district, regional, state, or national level" (p. 23). The *TF/TL Standards* comprise a list of eight general areas of expertise, including: (1) *Technology Operations and Concepts*; (2) *Planning and Designing Learning Environments and Experiences*; (3) *Teaching, Learning, and the Curriculum*; (4) *Assessment and Evaluation*; (5) *Productivity and Professional Practice*; (6) *Social, Ethical, and Human Issues*; (7) *Procedures, Policies, Planning, and Budgeting for Technology Environments*, and (8) *Leadership and Vision*. These eight standards are further broken down into individual indicators, one set of indicators developed for technology facilitators, and another set aimed at technology leaders. Though these standards include substantial overlap with the *TSSA Standards*, the *TF/TL Standards* are unique in that they "were intended to influence university preparation programs, district/state policies and practices, and inservice professional development in the field" (Williamson & Redish, 2007, p. 25).

The *TSSA Standards* were later adopted by ISTE and integrated into their organizational framework. At first, ISTE named these standards the *National Education Technology Standards for Administrators* (NETS-A). These NETS-A Standards have

gone through multiple iterations and updates, but in 2007 were renamed (again) to the *ISTE Standards for Education Leaders* (ISTE, 2021). Barr and Sykora (2015) explained that the original technology standards focused on "learning to use technology." In contrast, the focus now is on "using technology to learn" (p. 1). The *ISTE Standards for Education Leaders* "guide [education] administrators in supporting digital age learning, creating technology-rich learning environments, and leading the transformation of the educational landscape" (para. 3). The most recent iteration of the *ISTE Standards* comprises five standards with four to five specific indicators supporting each standard. They include: (1) *Equity and Citizenship*, (2) *Visionary Planner*, (3) *Empowering Leader*, (4) *Systems Designer*, and (5) *Connected Learner.* These *ISTE Standards* serve as the organizing structure and conceptual framework for the following sections of the literature review. Below I review the relevant, empirical literature base regarding technology leadership, organized by the general content represented by each of the standards. I have provided a complete listing of the most recently published *ISTE Standards* in Appendix B.

Standard 1: Equity and Citizenship Advocate

ISTE Standard 1 states, "Leaders use technology to increase equity, inclusion, and digital citizenship practices" (ISTE, 2021, para. 1). Indicators for this standard state:

Education leaders:

(a) Ensure all students have *skilled teachers* who actively use technology to meet student learning needs;

(b) Ensure all students have *access* to the technology and connectivity necessary to participate in authentic and engaging learning opportunities;

(c) Model *digital citizenship* by critically evaluating online resources, engaging in civil discourse online and using digital tools to contribute to positive social change; and

(d) Cultivate *responsible online behavior*, including the safe, ethical, and legal use of technology (italics added, ISTE, 2021, para. 1).

Skilled Teachers

Developing professional capacity among teachers in their use of technology in instruction is one of the most frequently researched areas related to technology leadership among school administrators (Dexter & Richardson, 2020). Professional development and support for teachers from school leaders are critical to ensuring that teachers are skilled in its use. The empirical literature in this area emphasizes several areas including: (a) effective professional development; (b) school leader knowledge of curriculum; (c) school leader support for technology; (d) and support for teacher social, emotional, and contextual factors (Dexter & Richardson, 2020). Generally, researchers who explored the area of effective professional development for teacher concluded that effective school administrators aligned the use of technology with specific curricular and instructional goals and then worked to make this alignment explicit to teachers through modeling and specific examples (Dexter & Richardson, 2020; Hartnell-Young, 2006; O'Neill, 2007; Staples et al., 2005). Other researchers emphasized the need for school leaders to learn as much as possible about the curriculum in their schools to support technology-enhanced instruction (Gerard et al., 2008; Juang et al., 2008; Stein & Nelson, 2003). Thorough

knowledge of curriculum facilitates school leader expertise in knowing how best to influence teachers in the use of the most effective technology tools to deliver curriculum and meet learning goals.

School leader support also plays a critical role in ensuring that teachers are skilled in the use of technology. Several research teams concluded that support and enthusiasm coming from the school leader facilitated and encouraged teachers to develop their skills in technology integration. Providing enthusiastic support for teachers' efforts can come in the form of providing professional development, giving teachers access to experts, facilitation of teacher collaboration and reflective practice, and buffering teachers from distractions from their technology learning (Dexter & Richardson, 2020; Kafyaulilo et al., 2015; Kafyaulilo et al., 2016; Pan & Franklin, 2011). Several researchers emphasized that school leaders must attend to both the technical aspects of technology learning for teachers as well as the affective and physical contexts. Leaders who attended to teacher anxiety; the presence, or lack of teacher self-efficacy; and teacher reluctance to risk new strategies and teaching techniques were perceived as being more effective in their technology leadership (Chiu, 2017; Dunn et al., 2013; Muir-Herzig, 2004). Likewise, leader behavior such as facilitation of collaborative teacher planning time, conducive physical space for technology use and learning, and the use of expert teachers as role models for peers were identified as effective practices (Courduff et al., 2016; Glazer et al., 2009; Hartnell-Young, 2006).

Student Technology Access

The second indicator for ISTE Standard 1 addresses the leader's responsibility to ensure that students have the necessary access to technology (i.e., hardware and software) used in their school and, by implication, outside of school, as well. Specifically, the indicator states that leaders should "Ensure all students have *access* to the technology and connectivity necessary to participate in authentic and engaging learning opportunities" (ISTE, 2018, para. 1). While researchers have explored the topic of providing access to computer technology for more than three decades, pressure on schools and school leaders to provide such access has been increasing in recent years (Pautz & Sadera, 2017). This is especially true in the context of a global pandemic, which has driven a dramatic increase in the demand for instructional services to rely heavily on one-to-one computing and remote access by students to school technology resources and infrastructure.

Historically, student access to technology has been conceptualized as a binary concept between the *haves* and the *have-nots*, or those who owned personal computers and those who did not. Researchers often refer to this gap in access as the *digital divide* (Vie, 2008; Warschauer et al., 2004; Wilson et al., 2003). Delgado et al. (2015) conducted a meta-analysis of the empirical literature addressing student access to technology published between 1986 and 2014, among other issues. Based upon their review of relevant research reports, Delgado et al. wrote, "The vast majority of students in the United States are able to access the Internet from home or school" (pp. 397-398). The National Center for Education Statistics (2021) corroborated this finding, stating that in 2019, approximately 95% of students, ages three to18 years old had home Internet access. Delgado and colleagues further reported that, because increasing student access to

technological devices in schools has been so ubiquitous, the student-to-device ratio has been reduced in the last two decades from 11:1 to less than 2:1 (in 2015) in terms of daily student access to computers or other devices (Delgado et al., 2015).

Currently, however, defining access to technology for K-12 students has expanded far beyond whether a student owns or has access to a computer. Issues such as Internet connectivity; bandwidth; access to software; technology skill levels, beliefs, and attitudes of teachers and students; and mobile technology are only a few of the compounding issues that now must be considered by school leaders when addressing access to technology for their students (Dolan, 2016). Further, Delgado et al. (2015) pointed out that technology use in classrooms to enhance instruction has resulted in a transition in the "types of skills students need to identify quality information and where learning takes place" (p. 398). Thus, while schools seem to have been quite effective in addressing the digital divide based upon whether students have physical access to technological devices, the complexity of the issues involved has increased substantially over time.

Dolan (2016) also conducted a comprehensive review of the empirical literature base relative to student access to technology in and out of school. Dolan broke down the literature into five areas of inquiry as follows:

Student Technology Access at Home. Research findings indicated that home access to technology varied according to student/school geographic location, ethnicity, socioeconomic status (SES), and citizenship status (Calvert et al., 2005; Cleary et al., 2006).

Student Technology Access at School. Scholars determined that school access to technology involved the location of computers in the school (e.g., in classrooms, in computer labs); and school technology infrastructure including Internet access, bandwidth, software availability, and school-installed firewalls or blocking software (Hargittai, 2004; Tyner, 2003; Valadez & Duran, 2007).

Redefined Access through Mobile Technology. Over 275 million people in the United States are smartphone users/subscribers (O'Dea, 2021). K-12 students in 2020 had access to the Internet from the palm of their hand. While schools may see such widespread access to the Internet as progress, mobile technology brings with it other, unique challenges, such as selection of software, use policies in schools, network maintenance, modification of curriculum and instruction, training for teachers, parents, and students (Zucker, 2004).

Technology Access at Outside Locations. Students often have access to computers at various locations in their larger community, as well. Such locations may include community centers and public libraries. However, long wait times and a lack of adult supervision in such places are important factors for consideration (Warschauer & Matuchniak, 2010).

Home vs. School Use of Technology. Researchers have also learned that students often use technology at home very differently than how they use it at school. Home use often consists of students messaging others and accessing social media, gaming, and other entertainment whereas at school, students use technology to research topics and for writing papers. Schools have been slow to learn from such student *out-of-school literacies* and to integrate them into school curriculum and instruction (Black, 2008).

Other researchers examined student technology access and focused on student use of technology as either producers or consumers. Clark and Gorski (2001), for example, stated that student technology access is often a function of student social and cultural identity groups, especially related to the socioeconomic status of the student, their families, and the schools they attend. Clark and Gorski stated:

> Although students in school with low concentrations of poverty were most likely to be assigned computer-related tasks focused on active learning, students in schools in which [most families] were eligible for free or reduced-price school lunch were more likely to be assigned practice drills than any other computer-related task. (p. 40)

Given all these factors related to student technology access in the current context of schooling, seeking, establishing, and maintaining access for students and teachers in schools is certainly complex, and increasingly so.

Digital Citizenship and Responsible Online Behavior

Despite the explicit expectation that school technology leaders model and teach *digital citizenship* and that they promote *responsible online behavior* in order to promote safe, positive, technology-enhanced social change in schools, the empirical literature relative to these topics is relatively silent. Richardson et al. (2012) determined, nearly a decade ago, that research related to school leader role in developing student digital citizenship is one of the least studied areas in the empirical literature base. In recent updates, however, scholars still did not identify or review research related to developing digital citizenship or the promotion of responsible online behavior by school technology

leaders (Dexter et al., 2016; Dexter & Richardson, 2020). Clearly, these topics remain under-researched.

Standard 2: Visionary Planner

PSEL Standard 1: *Mission, Vision, and Core Values* reiterates the importance for school leaders to establish and maintain a shared vision for school personnel. Standard 1 states, "Effective educational leaders develop, advocate, and enact a shared mission, vision, and core values of high-quality education and academic success and well-being of each student" (NPBEA, 2015, p. 9). Revisiting the development and evolution of educational leadership standards underscores the profession-wide emphasis placed upon the importance of visionary leadership from educational leaders. Ritzhaupt et al. (2008) wrote, "Successful integration of technology throughout a school system should be consistent with the school district's overall education mission, vision, and strategic plan" (p. 2). Ritzhaput and colleagues studied trends in technology planning in Florida K-12 schools. Among their conclusions was critical nature of a mission- and vision-driven technology planning process to effectively identify critically important components in technology integration designed to improve student learning. Thus, when ITSE included *Visionary Planner* as one of five technology leadership standards, it was well within the established expectations for leaders in the profession. In other words, there is a profession-wide understanding of the importance of shared vision for high-quality education. This understanding certainly applies to technology leadership.

ISTE Standard 2, *Visionary Planner*, establishes the expectation that technology leaders "engage others in establishing a vision, strategic plan, and ongoing evaluation

cycle for transforming learning with technology" (ISTE, 2018, para. 2). The accompanying indicators underscoring this standard call for education leaders to: (a) *adopt a shared vision*; (b) allow the vision to drive the process of *strategic planning* designed to improve student success; (c) monitor and *evaluate student progress*, (d) *communicate with stakeholders*, and (e) share collaboratively about *lessons learned* in the process (ISTE, 2018, para. 2). Coleman and Dickerson (2017) concluded, "School leaders must be able to develop a school vision that includes systemic technologies to provide support for the increasing diverse students in public schools" (p. 1471).

