Spring 2018

Digital Literacy in Early Elementary School: Barriers and Support Systems in the Era of the Common Core

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DIGITAL LITERACY IN EARLY ELEMENTARY SCHOOL: BARRIERS AND SUPPORT SYSTEMS IN THE ERA OF THE COMMON CORE

A Dissertation

Presented to

The Faculty of the Educational Doctoral Program in Educational Leadership

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

by

Delnaz Hosseini

May 2018

The Designated Dissertation Committee Approves the Dissertation Titled

DIGITAL LITERACY IN EARLY ELEMENTARY SCHOOL: BARRIERS AND SUPPORT SYSTEMS IN THE ERA OF THE COMMON CORE

by

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APPROVED FOR THE EDUCATIONAL DOCTORAL PROGRAM IN EDUCATIONAL LEADERSHIP

SAN JOSÉ STATE UNIVERSITY

MAY 2018

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ABSTRACT

DIGITAL LITERACY IN EARLY ELEMENTARY SCHOOL: BARRIERS AND SUPPORT SYSTEMS IN THE ERA OF THE COMMON CORE

by Delnaz Hosseini

This study examines teachers' perceptions about digital literacy instruction in early elementary school grades (e.g., Kindergarten through grade 2) so as to identify existing obstacles to digital literacy instruction as well as support systems necessary to enhance instruction. Participants (n = 37) included Kindergarten, first, and second grade teachers from both Title I and non-Title I schools. Data was collected through an online survey with primarily closed-ended questions. Correlations and relationships amongst and across survey questions were analyzed. Analysis revealed that early elementary grade students in this school district are provided with more opportunities to practice computer literacy than information literacy skills. Teachers identified the high student to teacher ratio, lack of time to plan and teach technology lessons, and students' limited self-management and independence skills as major impediments to digital literacy instruction in the early elementary grades. Conversely, they indicated that access to district-level technology coaches and on-site technology support, opportunities to observe demo technology lessons, and their own knowledge of grade-level technology standards enhance their ability to teach digital literacy skills. Findings also show that teachers' grade-level assignment and the school's Title I status influence teachers' views about when and whether to introduce various digital literacy skills with clear implications for practice and future research.

ACKNOWLEDGMENTS

I dedicate this dissertation to my parents, Ahmad and Guisa, and to my husband, Kamran. Mommy and Bobby Joon, there are no words that can fully convey the depth and express the magnitude of my appreciation and gratitude for all that you have done for me and for our family – I am eternally thankful to you both. Your love, support, and encouragement have given me the strength and confidence to stride forward in life. I am here today because of you. Kami, I am forever grateful for your love, your unwavering support, encouragement, and confidence in me, and your scholarly advice and guidance as I navigated my way through the doctoral program. You are my inspiration. I would not be able to complete this journey without you.

I would like to express my sincerest gratitude to my Committee Chair, Dr. Emily Slusser. From helping me to narrow down my research topic to reading the many drafts of my dissertation and providing invaluable feedback and guidance, her help and support have been instrumental in making this dissertation possible. I would also like to thank my dissertation committee, Dr. Kathleen McConnell and Dr. Elaine Bernal, for sharing their scholarly wisdom and for providing feedback and guidance in completing this dissertation. I would like to thank Dr. Arnold Danzig and the committee who accepted me into the Ed.D. Leadership Program. The doctoral journey has been one of the most intellectually stimulating and enriching experiences of my life and I feel so privileged to have had the opportunity to complete this once-in-a-lifetime adventure as part of "C2."

And lastly, I am grateful to all the teachers who took the time to respond to my survey and provided me with invaluable data for this dissertation.

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LIST OF TERMS

21st Century skills	Knowledge, aptitude, and competencies needed to be successful in both digitized and non-digitized settings in the 21st Century
Common Core State Standards	English and mathematics standards, spanning grades K-12
Digital divide	Disparities in access to hardware and software resources and tools
Digital literacy	Operational, information-processing, and social skills needed to be successful in digitized settings
Digital literacy divide	Inconsistencies in digital literacy skills among students, which are caused by disparities in how digital technologies are used
Early elementary grades	Kindergarten, first, and second grades, including early elementary combination grades (e.g., Kindergarten/first grade)
Teacher beliefs	Teachers' pedagogical or educational beliefs
Technology	Digital technologies, including both software-based programs that are used in the classroom to enhance students' learning and hardware devices such as computers, laptops, and tablets

Chapter 1: Introduction

The Digital Literacy Divide: An Educational Equity Concern

The emergence and rapid development of digital technologies in the 21st Century have prompted significant changes in how human beings operate, communicate, and interact with one another on a daily basis (Mishra & Koehler, 2006). This fast-paced evolution and advancement of digital technologies has permeated schools and classrooms around the United States in recent years and children are growing up in a world that is progressively commanded by computerized environments (McKenna, Conradi, Young, & Jang, 2013). This has prompted educators and policymakers to reexamine teaching and learning in the 21st Century (Collins & Halverson, 2009) as children must become proficient in accessing, analyzing, evaluating, and producing information in both digitized and non-digitized settings (McKenna et al., 2013). Thus, in addition to acquiring basic literacy skills in reading, writing, and arithmetic, children in the 21st Century must become digitally literate (Hsu, Wang, & Runco, 2013; see also List of Terms).