Dexter and Richardson (2020) conducted a systematic and comprehensive review of the empirical literature, published between 1998 and 2018, addressing technology in K-12 schools. Borrowing from Hitt and Tucker's (2016) *Unified Model of Effective Leader Practices* as an organizing structure for their review, Dexter and Richardson looked closely at the research that addressed establishing and conveying the vision of technology integration into the process of teaching and learning. These authors pointed out the work of Yee (2000) who studied 10 schools exemplary in the use of technology in Canada, New Zealand, and the United States. Yee stated that principals were "keepers of the vision" (p. 293) for technology integration. Similarly, Al Sharija and Watters (2012) studied two exemplary secondary principals in Kuwait and concluded that the principal is the primary party in setting direction, communicating, and promoting the vision of technology use and integration.

Vanderlinde et al. (2010) conducted case studies in three Flemish primary schools. School leaders and teachers were using an online tool designed to assist school personnel in developing a strategic plan to integrate information and communication

technology (ICT) into the learning process. Vanderlinde et al. stated, "The first step [in the technology planning process] is to formulate a team-based vision on the nature of 'good' education in relation to information and communication technology [ICT] integration....An ICT policy plan should be grounded in a vision on education" (p. 444). The researchers noted that each school developed different technology policies and made different decisions about the strategic use of technology in their classrooms and beyond, based upon the individual school vision on what *good* education is. After examining their philosophy of education and (1) *establishing a shared vision*, school personnel continued with the five-step process, facilitated by the online tool, to (2) *inventory the use of technology,* (3) *set priorities,* (4) explore possible *new activities and technologies*, then (5) draw up an *action plan* based upon the shared vision of technology integration (Vanderline et al., 2010).

Dexter and Richardson (2020) also concluded that school administrators advocated for training in how to be visionary technology leaders. A Florida study of 268 principals conducted by Brockmeier et al. (2005) pointed out that principals surveyed expressed a desire to receive targeted professional development specifically in learning how to be visionary leaders in the process of technology use. Further, Stuart et al. (2009) found that, among the 64 school leaders from New Zealand they studied, leaders expressed that “professional development in information and communications technology (ICT) and ICT usage are antecedents of ICT competency.” Stuart et al. stated that school leaders are “ICT competent and willing ICT champions” (p. 733). Yu and Durrington (2006) found, however, that the aspiring and practicing school leaders they studied were more interested in learning about the practicalities of how to help teachers integrate

technology into their instruction than they were learning about how to develop and steward a vision for technology use.

Other researchers' findings have not been so positive. For example, Duncan (2011) surveyed a statewide sample of 208 school principals in Virginia to gather principal perceptions on their competencies in enacting technology leadership standards. Using the Principals Technology Leadership Assessment (PTLA) based on the National Educational Technology Standards for Administrators (NETS-A) and published by the International Society for Technology in Education (2002), Duncan (2011) found that "Virginia public school administrators are barely meeting minimum standards in five out of the six dimensions" of the NETS-A (p. vii). Duncan continued, "The overall mean for the dimension 'Leadership and Vision'…was the lowest mean of all six dimensions, meaning that respondents…self-reported their lowest skills, knowledge, and ability overall [in the Leadership and Vision domain]" (p. 67).

Standard 3: Empowering Leader

The third ISTE (2018) standard is entitled *Empowering Leader* and establishes an expectation for education leaders to "create a *culture* where teachers and learners are empowered to use technology in innovative ways to enrich teaching and learning" (para. 3). Because ISTE Standard 3 addresses school culture, this standard contains many expectations that overlap with other standards. Language from other standards that impact school culture, for example, include ISTE Standard 1 addressing the development of skilled teachers through professional learning. Standard 2 encourages a mission- and vision-based technology plan. Standards 4 and 5 address technology leadership to support

continuous professional learning, while also addressing the need to establish technology teams, infrastructure, and community connections and partnerships (ISTE, 2018). Specific, behavioral indicators for ISTE Standard 3 include: (a) enabling professional educators to exercise *professional agency*, build their own *leadership skills*, and tend to their own *professional learning*; (b) expanding educator *confidence and competency*; (c) nurturing a culture of *innovation* and *collaboration*; (d) addressing *diverse learning, cultural*, and *social-emotional needs* of students; and (e) *assessing student learning* in real time (italics added, ISTE, 2018, para. 3).

Many ISTE Standard 3 components also correspond to Domain 3 of the *Unified Model of Effective Leader Practices* (Hitt & Tucker, 2016) that Dexter and Richardson (2020) adopted as the organizing structure for their review of recent empirical literature covering the topic. Dexter and Richardson stated that this domain (i.e., *building professional capacity*) has been heavily studied by educational researchers and offers many best practices for educational leaders working to integrate technology into the culture and daily practice of educators. Dexter and Richardson wrote:

> The available literature centered on leaders fostering teachers' learning about the operation of educational technology and how its functionalities might align with curriculum goals, student outcomes, and teaching strategies. This…demands leaders learn how to create high quality school-based professional learning environments for teachers…often done through *developing aspects of the school culture* and aligning school structures and resources to support teachers' examining…instructional practice, attitudes, and philosophies. (italics added, p. 25)

According to some researchers, such capacity building should be of high quality and sustained over long periods of time for professional educators to develop the confidence and competence to integrate new strategies and techniques into their daily instructional practice (Stroud et al., 2014; Sweeney, 2010).

A major finding in the recent literature addresses leaders' building agency and leadership skills in teachers through providing ready access to instructional support personnel to customize specific professional development designed to meet teachers' immediate needs (Dexter et al., 2009). This type of access to support personnel resulted in increased interaction of teachers with technology specialists and media specialists in their schools, and with outside technology support systems, to focus technology training content. Other researchers found that, when allowed to design and create their professional development collaboratively with other teachers, classroom instructors found the professional development more productive and effective (Allan et al., 2010).

Another general finding ties school leaders' own professional learning and leadership development directly to teacher support and learning. Schoenbart (2019) confirmed that school leaders' attention to their own technology learning and integration of technology skills led to increased levels of support for teacher integration, collaboration, and to more positive student outcomes. Other researchers found that technology leaders who engaged in their own technology learning could lead teacher capacity building more effectively (Gerard et al., 2008; Tondeur et al., 2015; van Niekerk & Blignaut, 2014). When school leaders were themselves knowledgeable of the specific technology applications, they expect teachers to use in their daily instruction, leaders are able to lead by example (Tondeur et al., 2015), motivate teachers more effectively (van

Niekerk & Blignaut, 2014), and feel more equipped to create a school culture supportive of technology use. Anderson and Dexter (2005) agreed, stating that school leaders' integration of technology into their daily practice resulted in greater overall integration of technology into daily instruction, even more so than did leaders' efforts to support technology infrastructure and financial commitments. They wrote, "…although technology infrastructure is important, for educational technology to become an integral part of a school [and a school's culture], technology leadership is even more necessary" (p. 74).

Standard 4: Systems Designer

The fourth ISTE (2018) standard is entitled *Systems Designer* and establishes an expectation for education leaders to "build teams and systems to implement, sustain and continually improve the use of technology to support learning" (para. 4). This standard covers a broad scope of responsibility for school leaders, focusing on a school leader's ability to establish and nurture team leadership and address resources and infrastructure needs in the school. The standard also directs the establishment of protocols to ensure privacy and safety in data access and management and establish supportive partnerships to achieve the strategic vision and mission of the school (ISTE, 2018). Specific, behavioral indicators for ISTE Standard 4 include: (a) leading collaborative teams to *establish robust infrastructures*, (b) ensuring sufficient and scalable *resources*, (c) protecting *privacy and security* through established protocols in data management, and (d) nurturing and creating *partnerships* from within the school system and beyond, to support the vision (ISTE, 2018).

Dexter and Richardson (2020) examined the literature that specifically addressed *creating a supporting organization,* the fourth domain of the *Unified Model of Effective Leader Practices* (Hitt & Tucker, 2016), a domain in the model that most closely parallels ISTE Standard 4. Dexter and Richardson reviewed findings from approximately 20 recent research reports related to this topic. They concluded, "many studies centered on procuring hardware and software…at the expense of what several quantitative studies established was another element: supporting teachers' learning and collaboration" (p. 27). Further, these empirical studies often concluded that school leaders do not have the expertise to integrate technology into the instruction practices in their school widely and adequately, and thus relied on technology specialists to do this work. They continued, stating that formal school leaders who recognize the importance of technology integration in their schools established shared leadership expectations in order to "create an overall system of leadership practices that maximize enablers and minimize constraints for technology integration efforts" (p. 28).

Establish Robust Infrastructure

Ritzhaupt et al. (2008) studied trends in technology planning in K-12 schools in Florida. They analyzed results from a statewide technology survey (*System for Technology Accountability and Rigor,* Florida Department of Education, 2007), administered to K-12 schools. Survey results led Ritzhaupt and colleagues to conclude that Florida schools are increasing in the frequency with which they review their school technology plans and in the frequency with which they seek funding for technology-related initiatives. Further, schools are also expanding involvement from a variety of

stakeholders in technology planning. Nevertheless, Florida schools reported a decline in the adequacy of funding for purchase and maintenance of hardware and software and an increase in schools seeking funds for technology support through alternative sources, including grants, school initiatives, and donations.

Ritzhaupt et al. (2008) concluded that to establish and maintain a robust technology infrastructure, school leaders must "recognize that funding is temporary and needs are ongoing" (p. 7). Other recommendations included encouragement for school leaders to: (a) seek technology funding from multiple sources, (b) infuse technology planning into the standard operations of the school, (c) involve diverse stakeholders in technology infrastructure planning, and (d) establish an effective process for measuring success of the plan.

Results from other researchers support findings and recommendations from Ritzhaupt et al. (2008). For example, Van Neikerk and Blignaut (2014) conducted an in-depth qualitative inquiry into the perceptions and experiences as well as leadership and management styles of seven school principals in South Africa, regarding integration of technology in their schools. van Niekerk and Blignaut wrote, "Principals have to determine, plan, incorporate and direct appropriate [Internet and Communications Technology] ICT strategies…[in order to design] systems for effective and sustainable ICT integration in teaching and learning" (p. 243). They agreed that school leaders, in addition to planning and implementing targeted teacher professional development, must realize that "insufficient financial resourcing hampers integration of ICT into schools" (p. 243).

Taking a different perspective of what it means to establish a robust technology infrastructure, Benade (2017) conducted case studies of innovative teaching in "technology-rich, flexible learning spaces" (p. 796) in two New Zealand primary schools. Defining infrastructure for technology integration as inclusive of the physical space and design of school classrooms and learning spaces, Benade wrote:

> Open school design encourages flexibility in learning and teaching, and allows collaborative, team teaching, with designers claiming significant benefits. This arrangement of multiple classes using innovatively designed, technology-enriched common space, facilitated by multiple teachers, working in collaborative teams, is far-reaching in its likely implications for community expectations and responses, relationship-building, assessment, student learning, teachers' work, and initial teacher education. (p. 796)

Redefining and redesigning the physical classroom space as a technology-enhanced, open, and flexible space, Benade claimed, will serve to redefine how and where students and teachers use technology in schools. In such a design, virtually any space in a school that can be connected wirelessly can be a learning space. Benade continued, "This…spatial practice replicates the new dynamic of a remote and mobile workplace…and the importance of education preparing young people to be responsive to the demands imposed by global capital" (p. 805).

Ensuring Resources

ISTE Standard 4 also places at school leaders' feet the responsibility for ensuring sufficient and scalable resources for the integration of technology into teaching and

learning (ISTE, 2018). A closer look at this expectation, however, reveals its complexity. Resourcing technology is much more than merely purchasing computers and software to put in teachers' and students' hands. It includes many tangential aspects, including network installation, infrastructure development, professional development, technical support, maintenance and updating of school-based technology, and many other related concerns. Compounding an already complex situation, Stone (2020) wrote, "The COVID-inspired rush to distance learning is putting pressure on already-strained IT budgets in school districts nationwide as educators strive to provide students with needed devices and online tools" (para. 1). This, Stone added, "…comes on top of $13 billion districts already spend on ed tech tools each year" (para. 1).

Dexter and Richardson (2020) wrote that supporting technology integration into daily instructional practice "requires that leaders strategically allocate sufficient resources" (p. 28). This includes school leaders developing an understanding of how state and local sources provide access to and distribute technology funding (Ritzhaupt et al., 2008). Sharma (2019) examined principals' concerns in demonstrating technology leadership in Malaysian schools. Sharma looked at technology leadership challenges and training needs for principals to foster technology integration effectively in their schools. Sharma concluded, "Among…skills that really contributed [to effective technology leadership] include allocating ICT [Instructional Communication Technology] resource to enable teachers to better integrate ICT,…providing sufficient, quality support services,…[and] getting additional allocation of ICT resources" (p. 272). Other researchers concluded that education leaders should include consideration of resource allocation as a part of regular technology planning (Van Niekerk & Blignaut, 2014),

should carefully consider how to remove barriers to effective classroom integration of technology (Courduff et al., 2016), should ensure that resources are allocated to support hardware and software functionality (Robertson et al., 2006), and should ensure that technology resources are allocated and spent in alignment with the mission and vision of the school (Staples et al., 2005). Though findings such as these may help to inform the work of school leaders' technology resource management, they are general and vague at best. The empirical literature is relatively silent regarding technology resource management for school leaders. To date, there has been little exploration of what may comprise specific, school leader best practice in planning and allocating technology resources.

Privacy and Security Concerns

The issue of addressing student privacy and security concerns relative to technology use in schools is one that has received limited attention in the research literature (Anderson & Dexter, 2005; Harwell, 2018; Kumar et al., 2019). In fact, in a recent article in the *Washington Post*, Harwell (2018) wrote that how to protect their online privacy was "perhaps one of the most important and least understood school subjects in America" (para. 2). Other researchers agreed. Findings from a study including 25 focus groups comprised of elementary school educators in three metropolitan regions in the northeast United States, Kumar et al. (2019) found that little research has focused on privacy and security concerns among individual K-12 educators as it relates to their daily classroom instruction. Kumar and colleagues further concluded that, though technology use has become an integral component to daily classroom instruction in elementary schools, and

even though student online privacy has received much attention by journalists, policy makers, and activists, the actual teaching of lessons to children about digital privacy and security remain rare in U.S. schools.

In 2017, Hautea and colleagues researched children's perspective on privacy and data sharing on the Internet. They reported that students aged eight to 16 indicated nascent levels of understanding the implications of online data sharing and how it might affect their privacy. These findings were corroborated by Kumar et al. (2019) who concluded that children ages six to 10 had only a basic understanding of what information should or should not be shared online. Kumar et al. (2019) summarized, "These studies suggest that while children absorb aspects of how privacy plays out online, they may need support understanding more nuanced ideas" (p. 2). The literature suggests a clear need for enhanced professional development for K-12 teachers and school leaders in precisely how to teach students about protecting their privacy online.

In addition to student privacy, school technology leaders must also address social, ethical, policy, and access relative to technology use in schools (Anderson & Dexter, 2005). Giant (2013) addressed K-12 educator awareness of the social implications of student technology. Giant addressed a wide range of *E-Safety* issues, including: safety concerns at school and at home, cyber bullying, and sex and technology. Giant posed the question to educators: "If we teach our children how to use [technology] tools, and freely give them access, who will teach them how to use the safely?" (p. 12). Giant admonished school technology leaders to be aware of these safety concerns when developing policies and procedures for school technology use.

Dolan (2016) agreed, stating that safety precautions that include firewalls and the blocking of certain undesirable software and websites are now a part of the definition of providing access to technology to teachers and students. Dolan stated that the use of technology by students is heavily influenced by security concerns. Leaders must balance the responsibility of protecting students from certain aspects of online access with the need students and teachers must access a wide range of information online. Dolan wrote, "School filters and firewalls in place for student safety appear to severely limit students' and teachers' ability to complete their work, or the availability to access needed or desired sites" (p. 30). The dilemma of how to protect students and teachers while simultaneously allowing adequate and meaningful access to online resources is a constant battle among school technology leaders (Bailey, 1997). Donlan continued:

> Administrators must carefully consider the balance between recognizing the new and varied ways that students construct literacy and [how they] communicate, with a need for student safety through placing limits on the kinds of technology they use or placing strict firewalls or Internet blocking software. (p. 30)

School policy regarding technology use is an additional area where student privacy, safety, and security come together to pose unique challenges to school technology leaders. Several authors have weighed in on this topic, including Oliver et al. (2012) who recommended that usage policies and security options be built-in early to technology usage plans in schools. Garland (2009) stated, "School leaders have [the responsibility] to promote safe Internet policies, protect student privacy, adhere to copyright laws, and establish student health and environmentally sound policies" (p. 40). Garland further pointed out that the increased use of smart phones by students, sometimes

in place of laptop computers, increases principals' concerns for privacy, especially considering smart phones' video and camera functions.

School leaders should also be aware that the policies that schools and districts develop and adopt will inevitably set the tone for how technology use is perceived by educators. Ahn et al. (2012) reviewed K-12 school technology policies of 99 of the largest public elementary and secondary schools in the United States, across 26 states. These authors concluded that school policies that establish goals such as student *critical thinking* and *media literacy* result in opening opportunities for K-12 educators and students to learn to use technology in more creative ways than do policies designed to restrict technology use to only approved activities. Further, policies that frame technology as *the usual business of schooling* rather than a privilege prompts different responses from school leaders when students misbehave with the tools. Ahn et al. (2012) concluded that integration of social media into the regular instruction blurs the line between in-school and out-of-school life and activities and student conduct. They stated, "As technology continues to blur the boundaries of school, policies must incorporate parents and student responsibilities with new media" (p. 9).

Creating Partnerships for Technology Integration

Based on ISTE standards, there is a need for establishing partnerships to provide support for developing strategies, achieving learning priorities, and improving school operations (ISTE, n.d.). The technology leadership objective seeks to influence teachers to enhance the successful integration of technology into their daily instructional practices. Therefore, teachers are expected to be exemplary technology users for the students to

promote the successful integration of technology in schools. However, they face challenges while advancing from the stage of non-user of technology to expert users (Ertmer & Hruskocy, 1999). However, they can overcome such challenges by providing supports for them. That entails partnering with technology experts to support and meet the teachers' needs in the integration process. Partnership with technology experts will provide technology integrating support needed for initiating and maintaining teachers' technology implementation efforts in schools. The provision of an internal support system has been recommended to be critical for enhancing teachers' use of technology in schools. Besides, it is an effective means of sustaining technology integration into schools (Ertmer & Hruskocy, 1999). School technology integration partnership can be achieved in different ways. That includes building external professional partnerships with technology experts, including a university's Department of Education or sponsor such as Gates Foundation. Such supporters can provide educational technology supports with the 21st Century skills for the school leaders and teachers (Ertmer & Hruskocy, 1999; Rivard, 2010).

Standard 5: Connected Learner

According to ISTE (2021) standards, education leaders are to model and promote continuous professional learning for themselves, the teachers, and the students. Based on the standards, education leaders should remain current, participate in professional learning, engage in reflective practices, and navigate change.

Remaining Current

Education leaders are to set the goals toward remaining current concerning advancing technologies for learning and educational advancements. Therefore, educational leaders should remain focused on future achievement. They need to set the goals to develop the best possible teaching and learning structure in the school to improve student outcomes.

Rapidly changing technology is causing leaders to strive to keep up with the latest technology. Educational technology leaders that fail to change and adapt to the current technological advancements will exhibit failures in their leadership roles (Courville, 2011). Hence, education leaders must set the goals to keep abreast of the up-to-date technological advancement and effectively implement 21st Century technology in teaching and learning within their schools. To ensure effective leadership education and training to prepare education leaders and integrate technology into school educational programs, the leadership training needs a program structure with a clear vision of the content relevant to the education leader's situation (Huber & Hiltmann, 2011). Therefore, the transfer of technology learning should be considered as school leaders seek to remain current to lead teachers' learning and ensure a successful transfer of the knowledge to the learners (Orr & Orphanos, 2011). According to Darling-Hammond et al. (2010), other principals' education components should target fostering leadership-oriented learning that focuses on change management and organizational development within the school setting.

Participation in Professional Learning

ISTE (2021) standards recommended the regular participation of education leaders in online professional learning to collaborate and learn from other professionals and mentors. Evidence from research studies has shown that professional learning significantly impacted the integration of technology into daily classroom instructional practices (Chance, 2017).

To take full advantage of technology in transforming learning, there is a need for strong leadership qualities capable of enabling the shared vision of all members within the school community. Such leaders should have a clear understanding of how technology could impact and transform learning. Once the education leader has a clear understanding, they can realize the significance of technology to open new opportunities to move technology-enabled learning (Lemke et al., 2009). With that understanding, the leaders can acknowledge the need for professional training to acquire specific skills and competencies that technology leaders require to establish a technology-enabled learning environment in their schools.

Reflective Practices

The importance of reflective leadership in successfully maintaining organizations' operations and achieving present and future objectives is crucial. The reflective practice of school leadership is a vital factor for achieving success and ensuring sustainability in schools (Ersozlu, 2016). Therefore, using technology to regularly engage in reflective practices that can support education leaders' personal and professional growth is crucial for integrating technology into school (ISTE, 2021). The combination of reflective skills

and technology is beneficial for implementing and integrating technology in schools. Education leaders share their reflections with teachers to improve the teachers' skills and successfully implement technology in their schools (Baporikar, 2016).

Navigating Change

Change management in schools is one of the most tasking assignments for school leadership. Therefore, to successfully lead change, school leaders need to have a clear understanding of the change process. As such, school administrators as school leaders should develop the appropriate skills for leading and navigating change and promoting the goal of continuous improvement of technology-enabled learning (ISTE, 2021). Therefore, school leaders are to create a shared vision with teachers, and the relevant stakeholders inspire teachers to promote the implementation of technology in student learning.

Technology in Education

Technology has transformed every aspect of human life. It has significantly affected daily human living and experiences. The application of computers and mobile devices with the Internet is rapidly increasing and it continues increasing as the accessibility and advancement of technology and its application increase (Anderson, 2016; Anderson & Horrigan, 2016). The rapid technological growth concerning Information Communication Technology (ICT) has led to remarkable changes today, and it is affecting human demands and preferences in this modern society (Bladergroen et al., 2012).

The transformational role of technology in education has significantly impacted classroom teaching and learning, including educational materials and programs. The integration of technology into the education system has transformed teaching and learning. There is increasing progress in technology integration into the school instructional programs to prepare students for the global ICT demanding society and the skills meeting the job market demands (Muro et al., 2017). Besides, technology integration into education is making teaching and learning processes more effective and accessible. It facilitates learning and provides resources for making teaching and learning more effective and convenient. It is bridging the communication gap between teachers and learners, providing the platform for them to connect and communicate, and making education more engaging for educators and students (Hazarika, 2020). Education is not an exception.

Due to the rapid technological advances, there is increasing reliance on technology. Technology is constantly changing within the work environment and the workforce is evolving. Technology is replacing manual labor, but at the same time, it is expanding the workforce capacity globally (Cascio & Montealegre, 2016; Sheninger, 2014). Muro et al. (2017) determined the impact of workforce digitalization on the United States job market; they found that it has pervaded every business, organization, and work environment, and remaking the United States and global workforce market and economy. Based on their findings regarding changes, digitalization has caused in the United States workforce between 2001 and 2006, the average score of digitalization has increased by 57%. That indicated significant impacts of technology in transforming the United States workforce. Therefore, the workforce market has changed because of

increasing the demands for digital skills and qualifications (Sheninger, 2014). Students must be equipped with specific skills, including problem-solving, communication, collaborative, and engaging skills, complying with the current application of technology (Muro et al., 2017; Sheninger, 2014). Therefore, due to increasing demands for the 21st Century digital and technological skills in the workforce market, it has left the education system with no choice other than to equip students with the skills meeting the current workforce skills in the job market. Therefore, the integration of technology into teaching and learning has become a necessity.