According to the American Academy of Pediatrics (AAP), the number of young children who have access to digital technology devices has increased dramatically in recent years. In 2011, 52% of young children (ages 0-8) had access to mobile technology devices whereas in 2013, that number had increased to 75% (American Academy of Pediatrics, 2016). Over the last two decades, federal and state governments have allocated substantial funding to provide technological resources to classrooms and students across the nation (Miranda & Russell, 2012). For example, in 2014 the Federal

Communications Commission (FCC) authorized two E-rate Modernization Orders to guarantee access to inexpensive and reasonably priced high-speed broadband for constituents (Federal Communications Commission, 2014). The aim of this initiative was to promote technology-enhanced learning in schools and to ensure reliable and durable connectivity for libraries across the nation.

Torlakson (2011), the California State Superintendent of Public Instruction, expressed his vision of creating more prolific instructional settings by "making digital technology as effective and productive a tool in the school environment as it is in the world beyond schools" (p. 12). Beginning in 2010, public schools across California have experienced a series of transformative initiatives that have aimed to eliminate what Becker (2000) refers to as the digital divide – the disparate and unequal access to digital technologies (Judge, Puckett, Cabuk, 2004). The digital divide phenomenon has also been described as the "haves" and "have nots" (Dolan, 2016, p. 16).

The state of California has taken proactive measures, such as allocating more than $25,000,000 to fund grants that enable schools to acquire network and connectivity infrastructure as well as providing economical and discounted telecommunication options to qualifying schools in an effort to reduce and ultimately eliminate the digital divide that currently exists in public school classrooms across the state (California Department of Education, 2015). As a result, and according to data provided by the K-12 High Speed Network (K12HSN; a program funded by the California Department of Education), 82% of schools, 87% of school districts, and 100% of offices of education at the county level

across the state now have network connectivity and internet services (K-12 High Speed Network, 2018).

Furnishing classrooms with digital technology hardware and software, however, does not adequately address digital literacy in K-12 settings (Langub & Lokey-Vega, 2017). Despite the considerable increase in the availability and access to digital technologies in K-12 settings across the nation (Judge, Puckett, & Bell, 2006), quality of technology use remains inconsistent and varied (Dolan, 2016). In an analysis of secondary student data from the Florida Department of Education, Reinhart and colleagues (2011) found disparate quality of technology use between schools serving primarily low- versus high-socioeconomic status (SES) families. They concluded that, in contrast to the more sophisticated uses of technology in high-SES schools, technology use in low-SES schools consisted primarily of basic computer skills. It seems, therefore, that developing children's digital literacy skills remains a "luxury" in many schools (Watkins, 2012). To ensure equitable access to knowledge, however, digital literacy skills must be explicitly taught to children of all socioeconomic backgrounds (Langub & Lokey-Vega, 2017).

Gaps in the effective use and implementation of digital technologies have prompted scholars to reexamine the digital divide phenomenon (Mardis, Hoffman, & Marshall, 2008). In so doing, a new layer of the digital divide, referred to in literature as the second-level digital divide, or the "digital literacy divide" (Watkins, 2012, p. 9), has been identified (Dolan, 2016; Reinhart, Thomas, & Toriskie, 2011). Although the digital divide has narrowed (Judge et al., 2006), the digital literacy divide continues to expand

(Cohron, 2015) given that there are increasing disparities and inequities in how K-12 public school students use digital technologies (Dolan, 2016).

Significance of the Study

Findings from the present study will provide valuable information for district- and site-level educational leaders as they seek to remove existing barriers and provide the supports needed to facilitate digital literacy instruction in the early elementary grades. Although barriers to technology integration (e.g., limited or lack of resources) in K-12 settings have been identified in previous research (e.g., Ertmer, 1999), few studies, if any, have explored the barriers and support systems needed to address the digital literacy component of the Common Core State Standards (CCSS; NGA & CCSSO, 2010). Moreover, previous research on digital literacy has focused primarily on upper elementary (e.g., Gormley & McDermott, 2014), intermediate (e.g., Ahn, Beck, Rice, & Foster, 2016; Hsu et al., 2013; Windschitl & Sahl, 2002), secondary (e.g., Ladbrook & Probert, 2011), and post-secondary educational settings (e.g., Grant, Malloy, & Murphy, 2009; Ng, 2012). Furthermore, while teacher beliefs regarding technology integration (e.g., Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010) and teacher attitudes about the CCSS (Porter, Fusarelli, & Fusarelli, 2015) have been examined in the past, several authors have noted that scholarship on teachers' beliefs and attitudes about digital literacy is scarce (e.g., Ruday, Conradi, Heny, & Lovette, 2013). These studies have not explicitly examined early elementary grade school teachers' beliefs about the digital literacy component of the CCSS.

Additional research is therefore needed to understand Kindergarten, first, and second grade teachers' views about digital literacy development in the Common Core era and to examine the extent to which young elementary school students are provided with opportunities to achieve digital literacy skills, particularly those skills that are recommended by the CCSS K-12 Technology Skills Scope and Sequence (Long Beach Unified School District, n.d.).