Digital Divide - The Impact on Education System

The digital divide gained significant attention in 1995 while the United States National Telecommunications and Information Administration (NTIA) coined the term to describe the unequal access to ICT resources in the United States as the minority groups, including the poor, less educated citizens, senior citizens, were highly disadvantaged (United States Department of Commerce, 1995). Based on NTIA findings three years later, they reported that the digital divide had truly pervaded and persisted in the nation, while the minority groups, including Black and Hispanic Americans, were technologically or digitally lagging behind White students in access to ICT resources in the United States (United States Department of Commerce, 1998). Therefore, NTIA recommended the foundational role of addressing the digital divide and creating increased digital access in the United States by introducing technology into the education system. However, the United States Department of Education (2017) reported that the digital divide was growing through the education reform policies over the past 20 years

and outlined the plan to address the situation. Furthermore, the United States Department of Commerce identified education as a potent tool to address the growing digital divide and recommended the need for providing equitable access to ICT resources for all students. That led to the policy promoting the need for education technology in all schools. Based on the policy, all teachers in the United States should be trained and supported with the resources they need to assist their students to use computers and ICT resources. Also, all teachers and students should be provided with access to modern ICT tools and resources in their classrooms to support a technologically enriched learning environment.

Therefore, National Education Technology Plan (NETP) outlined the steps for meeting the goals of providing a technologically enriched and supportive learning environment in schools (United States Department of Education, 1996). Based on the United States Department of Education's update, NETP began focusing on the education digital divide and the measures educators need to adapt to address it and ensure that every student develops the required digital skills to succeed in the 21st Century's digital age (United States Department of Education, 2017).

According to Delgado et al. (2015), students can only benefit from technology integration to increase their academic performance if they have access to the required 21st Century digital tools and resources. Therefore, based on the United States Department of Education (2017) recommendation, school leaders are required to address the digital divide by adopting the measures to address inequity in technology access by ensuring that every student has access to education technology meeting federal and state standards.

Educational Leadership

One of the crucial qualities of school leaders is to enable education to focus on preparing students for globally connected societal demands while addressing the education system inequities that can contribute to the digital divide (Vermeulen et al., 2017). For school leaders to achieve that, they must be prepared to lead the change in their schools. Fessehatsion (2017) examined the school principal's role to facilitate teaching-learning process change in schools. Findings from the research study indicated that school administrators were striving to facilitate change by their leadership styles through their roles as mobilizers, supervisors, and enhancers of school-based development and training programs and creating appropriate channels for communication. Education Development Trust (2016) reported that school leaders can effectively lead the change in their schools by developing the leadership style for motivating the teachers and enhancing their commitment. Also, based on the evidence from a research study regarding school leadership in establishing positive education in school staff, Morris et al. (2019) found that principals' leadership style was pivotal in ensuring staff cultural change by increasing the staff morale and commitment to effect the needed change in the school. Leithwood and Jantzi (2006) identified the critical role of principals to facilitate the implement change initiatives in school instructional programs.

Principal Technology Leadership

Literature has indicated the crucial role of school leaders in facilitating change and successfully implementing initiatives in schools (Education Development Trust,

2016; Leithwood & Jantzi, 2006; Morris et al., 2019). Also, it has been found that effective school leadership is essential to support the implementation of technology initiatives in schools. Through their leadership role as change leaders, they have the potential for creating a technology-rich learning environment to enhance student learning (Covington, 2012; Richardson et al., 2015). A research study was conducted to examine the influence of school principals' technology competencies on their transformational function to implement ICT in schools. Findings indicated levels of the school leaders' technology competencies influenced their transformational capability to implement ICT in their schools (Mojgan et al., 2021). Similar findings were reported by Hadjithoma-Garstka (2011) that school leaders need both leadership styles and basic computer skill training to implement technology in their schools. Therefore, school administrators must have effective leadership skills with the technological skills to lead and implement technology integration meeting the United States Department of Education's goals for NETP (United States Department of Education, 2017; Vanderlinde et al., 2010).

NETP school administrators identified principal technology leadership as a crucial factor to integrate educational technology in schools. According to the school administrators, students' engagement and learning experiences should be empowered by leveraging technology in teaching while school leaders create the culture and conditions to implement innovative technology initiatives and change in their schools. Also, the principle states that infrastructures should be provided in schools for all educators and students to have access to and effectively use education technology in schools. Hence, school administrators are to lead systemic changes in learning and teaching by creating the shared vision of the integration of technology and translating the vision into actions in

schools to meet the educational technology needs for teachers and learners (United States Department of Education, 2017).

Summary

This chapter reviewed the literature concerning leadership standards. The review included the evolution of leadership standards, comprehensive discussion on the technology leadership standards and ISTE-based education leaders' standards, digital divide, leadership in education, and school administrators' technology leadership. The leadership standards in education kept evolving with several modifications and updates over time. The leadership standards started with ISSLC standards that contained a set of standards that school leaders were required to meet. Through a series of amendments and updating, ISSLC evolved into PSEL. Later, in 2001, ISTE formulated TF/TL standards and later adopted TSSA standards, and that led to the development of NETS-A standards. The most recent ISTE standards contained five tenets: Equity and Citizenship, Visionary Planner, Empowering Leader, Systems Designer, and Connected Learner. The standards describe the conceptual framework for integrating educational technology in schools in which education leaders were identified as key initiators and implementers. Further review of the literature included the role of technology in education and the impact of the digital divide. Based on the findings from the review, school leaders were identified as the key influencer of education technology. Also, their crucial roles to address the digital divide and ensure students' equal access to technology were identified. Furthermore, the literature reviewed identified the education leadership role to lead the change and motivate teachers and facilitate the implementation of change initiatives in schools.

Finally, school administrators' leadership role was identified as essential for creating a technology-rich learning environment for enhancing teaching and improving student engagement and learning through the implementation of technology in schools. Based on the findings from the review, school administrators' technology competencies have significant influence on their transformational role to implement education technology in schools. The findings support the NETP school administrators that school administrators' technology leadership is crucial for integrating educational technology in schools.

CHAPTER 3

METHODOLOGY

In this chapter, I present the methodology used in the study. The recent advancement in education involves the introduction of technology into daily teaching and learning in today's schools. Technology is revolutionizing the educational context, impacting how teachers teach, how students learn, and how leaders lead. Several researchers have explored the perceptions of school leaders in technology leadership (Beytekin, 2014; Gallogray, 2015; Sauers et al., 2014). In this study, I used quantitative research methods to investigate the role of school administrators (i.e., school principals and assistant principals) as technology leaders in an academic setting. I closely emulated research conducted by Schoenbart (2019). I used a quantitative approach based on the purpose of the study. The quantitative approach is adopted to determine school administrator perceptions of their own technology leadership and analyze how those perceptions influence their performances as technology leaders in schools. This study also identified the challenges school administrators face while implementing 21st Century learning tools and technological advances.

Statement of the Problem

Advancement in technology is rapidly changing the world. It is dynamically revolutionizing every sector in society, including the educational sector. Internet connectivity has enabled communication networks to turn the world into a global village.

Therefore, technological advancement has led to a society where digital and computer skills are a prerequisite for workforce success. The lack of digital skills contributes to workforce failures, exacerbating equity issues (Graves, 2019, Ragnedda & Ruiu, 2018). That implies schools need to adopt current technological advancements that will engage students in technologically embedded learning opportunities by integrating 21st Century skills into teaching and learning systems and curriculum development in schools (Berger & Frey, 2017; United States Department of Education, 2017).

There is a need to equip students with digital technology skills equivalent to the current workforce qualification demands. School administrators are in a pivotal position to ensure that needed technology is implemented to provide the quality of education and development of student digital capacity to meet 21st Century workforce demands. School administrators must monitor and evaluate their technology programs. Researchers have indicated the significant impacts of teacher technology behaviors on integrating technology in schools. However, there is a paucity of empirical information regarding the impact of school administrator technology leadership behaviors on integrating technology in schools (Graves, 2019; Schoenbart, 2019). Principal and assistant principal knowledge and understanding regarding their roles and responsibilities as technology leaders are crucial. Schoenbart (2019) developed a measure of principal technology leadership behavior, the Education Leaders Technology Survey (ELTS), to explore principal technology leadership behaviors to understand their perceptions as technology leaders. I used the ELTS in this study to do the same for Alabama school principals.

Purpose of the Study

This study aimed to explore school administrator technology leadership perceptions to identify their technology leadership behaviors based on self-reported information in schools in the Alabama. Also, in this study I identified differences in the school administrator self-reported technology leadership behaviors across various principal and school demographics. Technology leadership, as defined in this study, is based on Schoenbart's (2019) definition of leadership behaviors of school administrators aligning with the 2018 International Society for Technology in Education Standards for Education Leaders (ISTE-EL) standards, which support effective technology integration into schools.

In the template research study, Schoenbart (2019) aligned each item of ELTS to specific leadership behaviors identified by the 2018 ISTE-EL. Based on ISTE-EL standards, technology leadership standards are divided into five categories. The five categories, or standards, require the school administrator to be (a) an equity and citizenship advocate, (b) a visionary planner, (c) an empowering leader, (d) a system designer, and (e) a connected learner (ISTE, 2021). Because data collection was conducted using the ELTS, the initial study purpose entailed assessing internal reliability of the ELTS tool for educational technology research with this specific sample, following the guidelines of 2018 ISTE-EL and the model provided by Schoenbart.

Research Approach

For this study, I used a non-experimental, quantitative, inferential approach and comparative analysis to investigate the research questions. Since this study involved

comparing groups of participants currently serving as school administrators, I used a cross-sectional, research design. That necessitated assigning participants (i.e., school principals and assistant principals) and their respective schools as study groups. I determined the relationships between the variables identified in the research questions and added the knowledge of the quantitative study of principal leadership behaviors (Creswell & Creswell, 2018; Schoenbart, 2019). Based on this non-experimental approach, I did not assign participants into groups, nor did I use a control group or an intervention group. Participants included school principals and assistant principals in a study of their own self-perceptions of their leadership technology behaviors.

Conceptual Framework

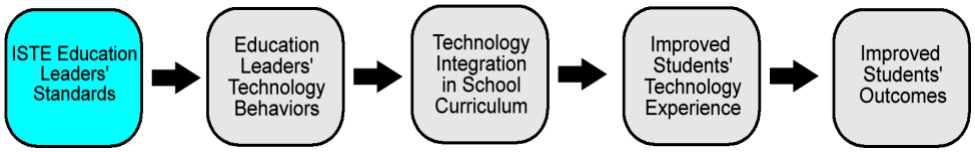
Technological advancement dynamics are rapidly changing (Muro et al., 2017). The same rapid advancement is revolutionizing the educational setting and calling for technological updates in schools. Since school leaders hold the crucial position of enacting change in the school system, their roles and responsibilities as technology leaders are significant. Therefore, they hold a pivotal position to promote and enable the implementation of technology in their various schools. To prepare and engage students in the current technological society, the school administrator must adopt the technological development and be ready to implement the required changes, according to 21st Century technological skills, into the school curriculum and instructional programs (Richardson et al., 2015). Researchers have shown that the practice of effective leadership significantly contributes to the success of implementing school restructuring initiatives and enhances student outcomes (Day et al., 2016; Schoenbart, 2019). Hence, the leadership

philosophical concept, based on their pivotal roles of initiating change in education, offers a paradigm for restructuring the educational system.

The ISTE-EL contains well-recognized professional standards for establishing the framework for technology leadership research. The ISTE has an education leader section supporting the implementation of ISTE standards for educators and students. More importantly, the standards offer a framework to guide digital-age learning. The ISTE education leader section focuses on school leader behaviors and knowledge in empowering teachers and enhancing student learning. Therefore, a comprehensive understanding of the ISTE-EL-based technology leadership framework will contribute to the success of implementing technological instructional programs in schools (Graves & Bowers, 2018; Schoenbart, 2019). That forms the basis of the philosophical paradigm for conducting this research study. This paradigm was used to develop the conceptual framework for conducting this study (See Figure 1).

Figure 1

Conceptual Paradigm-based Framework



Note. Philosophical paradigm-based framework that identifies how school administrator technology leadership behaviors will impact technology integration in schools and improve student digital technology experiences and outcomes.

This philosophical paradigm is based on the concept that ISTE education leader standards are related to school principal technology leadership behaviors as the standards target school leader behaviors and knowledge to empower teachers through the integration of technology into the school instructional program and curriculum. The change in principal knowledge and behavior will initiate pedagogical shifts in teaching and learning that will contribute to a successful implementation of technology initiatives in schools. The initial implementation will change teacher behavior, which will, in turn, positively impact student technology experiences and learning outcomes. This approach and paradigm is noted in the literature (Day et al., 2016). According to researchers, principals in the present digital age should encourage digital teaching and learning transformation by creating a sustainable digital culture and leading the successful integration of technology initiatives in schools to improve student digital skills and experiences (Graves, 2019; Zhong, 2017).

Research Questions

This research study addressed the following research questions:

1. What are the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?
2. To what extent are school principals demonstrating technology leadership behaviors?
3. To what extent do principal technology leadership behaviors differ across demographic groups of gender identity, age, and experience?

4. To what extent do principal technology leadership behaviors differ across the school demographic groups of school type, size, community technology access, socioeconomic status, and location?

Sampling

Since the research design was non-experimental, a non-random sampling approach was used. This involved convenience sampling based on the current and easily accessible group of participants. Though the convenience sampling approach limits generalizability of research findings, it was an appropriate and effective sampling approach for this study because I adopted the recently developed ELTS for data collection (Schoenbart, 2019).

Participants in the sample included principals of K-12 schools in Alabama. The participants were currently active principals and assistant principals in elementary, middle, and high schools. The schools represented by these school administrators enroll students from diverse racial, ethnic, and socioeconomic backgrounds. I selected the participants in the study due to the convenience in obtaining contact information (i.e., email addresses) and other required information for the study. Email addresses were obtained with help from the CLAS directory, as described above. Institutional Review Board (IRB) approval was obtained from the appropriate agency (See Appendix C). After obtaining IRB approval, additional approval to conduct the study in the school settings was obtained from the appropriate, individual school district superintendents or delegees.

Instrumentation

Surveys to measure school administrator technology skills and behaviors have developed over time. The Education Leaders Technology Survey (ELTS) was the first survey instrument developed to measure principal technology behaviors. In its first iteration, the ELTS was based on the Principals Technology Leadership Assessment (PTLA), in 2005 (Macleod, 2017). Zhong (2017) recommended the need for an up-to-date instrument to assess technology leadership behaviors compared to updated standards and indicators. In response, Schoenbart (2019) developed an updated version of the ELTS to assess the technology leadership behavior of school leaders. The updated survey asks respondents to answer questions built around each of the five tenants of the ISTE-EL standards described previously in this report. The ELTS contains 45 survey questions developed to measure recent school principal technology leadership behaviors. Each question is designed as a five-point, Likert-type scale with response options including, 1 = *Not at all*; 2 = *Minimally*; 3 = *Somewhat*; 4 = *Significantly*; and 5 = *Fully* (Schoenbart, 2019). Schoenbart reported on findings relative to the acceptable levels of reliability and validity of ELTS for assessing the recent ISTE principal technology leadership behaviors.

According to a recent study, the use of the ELTS for a quantitative study has been replicated in a smaller setting, but not statewide. Gerald (2020) conducted a quantitative study using Schoenbart's ELTS survey; however, the study focused only on one school district in Virginia with 23/39 principals reporting.

Due to the nascent status of the ELTS development, the fact that it is based explicitly on the 2018 ISTE-EL standards, and given the acceptability of survey reliability and validity measures, I determined the ELTS to be an appropriate instrument

to use for this study. For this study, each participant was asked to complete an online version of the ELTS, created using Qualtrics, to measure the technology leadership behaviors of school principals. A copy of the entire survey is presented in Appendix A.

Data Collection

Data for this research study were collected using the online ELTS questionnaire adapted by Schoenbart (2019). The survey was sent via email to school principals and assistant principals using emails obtained from the Alabama CLAS directory.

Data Analysis

Data collected in this study were analyzed using descriptive and comparative or inferential data analysis. The data were analyzed using SPSS software.

Research Questions 1 and 2

Research Question 1 asks: What are the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?

Research Question 2 asks: To what extent are school administrators demonstrating technology leadership behaviors?

I used quantitative descriptive data analysis to address the first two research questions, and to determine the technology leadership behaviors of respondents. I summarized participant technology leadership behavior for each of the ISTE-EL standards and determined the overall scores of participant technology leadership based on data aggregated for each of the standards. Hence, the analysis included descriptive

statistics, including frequencies, mean, and standard deviation, skewness, and kurtosis analyses for each of the survey items.

Research Questions 3 and 4

Research Question 3 asks: To what extent do principal technology leadership behaviors differ across demographic groups of gender identity, age, and experience?

Research Question 4 asks: To what extent do principal technology leadership behaviors differ across demographic groups of school type, size, community technology access, socioeconomic status, and location?

I used comparative or inferential data analysis to address these questions. The quantitative data analysis was used to assess whether there are statistically significant differences between principal technological behaviors based on demographic characteristics of the respondent (Question 3) and then based upon demographic characteristics of their school (Question 4). In the comparative data analysis, frequency data were generated for the school administrator and school demographic characteristics, including each item of ELTS. Furthermore, a *t*-test and one-way analysis of variance (ANOVA) were conducted to determine differences between the principal and school demographics.

Verification Procedures

Verification procedures in this research study involved selecting an updated and previously validated survey instrument to establish the trustworthiness of the data, the focus for addressing Research Question 1; that is to analyze the internal reliability of the

survey items (Mahajan, 2017). Following Schoenbart's (2019) validation approach, Cronbach's alpha test (Cronbach, 1951), using Qualtrics software, was used for determining the ELTS internal validity based on the data that were collected. The analysis was conducted concerning ISTE-EL standards (Appendix B). Creswell and Creswell (2018) showed that quantification of internal validity of a survey item scale can be quantified using a Cronbach's alpha (α) value ranging from 0 to 1, while the optimal value ranges from 0.7 to 0.9. This standard was used in this research study to confirm the internal validity of ELTS for measuring principal technology leadership behaviors.

In updating the ELTS, Schoenbart (2019) shared the feedback obtained during pilot testing with two educational leaders for feedback. That led to the first revision of the instrument. Following that, Schoenbart (2019) shared the survey with education leaders on social media to garner their feedback and to further clarify the survey items and questions, and the definition of terms. Furthermore, Schoenbart (2019) used triangulation of interview results to assess the face validity of the ELTS to determine whether there would be high-level agreement from the interview participants. For the current study, validation of the ELTS, which includes the assessment of the internal reliability, was conducted by trusting the face validity of the study of Schoenbart (2019).

Ethical Considerations

Ethical issues are crucial considerations in a research study related to the researcher and the subject. That is related to the conduct of a research study involving humans as participants and to avoid the associated concerns collecting informed consent from the participants before the onset of the research study is well-recognized (Yip et al.,

2016). This research study did not pose any potential harm to participants. Nevertheless, collecting informed consent from them is a way of safeguarding potential legal issues that may arise from using the participants' personal information. Therefore, after approval, school administrators were provided an informed consent form attached to the ELTS, which will be sent via email. The consent form described details and purpose of this research study. Forms were gathered and retained to provide evidence of respondent voluntary participation in the study. Only results from school administrators that provided signed, informed consent were included in the study.

Conclusion

The issues explored in this study involved school administrator perceptions of their role as technology leaders in schools. This constituted the purpose of this research study. To explore the gaps in school administrator technology leadership behaviors, ELTS was used to collect data based on the standard of 2018 ISTE-EL replicating the research methods of Schoenbart (2019). The research approach used for this study was quantitative. The research design was based on the philosophical paradigm underlying the concept that ISTE education leader standards are related to school administrator technology leadership behaviors in structural initiatives that empower teachers and students with up-to-date digital skills in education, and that lead to improved student technology experiences and outcomes. Hence, this research study involved a quantitative approach to address the research questions. These research questions are regarding (a) the internal reliability of the ELTS instrument, (b) the extent to which participants perceived themselves as demonstrating technology leadership behaviors, and (c) statistical

differences between their demonstration of technological leadership behaviors across respondent and school demographic characteristics. In the next chapter, I present the findings from the study.

CHAPTER 4

STUDY FINDINGS

The purpose of the current study was to investigate school administrator self-perceptions of their technology leadership. It is an increasing expectation that technology be integrated into the classroom setting, both in terms of the way teachers incorporate it into their lessons and the way in which students are taught to apply it to their assessment. The use of technology was also exponentially increased as a direct result of COVID-19, and the launch of distance learning as an alternative means of instruction (Stone, 2020). In spite of this growing significance of technology in the field of education and the relationship between building leadership, the application of technology has not been closely examined in the existing body of literature (McLeod et al., 2011; Zhong, 2017). This study applied a quantitative research approach to collect Likert-based data. Specifically, I used a survey, the ELTS, recently updated by Schoenbart (2019). This study provides an overview of how school administrators view their leadership role as it relates to technology.

This chapter provides an overview of study findings directly addressing the research questions. These questions are as follows:

1. What are the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?

2. To what extent are school administrators demonstrating technology leadership behaviors?

3. To what extent do school administrator technology leadership behaviors differ across demographic groups of gender identity, age, and experience?

4. To what extent do school administrator technology leadership behaviors differ across demographic groups of school type, size, community technology access, socioeconomic status, and location?

The previous chapter provided an overview of the research methodology for the study and outlined both the data collection and analysis procedures. This chapter provided specific details regarding the quantitative data collected, summarizes the data, provides specific findings aligned with that data, and provides results-based evidence related to each research question.

Summary of Setting and Data Collection Procedures

In this investigation of school administrator technology leadership, a sample was taken of administrators from a variety of public school locations across Alabama. School administrators working in the roles of principal or assistant principal at the elementary, middle and high school levels were included in the study. School administrators were contacted by email. Email addresses were obtained from the CLAS directory.

There were 1,745 potential participants eligible to respond to the survey. Of these, 140 responded and volunteered to participate, resulting in an 8.02% response rate. This is representative, according to Peng et al. (2006) who concluded that it is common for educational research to yield a response rate of less than 10%. Further, evidence suggests that online survey response rates are lower than traditional forms of survey collection, like in-person surveys (Pew, n.d.). In the case of the current study, the target was a

minimum of 180 participants and the response rate was close to this minimum. Therefore, the results are deemed effective in terms of provision of data.

Findings

The data for the study were collected and analyzed quantitatively, using statistical measures. I analyzed the data collected using both descriptive statistics and more specific measures. Such measures included Cronbach's alpha (Cronbach, 1951) to check for internal consistency of the scale and analyses of variance (ANOVA) to determine the perception of school administrators as they relate to technology leadership. Findings were based on demographic groups, including information regarding the school administrators themselves and the school buildings that they lead.

ELTS Data Results

ELTS is made up of 45 Likert-based questions, arranged by theme, within the survey (See Appendix A for a copy of the complete ELTS). These items are primarily related to the application of technology leadership. Additionally, it contains 10 demographic items, intended to provide insight into the demographic makeup of the sample and to ensure that the sample is representative of the larger population. The demographic questions gathered data related to participant attributes and school setting related characteristics. Participant demographics collected included gender, age, and professional experience. School-setting related demographics include school type, size, access to technology, socioeconomics, and school location. As mentioned, 140 school administrators from across the state of Alabama completed the ELTS. Respondents were

nearly evenly split in gender, with slightly more female participants. The median age was between 40 and 49. The median experience in education for participants was 21 to 25 years, while the median years serving as an administrator was four to nine years. According to the educator demographics from the Alabama State Department of Education report card, these are all consistent with the larger population of administrators in Alabama and in the United States as a whole (ALSDE, 2021).