Purpose of the Study

The present study will identify existing barriers to digital literacy instruction and determine the support systems needed to facilitate digital literacy instruction in the early elementary grades. Digital literacy instruction is particularly problematic in the early elementary grades because, prior to the adoption of the CCSS, teachers in the early elementary grades did not have to teach digital literacy skills (e.g., see ELA Content Standards in California Department of Education, 1998). Furthermore, formal accountability measures related to digital literacy currently do not exist in the early elementary grades even though there is a new expectation for teachers to incorporate digital technologies and promote the development of students' digital literacy skills. In order to evaluate and assess the digital literacy divide, the present study will identify links between early elementary school teachers' grade-level assignment and their beliefs and attitudes about digital literacy development. The study will also evaluate the relationship between students' socioeconomic status and teachers' attitudes and beliefs about digital literacy instruction in the early elementary grades.

Research Questions

The following five research questions will guide this study:

RQ1: Are early elementary school students (Kindergarten – second grade) provided with ample opportunity to achieve the skills recommended in the CCSS K-12 Technology Skills Scope and Sequence?

RQ2: What specific school-level supports enhance digital literacy instruction in the early elementary grades and to what extent do these supports influence teaching practices?

RQ3: What specific barriers interfere with digital literacy instruction in the early elementary grades and to what extent do these barriers influence teaching practices?

RQ4: What is the relationship between early elementary school teachers' current teaching assignment and their beliefs about digital literacy development?

RQ5: What is the relationship between students' socioeconomic status and early elementary school teachers' beliefs about digital literacy development?

Summary

Digital technologies represent one of the most recent elements of the educational system that amplify already existing inequities in children's educational experiences (Natriello, 2001). Despite national and local efforts to increase access to digital technologies in K-12 settings, inconsistencies in students' digital literacy skills and overall quality of use remain a problem of educational equity. The next chapter provides a synthesis of the literature on digital literacy and its connection to the CCSS and the 21st

Century skills – a framework (discussed at length in Chapter 2) that includes knowledge, aptitude, and competencies needed to function successfully in both digitized and non-digitized settings (Partnership for 21st Century Learning, 2007). This is followed by a summary of the barriers to technology integration in K-12 educational settings that have been identified in previous research. The chapter ends with the conceptual framework for the present study.

Chapter 2: Review of the Literature

Digital Literacy Development in the Era of the Common Core

The adoption of the CCSS in 2010 has resulted in a significant paradigm shift for teaching and learning in California public schools. The CCSS have reconceptualized the definition of literacy and what it means to be literate (Dalton, 2012). In addition to addressing traditional literacy skills, K-12 teachers are now required to incorporate digital technologies in instructional practices and create student-centered educational experiences that effectively address 21st Century skills.

Research on technology integration in K-12 settings has demonstrated that effective integration of technologies is an elusive and complex task (Brantley-Dias & Ertmer, 2013). While previous studies have identified barriers to technology integration such as teachers' traditional beliefs and attitudes about instruction and learning (which may stem from the belief that technology should not be introduced until older age; Ertmer, 1999), research on early elementary grade teachers' beliefs about the digital literacy component of the CCSS remains scarce (see Chapter 1).

This chapter will examine empirical and theoretical research so as to establish the groundwork for the present study which seeks to (1) understand teachers' attitudes and beliefs about digital literacy, (2) identify existing barriers to digital literacy instruction in Kindergarten-second grade classrooms, and (3) explore support systems needed to facilitate instruction in the early elementary grades. The first part of this review will define digital literacy, determine its connection to the CCSS and 21st Century skills, and highlight the importance of its development in the early elementary grades. The

following review on common barriers to the integration of technology in early elementary classrooms will consider both first-order barriers (e.g., organizational challenges such as a lack of resources) and second-order barriers (e.g., personal challenges such as teachers' attitudes toward technology) (Ertmer, 1999). The chapter additionally outlines a conceptual framework that serves as a 'road map' to the present study and closes with a synthesis of key findings.

What is Digital Literacy?

The term digital literacy was first introduced by Gilster (1997) to describe "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1). Digital literacy has since become an all-encompassing phrase (Eshet-Alkalai, 2004). While some have used this term to describe the technical and operational skills linked with computer usage (e.g., Bruce & Peyton, 1999), others have extended the definition to describe information literacy, highlighting the higher-order cognitive aptitude to access, analyze, and produce information using digital technology tools and resources (van Laar, van Deursen, van Dijk, & de Haan, 2017). The term computer literacy focuses primarily on the operational and technical skills associated with computers, other hardware devices, and software applications, whereas information literacy focuses on the students' aptitude to gather, evaluate, and effectively use information acquired through digital sources (Hignite, Margavio, & Margavio, 2009). While the fundamentals of information literacy in digitized settings (e.g., an online article) remain the same as non-digitized settings (e.g., printed materials such as textbooks), students are now required to utilize these skills more expeditiously to

complete activities in more diverse contexts, including both digitized and non-digitized settings (National Research Council, 2013).

The breadth of skills and competencies involved in digital literacy include motor skills as well as higher-order cognitive and socio-emotional skills (Eshet-Alkalai, 2004). Digital literacies are also referred to as new literacies, new media literacies, and multiliteracies (Lankshear & Knobel, 2003; Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009; The New London Group, 1996, respectively). Eshet-Alkalai (2004) describes digital literacy as the "survival skill in the digital era" (p. 102). He asserts that digital literacy skills are needed to accomplish a variety of tasks and to "survive" or overcome hurdles within digitized settings. Therefore, by utilizing the various forms of digital literacy, individuals are able to successfully function in digital settings (Eshet-Alkalai, 2004).