A majority (85.7%) of participants reported complete access to technology within the local communities, selecting full access. In contrast, only 13.2% responded that their communities *somewhat* have access to technology. No respondents described their communities as being high-need or having little to no access.

Approximately 42% of respondents reported that the in-school population that they work with is high need regarding socioeconomic status. Low needs districts made up only 15.7% of the respondent schools. Table 1 presents the frequencies for the participant administrator individual demographics and Table 2 presents the frequencies of school demographics.

Results Addressing Research Question 1

To determine the internal consistency of the ELTS survey, I conducted Cronbach's alpha (Cronbach, 1951) test in SPSS for all domains related to each of the five ISTE-EL Standards, or targeted survey subsections. These standards include the following: (a) equality and citizenship advocacy, (b) visionary planning, (c) empowering leadership, (d) system design, and (e) connected learning (ISTE, 2018b). The standards included a total of 22 indicators, made up of 45 unique survey items presented in the form of Likert-based questions. Cronbach's alpha was needed to test the internal

reliability because it is critical to determine whether the items on the survey are measuring the same thing, in a consistent and valid way. The results of the Cronbach's alpha for each standard are presented in Table 3 below.

Table 1

Participant Demographic Characteristic Results

Characteristic	Number and Percent of Respondents
Gender	
Male	61 (43.6%)
Female	78 (55.7%)
Prefer not to respond	1 (.7%)
Age	
30-39	19 (13.6%)
40-49	64 (45.7%)
50-59	52 (37.1%)
60+	5 (3.6%)
Years in Education	
< 10 years	1 (.7%)
11-15 years	14 (10%)
16-20 years	42 (30%)
21-25 years	41 (29.3%)
26-30 years	25 (17.9%)
31-35 years	13 (9.3%)
36-40 years	4 (2.9%)
Years as Administrator	
1-3 years	31 (22.1%)
4-9 years	41 (29.3%)
10-14 years	31 (22.1%)
15-19 years	25 (17.9%)
20-24 years	10 (7.1 %)
25-29 years	2 (1.4 %)
Administrative Role	
Principal	120 (85.7%)
Assistant Principal	20 (14.3%)
Years in Current Position	
1-4 years	83 (59.3%)
5-9 years	39 (27.9%)
10-14 years	10 (7.1%)
15-19 years	6 (4.3%)
20-24 years	2 (1.4 %)

Table 2

School Demographic Characteristic Results

Characteristic	Number and Percent of Respondents
Type of School Setting	
Elementary School	50 (35.7%)
Middle School	44 (31.4%)
High School	46 (32.9%)
School Size	
<150 students	2 (1.4%)
151-249 students	9 (6.4%)
250-499 students	44 (31.4%)
500-749 students	40 (28.6%)
750-999 students	22 (15.7%)
1000-1249 students	14 (10%)
1250-1499 students	4 (2.9%)
More than 1500 students	5 (3.6%)
Community Access to Technology	
Fully	120 (85.7 %)
Somewhat	20 (14.3%)
No/None	0 (0%)
Socioeconomic Status	
Low need	22 (14.3%)
Moderate Need	59 (42.1%)
High Need	59 (42.1%)

The overall findings indicate that there is a high level of internal reliability for all subscales (George & Mallery, 2016). This shows that the survey items are well aligned with the ISTE-EL standards, and that they effectively represent a consistent way to test responses related to those standards or sub-scales. When calculating the internal reliability, certain questions were removed because they are concerned with future, and not current behavior. These included questions 9, 20, 31, 39, and 45, all of which ask for

future opportunities regarding technology leadership, and not on the measured behaviors themselves. The ELTS has a high degree of internal reliability, based on these results, and so should be considered a reliable tool for the measurement of technology leadership behaviors within the current sample.

Table 3

Internal Reliability Scale for ELTS

ISTE-EL Area	ELTS Items	Cronbach's Alpha	Level of Reliability
Equality and Citizenship Advocate	1-8	.84	Good
Visionary Planner	10-19	.94	Excellent
Empowering Leader	21-30	.89	Excellent
System Designer	32-38	.91	Excellent
Connected Learner	40-44	.86	Good

Results Addressing Research Question 2

To determine the extent to which administrators are demonstrating active technology leadership and related behaviors, I used multiple indices to analyze individual measures of technology leadership relative to the subscales within the ELTS. Like the measure for internal reliability, questions related to future behavior or opportunity for behavior were removed from calculation because they do not relate to the demonstration or realization of current technology leadership behaviors. In addition to calculating individual indices for the subscale, I obtained a single measure across the 40 subscales for the concept of technology leadership. This included data from all indices. Last, I created an index to measure opportunity or the realization of future potential which was comprised of previously removed items (i.e., items 9, 20, 31, 39 and 45). The resulting descriptive statistics are displayed in Table 4. These data illustrate that the majority of

school administrators who participated in the ELTS perceive themselves to be fulfilling the technology leadership role within their school as identified by the subscales or ISTE-EL standards. Respondents had a corresponding leadership index of 3.66 or higher. The standard deviation, skewness, and kurtosis all fell within the expected and acceptable range for the measure (Pallant, 2016).

Table 4

ELTS Descriptive Statistics

Index	Mean	SD	Skewness and SE		Kurtosis and SE	
Tech. Ldrshp	3.66	.58	-5.15	.21	.665	.41
Standard 1	3.99	.62	-1.32	.21	4.55	.41
Standard 2	3.44	.75	-.7.55	.21	.937	.41
Standard 3	3.75	.65	-5.81	.21	1.11	.41
Standard 4	3.37	.84	-.27	.21	-.216	.41
Standard 5	3.76	.69	-.45	.21	-.042	.41
Opportunity	3.61	.71	-.75	.21	1.42	.41

The respective indices for features of technology leadership range in mean value from 3.37 to 3.99, falling between the value of somewhat significant and significant on the ELTS Likert-based scale with categorical equivalence. This indicates that the school administrators in question report a generally positive, confirmatory stance as it relates to the technology leadership they have provided in their building. In other words, participants consistently felt that they were providing some level of technology leadership in their school settings. However, the analysis of individual indices shows that administrators do not feel confident or did not report that they were acting fully as

technology leaders across all areas or in any single area. Rather, they reported that they are only partially fulfilling that role.

Participants reported the highest level of proficiency in response to the first subscale which is ISTE-EL Standard 1: Equity and Citizenship Advocate. This had a mean value of 3.99 which is significant as a descriptor of outcome. This standard is designed to measure the way in which the administrator ensures that students have access to highly qualified teachers, access to technology, consistent connectivity, and the modeling of good digital citizenship.

In contrast, the area with the lowest mean response was related to Standard 4, with a mean value of 3.37. This addresses the administrator's role in technology leadership as it relates to the creation of infrastructure or ensuring the availability of resources and the establishment of partnerships that meet school district technological needs. In this area, the findings indicate that administrators are *somewhat* fulfilling the role outlined in the ISTE-EL standard.

This also relates to opportunity. The overall index indicated a mean of 3.66 which falls within the *somewhat* scale response for school administrators' ability to fill the role of technology leadership in their schools. Correspondingly, the opportunity index had a mean score of 3.66. This indicates that administrators feel that they are consistently only *somewhat* able to realize their overall goals as technology leaders, or that they are limited by factors other than their own leadership. It also indicates that they feel they are maximizing opportunities they are given, or feel that their performance and ability to lead aligns with the level of resources they have to fulfill the standards outlined by the ISTE-EL.

Results Addressing Research Question 3

Research Question 3 asked: To what extent do school administrator technology leadership behaviors differ across demographic groups of gender identity, age, and experience?

To determine the extent to which school administrator technology leadership behaviors differed across various demographic considerations, multiple one-way analyses of variance (ANOVA) were carried out. Specifically, individual ANOVAs were calculated to determine what differences in the overall level of agreement occur within the technology leadership index, based on demographic variables. There is a statistically significant relationship between overall reported level of technological leadership and the number of years that an administrator has been in their current position ($p = .049$). No statistically significant relationships were found between technology leadership and the other demographics measured via the ANOVA or post hoc testing of the relationship between demographics and the overall index. The specific outcomes are demonstrated in the table below

Table 4

Descriptive Statistics and Results of ANOVA Testing of School Variables, in Relation to Technology Leadership

Demographic	Mean	SD	F	Degrees of Freedom	P-value	Effect Size
Gender	1.57	.54	.78	2	.46	.01
Age	3.31	.75	2.08	3	.11	.04
School Role/Job Title	1.26	.44	3.13	1	.08	.02
Years Working in Education	3.93	1.26	.40	6	.88	.02
Years as an Administrator	2.63	1.28	.75	5	.59	.03
Years in Current position / role	1.61	.90	2.45	4	.05	.07

Results Addressing Research Question 4

Research Question 4 asked: To what extent do school administrators' technology leadership behaviors differ across the school demographic groups of school type, size, community technology access, socioeconomic status, and location?

To determine the extent to which school administrator technology leadership behaviors differed across various school related demographic considerations, multiple one-way analyses of variance (ANOVA) were carried out. Specifically, individual ANOVAs were calculated to determine what differences in the overall level of agreement occur within the technology leadership index based on demographic variables. No statistically significant relationships were found between technology leadership and the other environmental or school related demographics measured, via the ANOVA or post hoc testing of the relationship between demographics and the overall index. The results of the ANOVA testing, when compared to the technology leadership index, are located in the table below.

Table 5

Descriptive Statistics and Results of ANOVA Testing of School Variables, in Relation to Technology Leadership

Demographic	Mean	SD	F	Degrees of Freedom	P-value	Effect Size
School Type	2.74	1.74	.08	2	.92	.00
Size of Student Body/Enrollment	4.10	1.45	.69	7	.69	.04
Access to Technology	2.86	.35	1.30	1	.26	.01
Socioeconomic level	1.74	.72	.40	2	.67	.01

Summary

In this chapter, I provided an overview of the findings, and specifically statistical data analysis for the current study. The quantitative study addressed the following research questions:

1. What is the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?
2. To what extent are school administrators demonstrating technology leadership behaviors?
3. To what extent do school administrators' technology leadership behaviors differ across demographic groups of gender identity, age, and experience?
4. To what extent do school administrators' technology leadership behaviors differ across the school demographic groups of school type, size, community technology access, socioeconomic status, and location?

The chapter first provided an overview of the setting and data collection procedures as it provides context for the results. Then, the statistical findings were

presented, beginning with a more specific overview of the participants and their demographic features. This was followed by descriptive statistics that provide a measure of the outcomes. Tables 1-4 demonstrate patterns in the data and present comprehensive findings throughout the chapter. Findings were solely related to the collection and analysis of Likert-based data from the ELTS. Based on this foundation, the next chapter, Chapter 5, will offer a discussion of the significance of the results for this study and their implications and limitations. This will include consideration of how this may influence future research. Finally, specific recommendations will be made for school administrators, as it relates to practical application of the findings.

CHAPTER 5

DISCUSSION OF RESEARCH FINDINGS

The purpose of this quantitative study was to measure school administrator work behaviors and related perceptions of their role as technology leaders in the school setting. Administrators are key to the success of students and teachers in the school environment and have significant power to alter the school environment. Technology leadership is increasingly important as technological tools play a greater role in education and society in general. However, technology leadership, as it relates to education and to academic administration, are relatively new concepts. Therefore, it has not been sufficiently studied. The research applied the previously constructed instrument, the ELTS, to measure school administrator perceptions of their own technology leadership and the way in which their behaviors actively align with the ISTE-EL Standards. This study was guided by the following research questions:

1. What are the internal reliability of the Education Leaders Technology Survey (ELTS) instrument?
2. To what extent are school administrators demonstrating technology leadership behaviors?
3. To what extent do school administrators' technology leadership behaviors differ across demographic groups of gender identity, age, and experience?