Digital technologies have transformed what it means to be a literate person in the 21st Century. The contemporary definition of literacy extends beyond the mere ability to read, write, and access information via printed texts (Ajayi, 2009). Traditionally, curriculum and instruction in U.S. public schools have relied primarily on print materials such as textbooks (Rose & Gravel, 2013) and teacher-centered practices to disperse information and instill knowledge (Brooks & Brooks, 1999). As the interconnection of digital technologies and literacy becomes more elaborate, the need for more sophisticated and innovative classroom instructional practices significantly increases (Pacino & Noftle, 2011). According to Hsu and colleagues (2013), well-educated individuals in the 21st Century are those who are digitally-literate.

In May 2009, then Governor of California, Arnold Schwarzenegger, issued an executive order that called for the development of a California Action Plan for ICT Digital Literacy, to guarantee that all Californians are digitally literate (California Emerging Technology Fund, n.d.). This then designated California as one of the pioneer states in the nation to officially establish a definition for digital literacy and institute approaches to ensure that all of its residents are informed consumers and skilled producers of knowledge using digital technology devices and resources. The ICT Digital Literacy Leadership Council and its Advisory Committee, assembled in accordance with the governor's executive order in 2009, defined digital literacy as "a lifelong learning process of capacity building for using digital technology, communication tools, and/or networks in creating, accessing, analyzing, managing, integrating, evaluating, and communicating information in order to function in a knowledge based economy and society" (ICT Leadership Council Action Plan Report, 2010, p. 3). In a continued effort to equip students with 21st Century competencies, including digital literacy skills, California's Superintendent of Public Instruction, Tom Torlakson, announced his department's collaboration with Partnership for 21st Century Learning (P21) in 2013 (California Department of Education, 2013). P21, founded in 2002, is a national advocacy organization that promotes the integration of technology in education and offers resources to policymakers and educators to facilitate and aid this process (National Education Association, 2015). P21 also developed the Framework for 21st Century Learning which outlines the skills, knowledge base, and support systems that are essential for student success in the new century within the national and global context (Partnership

for 21st Century Learning, 2007). The Framework for 21st Century Learning classifies digital literacy along three dimensions: Information Literacy, Media Literacy, and ICT (Information Communications Technology) Literacy (Partnership for 21st Century Learning, 2007). Students who are literate in information processing are able to efficiently access, critically evaluate, innovatively utilize, and successfully manage information from multiple sources for various purposes (e.g., problem-solving) while adhering to ethical and legal standards (Partnership for 21st Century Learning, 2007a). Further, students who are proficient in media literacy are able to examine the function of media (e.g., radio, television, Internet, video games) and effectively analyze and utilize messages received through various forms of media (Partnership for 21st Century Learning, 2007b). ICT literacy, then, is the ability to successfully utilize digital technologies "as a tool to research, organize, evaluate, and communicate information" (Partnership for 21st Century Learning, 2007c, "Apply Technology Effectively," para. 1).

The International Society for Technology in Education (ISTE), a U.S.-based nonprofit organization, has developed a framework of standards for incorporating digital technologies in teaching and learning. The ISTE Standards for Students, formerly known as the National Educational Technology Standards (NETS) for Students, aim to develop technology literate individuals who are "empowered learners, digital citizens, knowledge constructors, innovative designers, computational thinkers, creative communicators, and global collaborators" (International Society for Technology in Education, 2016). Additionally, these standards reinforce and emphasize the higher-order cognitive skills that the CCSS and the Next Generation Science Standards (NGSS) focus on within a list

of content-specific standards (International Society for Technology in Education, 2016a). In addition to developing standards for students and educators, the ISTE (2007) has also established profiles for Technology (ICT) Literate Students across four grade ranges (e.g., Grades PK-2 (ages 4-8), Grades 3-5 (ages 8-11), Grades 6-8 (ages 11-14), and Grades 9-12 (ages 14-18)). Each grade range encompasses "indicators of achievement" that are directly linked to the following categories: (1) Creativity and Innovation, (2) Communication and Collaboration, (3) Research and Information Fluency, (4) Critical Thinking, Problem Solving, and Decision Making, (5) Digital Citizenship, and (6) Technology Operations and Concepts (ISTE, 2007).

Digital literacy and the CCSS. The CCSS have instituted a new approach to teaching and learning. Since the adoption of the CCSS and the Framework for 21st Century Learning (Partnership for 21st Century Learning, 2007) by states across the nation, there has been considerable momentum toward the alignment and implementation of instructional strategies that are student-centered and stimulate higher-order cognitive skills. The CCSS promote 21st Century skills to ensure children's college and career readiness. The new standards are focused on equipping students with knowledge and skills needed for success in the 21st Century (Neuman, 2013). According to the CCSS, "literacy" encompasses both conventional and digital literacy skills (Dalton, 2012). Although the CCSS do not include a stand-alone technology strand, the implementation of these standards requires teachers to integrate digital technologies in their instruction as early as in Kindergarten (McKenna et al., 2013). Digital literacy skills are referenced in the CCSS standards for mathematics (grades 6-12 only) and English language arts with

the expectation that the educational experiences that teachers develop for their students utilize both digital and non-digital settings (McKenna et al., 2013; see Table 1 below).