4. To what extent do principal technology leadership behaviors differ across the school demographic groups of school type, size, community technology access, socioeconomic status, and location?

Throughout this chapter, I draw conclusions related to the research, and provide a comprehensive discussion of the findings, organized according to the previously listed research questions. After identifying limitations of the study, the implications of the findings and recommendations for practical application, future studies are discussed.

Discussion

In this chapter, I provide an overview of quantitative findings of the current study. Based on these findings, the research questions are discussed to determine how they are directly addressed by the findings, and what implications that has on the total body of research.

Discussion of Research Question 1

The ELTS was developed by Schoenbart (2019) to provide a meaningful measure of school administrator perceptions of their own technology-related behaviors and leadership as compared to ISTE-EL Standards (2018). Based on survey results, I confirmed the internal reliability by conducting Cronbach's alpha test (Cronbach, 1951) using SPSS for each of the ISTE-EL subscales. The analysis established internal consistency for the scale for this study, previously demonstrated in Schoenbart's (2019) work and showed the ELTS to have a high level of internal reliability, both overall, and as it relates to the subscales within the tool.

Discussion of Research Question 2

In this study, I administered the ELTS to measure school administrator responses related to their own (self-reported) demonstration of technology leadership behavior. The ELTS contains multiple indices, or sub-scales, to measure the ways in which they exhibit technology leadership. Additionally, survey results provide a view of technology leadership overall. Finally, I calculated an opportunity index as it relates to future opportunity or potential. These indices showed that most respondents felt that they were only *somewhat* effective as technology leaders, or in fulfilling the ISTE-EL standards. No index indicated that school administrators were fully acting as technology leaders.

Respondents were strongest or *nearly always effective* as it relates to Standard 1 which focuses on the theme of equity and citizenship advocacy. By comparison, the lowest self-reported indices were Standard 4, System Designer, which relates to the ability to develop the necessary infrastructure for technology leadership. From these results I conclude that school administrators who responded to the survey perceive themselves to be moderately effective at providing technology leadership across all areas measured, both individually and cumulatively.

It is also of interest to note that in terms of statistical measure of response, the school administrators perceived themselves to have equal levels of opportunity for and realization of technological leadership in schools. This indicates that, in addition to their general agreement on action taken as technology leaders, respondents reported that they are maximizing the realization of opportunity.

Discussion of Research Question 3

The ELTS tool has the benefit or providing a significant focus on, and multiple measures of, leadership demographics including gender, age, and professional experience. To determine whether there was a statistically significant relationship between technology leadership and various demographic variables, I computed one-way analysis of variance (ANOVA) testing as it relates to the overall index for technology leadership and each of the related demographics. Gender, age, and years of educational professional experience were not found to have a statistically significant relationships to technology leadership. In contrast, the number of current years in the same administrative role was found to have a statistically significant relationship. This may indicate that administrators become more effective as technological leaders as they gain experience in an administrative role, but do not show a similar benefit from years of classroom experience.

Discussion of Research Question 4

The ELTS tool has the benefit of providing a significant focus on, and multiple measures of, leadership demographics including school size, school type, community access to technology, and socioeconomic status or level of need. To determine whether there was a statistically significant relationship between technology leadership and various environmental demographic variables, I computed one-way analysis of variance (ANOVA) testing as it relates to the overall index for technology leadership and each of the related demographics. School size, school type, community technology access, and

socioeconomic status or level of need, were not found to have a statistically significant relationship to technology leadership.

Conclusions and Implications

The previous section outlined the specific findings as they relate to the individual research questions which were developed to guide the study. These findings, and more significantly their discussion, have practical implications related to the ways the school administrators engage in technology leadership, as well as the need for further development of research on technology leadership in schools. This section of the chapter will provide a review of these more specific implications and their connection to the larger body of research that exists as they relate to or align with each research question.

Implications Related to Research Question 1

Research question 1 questioned the validity of the instrument used, the ELTS. This is significant because it allowed me to check the face and internal validity of the ELTS to ensure that the tool remains relevant over time and within the current population of interest. This is important due to the fact that I applied or administered the survey in a slightly different population and setting than the original survey that was used by Schoenbart (2019). The findings supported the continued use of the ELTS which was found to demonstrate internal reliability via the statistical analysis of Cronbach's alpha (Cronbach, 1951).

Schoenbart's (2019) tool is important because previous research and related measures for considering technological research were outdated and referred to technology as it relates to a very different level of technology and technological application (Anderson & Dexter, 2005, Gallogray, 2005). These studies, and the tools used within them, predated many of the technologies commonly used in the classroom today and

were less likely to be relevant and valid for measuring the desired perceptions and behaviors of study.

One such tool, which was previously used to measure technology leadership was the PTLA (Duncan, 2011). The PTLA was used to inform the ELTS structure and design; however, Schoenbart (2019) argued that the development of a new tool was necessary because the tool needed to be aligned with current performance standards. The PTLA was aligned with standards from 2002. The reconfirmation that the ELTS is a reliable tool generates value for the field of study because it allows for the continued use of the ELTS in new settings and shows that it remains a valid tool in education, even after the COVID-19 pandemic and the related changes that occurred in education. It also shows that it is valid when used in populations that are different from the original population it was applied to by (Schoenbart, 2019). This supports the use of the ELTS as a standard tool for the measurement of technology leadership which can be used as the foundation of multiple studies, in an expanded body of research, and needs to be developed to understand the phenomenon with greater clarity or accuracy.

Implications Related to Research Question 2

The second research question queried the degree to which administrators demonstrate technological leadership. More specifically the ELTS tool provides an opportunity for school administrators to self-report their technology leadership behavior, or ability to meet the key standards outlined by the ISTE-EL, for technology leadership. The study findings consistently indicate that the participants are only *somewhat* fulfilling the standards, failing to rise to the level of fully implementing any of the standards. These

findings are aligned with the larger, though limited, body of research on technology leadership. Schoenbart (2019) similarly found that school administrators are frequently, but not consistently or always fulfilling the ISTE-EL standards. This also aligns with the work of Duncan (2011) who found that school administrators need to improve the delivery of technology leadership, because most were only beginning to correctly develop skills related to the standards or were barely meeting the standard.

Regarding findings that are specific to the ELTS, the current statistical findings directly mirror those of Schoenbart (2019) in many respects. Like Schoenbart, the study found that the area in which administrators most struggle to meet the ISTE-EL standard is Standard 4, which is related to visionary planning and system design. This demonstrates a consistent issue with establishing the support network, the infrastructure needed to be a technological leader, and to ensure that students have consistent access to the tools needed to learn via technology. This inspires a potential area for further research, which is related to why this is an area of persistent weakness. It may, for example, be related to a lack of resources within those districts or other barriers to the full implementation of Standard 4. This also aligns with the larger body of literature which indicates that vision is often an area of weakness for administrators (Duncan, 2011).

In contrast, both Schoenbart (2019) and findings from the current study demonstrated Standard 1 to be a consistent area of strength. In the current study, the finding had a mean of 3.99, rising nearly to the level of fully implementing the standard. Standard 1 references equity and citizenship advocacy. This is primarily related to school administrator ability to advocate for students to have access to and be able to use technology in learning. This is also consistent with prior research in the field. For

example, Metcalf and La France (2013) indicated that digital citizenship is often a strength of administrators in the delivery of technology leadership. What this means in practice is that school administrators are good at advocating for their students and that this is reflected in the standards, as it relates to citizenship.

It is also important to consider the findings related to technology leadership opportunities as they directly relate to school administrator performance. This is a key area of difference between Schoenbart's study (2019) and the current findings. While Schoenbart reported that school administrators were unable to fulfill the opportunities presented to them, findings from this study suggest that school administrators feel like their performance aligns with opportunities. This change may, in part, be to a difference in location and population. It could also reflect changes in the field of education which have occurred since 2019, like the COVID-19 pandemic, which directly affected the way that school administrators have approached technology leadership and related opportunities. This is another area which future research should place focus. For example, if performance and opportunity are aligned, but still at the *somewhat* level, it could indicate that other barriers are blocking the realization of technology leadership and realization of opportunity in the school environment. This aligns with the recommendations made by Graves (2019) and Zhong (2017) who both concluded that equipping schools with appropriate technology and ensuring that school principals have the resources they need to promote technology and provide technological leadership is key to the successful integration of technology into the school system and so is also tied to the ability to provide leadership and realize opportunity.

Implications Related to Research Question 3

Research question 3 sought to determine what statistically significant relationships exist between a school administrator's delivery of technology leadership and their personal demographics. The findings of this study only demonstrated significance as it relates to the number of years that a school administrator has worked in an administrative position. This closely reflects the findings of Schoenbart (2019) and Duncan (2011) who found no statistically significant relationships between personal demographics and performance. Differences in the current study, when compared with previous studies, may reflect the growing experience with technology leadership among experienced school administrators. Further research is needed to see if this is a consistent association which can be strongly associated with technology use, experience, and the development of leadership. Further, additional personal factors, like preparedness programs or professional development, formal training in technology leadership, opportunities to realize technology leadership, could all be studied as potential alternative personal demographics of interest.

Implications Related to Research Question 4

Research question 4 similarly sought to determine if there was a relationship between school-based demographics and technology leadership. The study did not find any statistically significant relationships between these factors and previous studies. This reflects the same findings that Schoenbart drew related to the relation between school demographics and technology leadership delivery. This, however, runs counter to Anderson and Dexter (2005) who found that student related demographics may influence

the delivery and realization of opportunity for technology leadership. Thus, further research is also needed in this area.

Limitations

There are several limitations which affect the interpretation of the findings for this study. First, the study took place in a limited geographic region and related population. Thus, it should not be assumed that any of the findings can be generalized to a larger population, or populations outside of the state of Alabama. The participants were also drawn from a single professional database which may have limited their diversity and representativeness of the larger population. For the survey phase, the response rate was also low, and while this is to be expected from educational research, it still limits the findings.

The data are also self-reported as it relates to the realization of technology leadership. Since all data are self-reported by school administrators regarding their own leadership roles and actions, this offers a limited perspective and so limits the study. Future research could implement a similar measure asking other stakeholders, like students and teachers, to provide feedback on administrator performance relative to technology leadership to reduce the effects of this limitation.

Finally, it should be noted that the study is limited as it relates to existing literature on the topic and previous application of both the ELTS tool and the ISTE-EL standards. These are both new measures which are used in a very limited body of previous research. Thus, it needs further testing and verification within the larger body of academic literature to determine its generalizability, reliability, and ability to remain

relevant as the field of technology continues to change. This reflects an overall need for technology leadership to gain greater attention in research.

Recommendations

The findings of the current study indicate that while school administrators are trying to meet the technology leadership needs of their district, they are not fully meeting the standards of the ISTE-EL and further professional development and improvement is indicated. These findings, therefore, have direct implications for administrative training programs, administrators, school districts, and future researchers.

Administrative Training Programs

Administrative training programs are directly responsible for educating administrators so that they are prepared for their role as school administrators. Thus, school administrator failure to meet the ISTE-EL standards, and in some cases apparent lack of awareness of the standards, reflects a weakness in their training program. School administrator training programs need to create a focus on technology leadership that is separate and apart from traditional leadership. This means focusing on technology, technology infrastructure, technology related citizenship, and the other key structures outlined in the ISTE-EL standards. This also means teaching the standards and the expectations tied to those standards directly.

School Administrators

School administrators already working in school districts also have a responsibility to increase their awareness and related level of technology leadership. This is related to the ability of administrators with experience, or who have been in their position for many years, to adapt to the changing educational environment and its dependence on technology. School administrators may be poorly prepared for this transition. This is an area where a school district can support the continued education and professional development of school administrators, as it aligns with the ISTE-EL standards, and allows them to become better technology leaders.

School Districts

This issue relates to the resources that are made available through the school districts to realize opportunity in the area of technology use, access, and infrastructure. As previously noted, in the current study, the level of perceived opportunity aligns with the level of achieved technological leadership among participants. This seems to indicate that there are other barriers. School district leaders need to reflect on this finding to ensure that districts are understanding and prioritizing technology related responsibilities and needs. Providing resources that allow for the school administrators to maximize realization of opportunity and to support their leadership should also be ensured by districts. This is especially a concern given that Standard 4 is consistently the area of lowest performance, as reflected in the ELTS. Thus, further focus is needed on the role of the school administrator as the visionary and how this relates to system design, infrastructure, and realization.

Additional Implications for Future Research

The current research and a significant review of the larger body of academic research, ISTE-EL standards, and related research needs informed the development of the research questions for the current study. The purpose of the study was to further validate the ELTS in a new population and to determine how that reflects specific realization of technology leadership in the target population. The methodology was designed to address the gap in the existing research which directly relates to a lack of measurement of technology leadership and a lack of application of the ISTE-EL standards within academic study of technology leadership. The application of the ELTS and the specific use of ISTE-EL as a measure of key performance indicators for administrators is underdeveloped. So, while the current study does further validate the use of the ELTS as a tool, it also reveals the need for extensive future research.

While this study did confirm the ELTS has a high level of internal reliability, future studies using it should also test the internal reliability to ensure that it continues to remain relevant. The tool may, in future research, need to be updated to reflect changes in the field or development of technology itself and technology leadership. Studies are also needed to explore the factors that influence technology leadership in greater depth. While the current study indicated that administrators are only *somewhat* fulfilling the ISTE-EL standards, it did not, and could not indicate why. In-depth interviews with the administrators would be beneficial to determine what school administrators feel are the barriers to making meaningful changes in education and to improve technology leadership.

Studies could also be conducted in other geographic regions or by studying a single level of education. For example, with a focus on elementary schools only, future research could determine if there are patterns that hold in other populations which were not found to have statistical significance in the current study.

Summary

Through this quantitative analysis of the roles of school administrators as technology leaders in Alabama schools, a greater understanding was developed regarding the appropriateness of the ELTS and the ISTE-EL standards. I also discussed the ways in which school administrators are or are not meeting those standards. Unfortunately, the more in-depth statistical analysis of possible influencing factors, in the form of personal and school demographics, did not reveal statistically significant relationships for further study beyond administrator experience.

The study found the ELTS to be reliable and valid and suggests that it can be used in further research as a tool to measure the ISTE-EL standards in the target population of administration. It confirmed the previous research findings that school administrators perform best as it relates to Standard 1, related to digital citizenship and advocacy, and worst as it relates to Standard 4, which is visionary and related to the development of infrastructure and digital design.

Based on these findings, I suggest several recommendations regarding how to best support school administrators in becoming more effective technology leaders and in further researching the role of school leadership in supporting technology. Technology leadership will continue to gain significance in education, as technology becomes ever

more present in the school system and in our lives. Thus, the development of technology leaders in the form of administrators is key to long-term success for schools.

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APPENDIX A

EDUCATION LEADERS TECHNOLOGY SURVEY

Please respond to each question below using the following scale:

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

Standard 1: EQUITY AND CITIZENSHIP ADVOCATE

1. To what extent did you ensure that all students had skilled teachers who were actively using ***technology*** (definition: devices and tools like computers, tablets, cell phones, and other communication tools, as well as their related hardware and software) to meet student needs?
2. To what extent did you ensure all students had access to the technology necessary to participate in engaging learning opportunities?
3. To what extent did you ensure all students had access to the connectivity (e.g. Internet access) necessary to participate in engaging learning opportunities?
4. To what extent did you model ***digital citizenship*** (definition: the behaviors, skills, and knowledge necessary for appropriate and responsible technology use) by critically evaluating online resources?
5. To what extent did you model digital citizenship by engaging in civil discourse online?
6. To what extent did you model digital citizenship by using digital tools to contribute to positive social change?
7. To what extent did you cultivate responsible online behavior?
8. To what extent did you cultivate the safe, ethical and legal use of technology?
9. Overall, to what extent did you have the opportunity to use technology to increase equity, inclusion, and digital citizenship practices?

Standard 2: VISIONARY PLANNER

10. To what extent did you engage ***education stakeholders*** (definition: anyone who is invested in the welfare and success of a school and its students, including administrators, teachers, staff members, students, parents, families, community members, local business leaders, elected officials, etc.) in developing and adopting a shared vision for using technology to improve student success?
11. To what extent did you build on the shared vision by collaboratively creating a strategic plan that articulated how technology would be used to enhance learning?

12. To what extent did you evaluate progress on a strategic plan for using technology to transform learning?
13. To what extent did you make changes to improve how technology is being used to transform learning?
14. To what extent did you measure the impact of using technology to transform learning?
15. To what extent did you encourage the development and growth of effective approaches for using technology to transform learning?
16. To what extent did you communicate effectively with stakeholders to gather input on a strategic technology plan?
17. To what extent did you communicate effectively with stakeholders to celebrate the successes of a strategic technology plan?
18. To what extent did you communicate effectively with stakeholders to continually improve a strategic technology plan?
19. To what extent did you share the impacts of learning with technology (e.g. lessons learned, best practices, challenges) with other education leaders who want to learn from this work?
20. Overall, to what extent did you have the opportunity to engage others in establishing a vision, strategic plan, and ongoing evaluation cycle for transforming learning with technology?

Standard 3: EMPOWERING LEADER

21. To what extent did you empower educators to exercise ***professional agency*** (definition: to take responsibility for and ownership of goals and learning and work strategies)?
22. To what extent did you empower educators to build teacher leadership skills?
23. To what extent did you empower educators to pursue personalized professional learning?
24. To what extent did you build the competency of educators to put the ISTE Standards for Students and Educators into practice?
25. To what extent did you inspire an innovative learning environment that allowed the time and space to explore digital tools?
26. To what extent did you support educators in using technology to advance learning that met the diverse learning needs of individual students?
27. To what extent did you support educators in using technology to advance learning that met the diverse cultural needs of individual students?
28. To what extent did you support educators in using technology to advance learning that met the diverse social-emotional needs of individual students?

29. To what extent did you develop learning assessments that provided a personalized view of student progress in real time?
30. To what extent did you develop learning assessments that provided an actionable view (e.g. specific feedback to drive instruction) of student progress in real time?
31. Overall, to what extent did you have the opportunity to create a culture where the school community was empowered to use technology in innovative ways?

Standard 4: SYSTEMS DESIGNER

32. To what extent did you lead teams to collaboratively establish robust infrastructure to implement a strategic plan?
33. To what extent did you ensure that resources for supporting the effective use of technology for learning were sufficient to meet future demand?
34. To what extent did you ensure that resources for supporting the effective use of technology for learning could anticipate and meet future needs?
35. To what extent did you protect privacy by ensuring that students and staff observed effective privacy and data management policies?
36. To what extent did you establish partnerships that supported a strategic vision?
37. To what extent did you establish partnerships to achieve learning priorities?
38. To what extent did you establish partnerships that improve operations?
39. Overall, to what extent did you have the opportunity to build teams and systems to implement, sustain, and continually improve the use of technology to support learning?

Standard 5: CONNECTED LEARNER

40. To what extent did you set goals to remain current on emerging technologies for learning?
41. To what extent did you participate regularly in ***online professional learning networks*** (definition: use of social media and technology to collect, communicate, collaborate, and create with connected colleagues anywhere at any time)?
42. To what extent did you use technology to regularly engage in reflective practices that supported professional growth?
43. To what extent did you develop the skills needed to lead change (e.g. building buy-in, listening, mentoring)?
44. To what extent did you develop the skills needed to promote a mindset of continuous improvement for how technology can improve learning?
45. Overall, to what extent did you have the opportunity to model continuous professional learning?

Demographics

Note: The ELTS was originally developed with the following demographic items, which were used to investigate possible correlations between demographic groups and technology leadership. Use, adapt, or remove them based on your needs.

46. What is your gender identity?
47. What is your age?
48. How many years have you worked in education?
49. How many years have you worked as a school principal?
50. How many years has it been since you worked as a classroom teacher (or similar position)?
51. Which school type best describes your school?
52. How many students are currently enrolled in your school?
53. To what extent does your school community have regular access to technology?
54. What is the socioeconomic status of your school community?
55. Where is your school located?

APPENDIX B

INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION (ISTE)
ISTE STANDARDS FOR EDUCATION LEADERS

1. Equity and Citizenship Advocate

Leaders use technology to increase equity, inclusion, and digital citizenship practices. Education leaders:

a. Ensure all students have skilled teachers who actively use technology to meet student learning needs.
b. Ensure all students have access to the technology and connectivity necessary to participate in authentic and engaging learning opportunities.
c. Model digital citizenship by critically evaluating online resources, engaging in civil discourse online and using digital tools to contribute to positive social change.
d. Cultivate responsible online behavior, including the safe, ethical and legal use of technology.

2. Visionary Planner

Leaders engage others in establishing a vision, strategic plan and ongoing evaluation cycle for transforming learning with technology. Education leaders:

a. Engage education stakeholders in developing and adopting a shared vision for using technology to improve student success, informed by the learning sciences.
b. Build on the shared vision by collaboratively creating a strategic plan that articulates how technology will be used to enhance learning.
c. Evaluate progress on the strategic plan, make course corrections, measure impact and scale effective approaches for using technology to transform learning.
d. Communicate effectively with stakeholders to gather input on the plan, celebrate successes and engage in a continuous improvement cycle.
e. Share lessons learned, best practices, challenges and the impact of learning with technology with other education leaders who want to learn from this work.

3. Empowering Leader

Leaders create a culture where teachers and learners are empowered to use technology in innovative ways to enrich teaching and learning. Education leaders:

a. Empower educators to exercise professional agency, build teacher leadership skills and pursue personalized professional learning.
b. Build the confidence and competency of educators to put the ISTE Standards for Students and Educators into practice.
c. Inspire a culture of innovation and collaboration that allows the time and space to explore and experiment with digital tools.
d. Support educators in using technology to advance learning that meets the diverse learning, cultural, and social-emotional needs of individual students.
e. Develop learning assessments that provide a personalized, actionable view of student progress in real time.

4. Systems Designer

Leaders build teams and systems to implement, sustain and continually improve the use of technology to support learning. Education leaders:

a. Lead teams to collaboratively establish robust infrastructure and systems needed to implement the strategic plan.
b. Ensure that resources for supporting the effective use of technology for learning are sufficient and scalable to meet future demand.
c. Protect privacy and security by ensuring that students and staff observe effective privacy and data management policies.
d. Establish partnerships that support the strategic vision, achieve learning priorities and improve operations.

5. Connected Learner

Leaders model and promote continuous professional learning for themselves and others. Education leaders:

a. Set goals to remain current on emerging technologies for learning, innovations in pedagogy and advancements in the learning sciences.
b. Participate regularly in online professional learning networks to collaboratively learn with and mentor other professionals.
c. Use technology to regularly engage in reflective practices that support personal and professional growth.
d. Develop the skills needed to lead and navigate change, advance systems, and promote a mindset of continuous improvement for how technology can improve learning.

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: GLUCK, CAROLINE

Co-Investigator(s):

Protocol Number: **E150623002**

Protocol Title: *Leaders of 21st Century Education: A Mixed-Methods Study of the Technological Self-Efficacy Beliefs of Secondary Administrators in Central Alabama*

The above project was reviewed on 7/27/15. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This project qualifies as an exemption as defined in 45CF46.101, paragraph 2.

This project received EXEMPT review.

IRB Approval Date: 7/27/15

Date IRB Approval Issued: 7/27/15

Cari Oliver
Assistant Director, Office of the
Institutional Review Board for Human Use
(IRB)

Investigators please note:

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

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