In the early elementary grades, as young children advance from one grade level to the next, their use and implementation of digital technologies evolve from exploration to the actual utilization of these resources (McKenna et al., 2013). This "vertical articulation" (p. 155) highlights the gradual complexity of use of technologies according to the CCSS (McKenna et al., 2013).

Table 1

Explicit Use of Technology in English Language Arts

Area	Standard	Kindergarten	Grade 1	Grade 2
Literature	7			✓
Informational text	5		✓	✓
Writing	6	✓	✓	✓
Speaking and Listening	2	✓	✓	✓
Speaking and Listening	5	✓	✓	✓
Language	4			✓

Note: Adapted from the Technology Use in the CCSS for ELA, Grades K-2 Table (McKenna et al., 2013, p. 153). This table shows the Kindergarten-second grade CCSS for English Language Arts where the application of technology is explicitly mentioned.

Since the CCSS do not include a distinct technology strand to facilitate the implementation of the CCSS technology component (McKenna et al., 2013), the Fresno County Office of Education has developed a framework entitled Recommended Digital Literacy & Technology Skills to Support the California Common Core State Standards,

which explicitly outlines digital literacy skills that correspond to the CCSS. In addition, the Long Beach Unified School District (LBUSD) has adapted the framework to create the Common Core State Standards K-12 Technology Skills Scope and Sequence, which includes grade-level specific digital literacy skills (LBUSD, n.d.).

Digital literacy according to the CCSS K-12 technology skills scope and sequence. The CCSS K-12 Technology Skills Scope and Sequence document categorizes digital literacy skills specific to each grade-level that are aligned to the CCSS. The document also identifies skills that students in grades 3-12 need in order to take the computerized Smarter Balanced Summative Assessment. Moreover, it highlights specific skills (e.g., responsible use of digital technologies) that have been adopted from the Creativity and Innovation, Digital Citizenship, and Technology Operations and Concepts sections of the ISTE Standards for Students (LBUSD, n.d.). Using Introduced (I), Reinforced (R), Mastered (M), and Optional for Grade Level (O), this document also displays the grade levels when each digital literacy skill should be taught to students (LBUSD, n.d.). The skills highlighted in this document are classified in three main digital literacy categories: technical skills (e.g., keyboarding and word processing), digital citizenship (e.g., safe and responsible use of devices and online information), and information literacy skills (e.g., use of digital technology for communication and exchange of ideas) (see Table 2).

Table 2

Digital Literacy Categories According to the CCSS K-12 Technology Scope and Sequence Document

Digital Literacy Categories	
Demonstrate proficiency in the use of computers and applications as well as an understanding of the concepts underlying hardware, software, and connectivity.	Basic Operations Word Processing Spreadsheet Multimedia and Presentation Tools
Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school and in society.	Acceptable Use, Copyright and Plagiarism
Demonstrate the ability to use technology for research, critical thinking, decision-making, communication and collaboration, creativity and innovation.	Research and Gathering Information Communication and Collaboration

Note: Adapted from the CCSS K-12 Technology Scope and Sequence Document (LBUSD, n.d.)

Digital literacy: A cornerstone of 21st century skills. The prevalence of the phrase "21st Century skills" is noticeable in present day debates about education (Silva, 2009). The term is now widely used by educators to highlight the core knowledge, meta-cognitive skills, and competencies (e.g., digital literacy) that students need in order to be at the leading edge of the globalized 21st Century economy and job market (Mishra & Kereluik, 2011). The phrase 21st Century skills is multifaceted and encompasses various themes, skills, and competencies that are necessary for students to succeed in their post-secondary education and professional careers (Mishra & Kereluik, 2011). In many instances, the terms 21st Century skills and the 4C's (a core component of the Framework

for 21st Century Learning which refers to communication and collaboration, critical thinking and problem solving, and creativity and innovation; Partnership for 21st Learning, 2007), have been used synonymously and interchangeably, thereby leaving out a fundamental component and one of the core competencies of 21st Century skills - digital literacy (Voogt, Erstad, Dede, & Mishra, 2013).

For nearly two decades, educational policy-makers and scholars have investigated and explored the nature of skills and competencies that are required for success in the 21st Century (Häkkinen et al., 2016). In their analysis of current 21st Century skills frameworks from around the world, Binkley and colleagues (2012) summarized the skills and competencies and identified the following four categories: ways of thinking, ways of working, tools for working, and living in the world (p. 36). While enthusiasts highlight the importance of teaching students higher-order thinking skills in conjunction with the core curriculum to ensure their readiness for college and underscore the skills' potential "to bridge the skills-content divide" (Silva, 2009, p. 630), opponents firmly maintain their position on focusing primarily on teaching the core subjects (Silva, 2009).

In fact, 21st Century skill sets and competencies are neither new nor unique to this era (Rotherham & Willingham, 2010) and associating these skills with a specific century can be deceiving (Silva, 2009). The aptitude to think critically, to unravel issues and challenges, and to search for solutions individually and collectively, for example, have contributed to the progress and advancement of humankind and world civilizations throughout history. These higher-order cognitive skills have been a part of high quality curriculum and educational systems for many years (Rotherham & Willingham, 2010).

As a result of the "global economization of education," however, 21st Century skills have assumed a novel identity as the "new currency" in today's world (Spring, 2015, p. 14). From a more conventional perspective, schools are seen as the 'suppliers of talent' by equipping students with necessary skill sets for future success (Senge et al., 2000). Reformists then seek to alter current educational practices to resemble a more business-like approach to teaching and learning (Senge et al., 2000). What makes 21st Century skills unique is the magnitude to which the future success of individuals in a globalized world economy, one that is stimulated by the continuous advances in digital communication technologies, depends on these skills (Rotherham & Wilingham, 2010).

Unlike conventional instructional methods (e.g., "one size fits all") often implemented in conjunction with curriculum from the previous century, the aim of the 21st Century skills movement is to draw attention to the newly formed contextual dimension of these skills and to promote more innovative approaches of teaching and learning (Dede, 2010).

Global and national frameworks and standards have been generated that define and organize the 21st Century skills and competencies (Binkley et al., 2012). There are several organizations and institutions in the United States that have developed 21st Century learning frameworks, including the P21, the Metiri Group and North Central Regional Educational Laboratory (NCREL), Organisation for Economic Co-operation and Development (OECD), and the American Association of Colleges and Universities (Dede, 2010).

The comprehensive Framework for 21st Century Learning is more extensively utilized compared to the alternatives (Dede, 2010). For example, the framework has been adopted by the state of California (California Department of Education, 2016) as well as twenty other states across the nation, including the neighboring states of Nevada and Arizona (Partnership for 21st Century Learning, 2007).

The expansion and prevalence of digital technology in everyday life and the call for more sophisticated "cooperative interpersonal capabilities" (Dede, 2010, p. 2), have generated the need for the more refined standards offered by the Framework for 21st Century Learning. The framework emphasizes the importance of developing 21st Century citizens who are able to competently assess, apply, and produce information using a wide variety of sources and tools, including digital technologies (Partnership for 21st Century Learning, 2007). Additionally, the framework underscores the significance of teaching higher-level cognitive skills and providing all students with opportunities to engage in "innovative learning methods that integrate the use of supportive technologies" and "inquiry- and problem-based approaches" (Partnership for 21st Century Learning, 2007, "21st Century Curriculum and Instruction"). The framework classifies Student Outcomes, comprising the skills, knowledge, and competencies that students need to learn in order to succeed as adults, in the following four categories: Life and Career Skills; Learning and Innovation Skills (4Cs); Key Subjects and 21st Century Themes (3Rs); and Information, Media, and Information and Communication Technology (ICT) Skills. The 4C's are in fact components of the Learning and Innovation Skills, one of the four elements of Student Outcomes (Partnership for 21st Century Learning, 2007). Key

Subjects and 21st Century Themes consist of core academic subjects such as mathematics and language arts as well as "21st Century interdisciplinary themes," which P21 has categorized as civic, health, and environmental literacy, global awareness, and financial, economic, business, and entrepreneurial literacy (Partnership for 21st Century Learning, 2007). In addition to Key Subjects and 21st Century Themes, the Framework for 21st Century Learning includes Life and Career Skills, which support the development of students' social and emotional growth and competence (Partnership for 21st Century Learning, 2007). The framework also includes Support Systems, which represent the conditions and systems, including the alignment of instructional practices and teachers' professional development with the 21st Century standards that are required to ensure the achievement of student outcomes. Along with providing a framework for 21st Century skills, P21 has also developed other resources for policymakers, educators, and families. These resources include the Framework for State Action on Global Education (Partnership for 21st Century Learning, 2014), P21 Common Core Toolkit (Partnership for 21st Century Learning, 2011), and P21 and Education for a Changing World - A Parents' Guide for 21st Century Learning and Citizenship (Partnership for 21st Century Learning, 2009).

Why is Digital Literacy Important?

Developing K-12 students' digital literacy skills is essential in ensuring their college- and career-readiness as well as their success in the 21st Century globalized economy. Nevertheless, the importance of digital literacy development extends beyond its contribution to children's future. Digital literacy skills are now an essential test-taking

aptitude that can potentially impact children's performance on state-mandated assessments (Parks, 2012). For example, the Smarter Balanced Summative Assessment, a component of the California Assessment of Student Performance and Progress (CAASPP) System, has introduced significant changes in the way student knowledge is assessed in grades 3 through 12. One of the major differences between this assessment and its predecessors is its digitalized and adaptive format (California Department of Education, 2017). Unlike the paper-based assessments of the Standardized Testing and Reporting (STAR) system from the previous decade, students are now required to take the Smarter Balanced Summative Assessment online. They must type all written responses and access all sources of information digitally (Parks, 2012).

While it remains unclear whether and how these skills are supported through K-12 instruction (specifically in the early elementary grades) studies of post-secondary undergraduate students reveal that students lack sufficient computer and information literacy skills. For example, Hardy, Heeler, and Brooks (2006) found that of the 164 undergraduate students who took a comprehensive computer literacy exam addressing computer concepts, word processing, spreadsheets, database, and presentation skills, only 1.2% received an overall score of 80% or higher, indicating "mastery" of these skills. The majority of students, 73.8%, scored at 60% or lower on this exam. Grant and colleagues (2009) reported differences in undergraduate students' perception of their own word processing skills and significant differences of their spreadsheet skills and their actual performance on the computer-based skills assessment. Overall, students perceived their computer skills proficiency to be higher than their actual performance. Further,

Hignite et al.'s (2009) examination of 600 first- and second-semester university students' aptitude in information literacy revealed that only 40% of participants attained a proficient score on the Information and Communications Technology (ICT) exam.

The significance of digital literacy development in the early elementary grades. The generation of children growing up with technology, whose lives have been influenced by the presence of digital technologies including computers, video games, the internet, smartphones and tablets has been described as the "Net Generation" (Tapscott, 1999). Prensky (2001) argues that these 'digital natives' have mastered the "language" of the digital age. However, this stance assumes that all digital natives are, by default, digitally literate (Judson, 2010), when in fact, digital literacy skills must be explicitly taught (National Association for the Education of Young Children, 2012).

The effects of the use of technology by young children have long been the subject of scholarly and contemporary public debates. While many promote and advocate the use of technology beginning at an early age (see Clements & Sarama, 2002; Haugland, 1999; Haugland, 2000), opponents warn against the negative impact of technology use on young children's cognitive and social-emotional development as well as on their overall physical fitness and health, citing computers as "the most acute symptom of the rush to end childhood" (Cordes & Miller, 2000, p. 19). Contrary to the claims made by the skeptics, however, research has shown that computers, when used appropriately, can promote learning in young children (Clements & Sarama, 2002). Advantages of incorporating digital technology devices and resources into young children's educational experiences include: enhanced engagement, introduction to new ideas and concepts, and

opportunities to communicate and collaborate with others (American Academy of Pediatrics, 2016).

The National Association for the Education of Young Children (NAEYC), a non-profit organization dedicated to the enhancement of education for children 0-8 years of age, has developed guidelines for developmentally- and age-appropriate instructional practices with young children from infancy to the early primary grades (NAEYC, 2016). The foundation of "developmentally-appropriate practice," also known as DAP, is based on theories of child development and learning (NAEYC, 2016). DAP takes into consideration each child's individual developmental and learning needs while providing learning opportunities that are culturally-sensitive and relevant (NAEYC, 2016). Research has shown that the developmentally-appropriate use of computers can greatly enhance the learning experiences of young children (Judge et al., 2004). Among the benefits of integrating digital technologies into educational experiences of children in the early elementary grades are enhanced cognitive processes as well as improved motor skills (Haugland, 1999). Findings from a study investigating the use of iPad apps by five year old primary school students in New Zealand revealed a correlation between the design and content of the apps used and the quality of the children's engagement and learning (Falloon, 2013). The 45 apps selected for this study focused primarily on the development of fundamental literacy and math skills. Apps that were identified as the most effective in enhancing student learning and promoting “thoughtful engagement” provided: (a) clear and easy-to-understand learning objectives and instructions, (b) consistent and orderly steps and procedures, (c) formative feedback, (d) elements of

"game, practice, and learning," and (e) structured parameters which allowed the children to remain focused on the learning objectives (Falloon, 2013).

Some studies have examined the digital literacy skills and competencies of young children (see Davidson, 2009; Donker & Reitsma, 2007; Fessakis, Gouli, & Mavroudi, 2013; Levy, 2009; Mills, 2011; O'Mara & Laidlaw, 2011) while others have focused on the children's understanding of the role of digital technologies and their various uses (see McPake, Plowman, & Stephen, 2013; Plowman, Stevenson, Stephen, & McPake, 2012). The NAEYC and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College (2012), for example, have published a joint position statement detailing the appropriate use of digital technologies in early childhood educational programs. According to these guidelines, young children must acquire the knowledge, competence, and skills required for analytical and rational decision-making when interacting with digital technology devices and web-based information sources. Children must learn how to effectively examine the information and make sensible choices. These practices constitute the foundation for digital and media literacy and will extend to other parts of the children's education and into their adult life (NAEYC, 2012). Additionally, the guidelines identify digital citizenship as an integral component of young children's digital literacy development (NAEYC, 2012). The guidelines also underscore the importance of developing and enhancing children's knowledge and awareness of appropriate uses of digital technologies, including responsible, ethical, and safe online conduct. Young children should therefore develop knowledge of issues related to cyber safety and form an emerging understanding of consequences related to inappropriate and

unethical web-based activities (NAEYC, 2012). According to NAEYC (2012), educators who work with young children, must be digitally literate themselves and must ensure the age- and developmental-appropriateness of instructional practices when integrating digital technology tools and resources in young children's educational experiences. Furthermore, teachers of young children must be knowledgeable and purposeful in their selection of digital technologies to address classroom learning objectives.

Summary

Digital literacy is an essential aptitude and an important component of the CCSS and 21st Century education. National and local efforts have been made to integrate these 'new' skills into K-12 educational practices (e.g., CCSS). Since young children's access to technology has increased in recent years (American Academy of Pediatrics, 2016), it is important that digital literacy skills are explicitly taught in schools to ensure that children can capitalize on the affordances of technologies and engage in safe and responsible use in digitized settings. This is particularly important for children who do not have access to digital literacy tools and resources outside of school (Ba, Tally, & Tsikalas, 2002). However, as mentioned in Chapter 1, although teachers are expected to include digital technologies in their instructional practices to enhance students' digital literacy development, formal accountability measures related to the level or quality of use are lacking in the early elementary grades. The next section provides a synthesis of the barriers to technology integration in K-12 educational settings including a discussion of first- and second-order barriers (Ertmer, 1999).

The Roadblocks: Obstacles to Technology Integration in K-12 Classrooms

While the barriers and supports needed to facilitate the instruction of the digital literacy component of the CCSS in the early elementary grades remain largely unexplored, factors and conditions that impede technology integration in K-12 settings have been identified in previous research (e.g., Blackwell, Lauricella, & Wartella, 2014; Ertmer, 1999; Hew & Brush, 2007). Of the studies that have examined the barriers to technology integration in schools, the most commonly cited barriers have been identified as: (a) lack of or limited resources, (b) institution (e.g., lack of or inconsistent vision and leadership), (c) attitudes and beliefs (e.g., teachers' negative attitudes and beliefs about technology's affordances in teaching and learning), and (d) lack of or limited knowledge and skills (Hew & Brush, 2007). These factors, among others, have been broadly categorized by Ertmer (1999) as either first-order (organizational) or second-order (personal) barriers. While these barriers will be defined and described at length in the next section, it is important to recognize that the relationship between first- and second-order barriers is intricate and complex (Ertmer, 1999) and a culmination of these factors clearly influences teachers' use of technology (Blackwell, Lauricella, Wartella, Robb, & Schomburg, 2013). For example, in a study of 1,329 early childhood (ages 0-4) educators, Blackwell and colleagues (2013) found that while first-order barriers impacted teachers' access to technology, teachers' beliefs about the affordances of digital technologies for teaching and student learning was a significant predictor of technology use among study participants. Teachers who believed that technology could enhance

student learning outcomes were more likely to incorporate it in their instructional practices.

First-order barriers. First-order barriers are organizational-level obstacles that impede technology integration and are extrinsic to classroom teachers (Ertmer, 1999). These are often district- and school-level factors that include inadequate or lack of access to digital technology resources, technical support (Miranda & Russell, 2011), teacher training, and situated professional development (Kopcha, 2012). The next section provides a description of first-order barriers that are commonly associated with technology integration in school settings.

Resources. Insufficient resources can significantly obstruct the path to successful technology integration in school districts (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010). Furthermore, school administrators often lack the knowledge or the experience that would allow them to effectively use available resources, consequently wasting a great deal of both financial and human capital (Fullan, 2010). An example of inefficient school expenditure includes spending funds to purchase digital technology hardware and software without providing teachers with adequate training and ongoing professional development to build their knowledge and skills (Fullan, 2010).

Access to technology and technical support. Insufficient access to technology (Hew & Brush, 2007) and inadequate on-site technical support (Hernández-Ramos, 2005) can hamper technology integration in classrooms. Teachers in a study examining perceptions of technology integration into literacy instruction reported that insufficient or lack of access to digital technologies and technical support were the main hurdles to teachers'

technology integration efforts (Hutchison & Reinking, 2011). Other studies have uncovered similar findings (e.g., Blackwell et al., 2014; Hernández-Ramos, 2005; Inan & Lowther, 2010).

Time. In addition to insufficient access to technologies and fiscal and human resources, lack of time to plan, collaborate, teamwork, and reflect on teaching practices has been cited as one of the first-order barriers to technology integration in classrooms (Ertmer, 1999). While teachers need time to develop their knowledge and build their skill sets and confidence in order to effectively integrate technology into their instructional practices (Ertmer, 1999), this additional planning and collaboration time is often hard to come by due to a number of factors including lack of adequate funding to provide classrooms with substitute teachers during the school day. Furthermore, the team planning and collaboration time that teachers do have often has a pre-scheduled agenda and focuses primarily on the core subjects (e.g., English language arts).

Institution: Leadership and vision. School culture plays an important role in influencing teachers' attitudes toward integration of digital technologies in instructional practices (Porras-Hernández & Salinas-Amescua, 2013). The school principal's leadership is an essential driver for school-wide technology integration (Chandra, 2016; Porras-Hernández & Salinas-Amescua, 2013) and it determines how digital technologies are used and managed (Chandra, 2016). School leaders also play an important role in establishing high expectations with respect to the use of digital technologies in their schools (Levin & Schrum, 2013). Data from a Use, Support, and Effect of Instructional Technology (USEIT) study revealed that, among school-level factors examined, such as

principal's beliefs about technology, the school principal's reported use of digital technologies may significantly influence teachers' reported use of technology (Miranda & Russell, 2011).

Second-order barriers. Second-order barriers are personal and entrenched in teachers' pedagogical beliefs and attitudes about technology (Ertmer, 1999). Public school classrooms operate within the cultural and historical realms of their individual school and district, both of which function within the larger and multifaceted county, state, and federal systems (Cuban, 2001; Mardis et al., 2008; Porras-Hernández & Salinas-Amescua, 2013). Teachers and students represent two key stakeholders in change efforts that seek to integrate digital technologies into teaching and learning (Li, 2007). Although the classroom teachers' circle of influence may be fairly limited in the realm of organizational and policy decision making and their day-to-day practices may be impacted by the school's culture (Porras-Hernández & Salinas-Amescua, 2013), teachers hold tremendous power and influence over their students (Delpit, 1988). Their beliefs and values significantly impact their choices and decisions regarding classroom practices (Cuban, 2001). They possess a certain level of autonomy in how subject matter and skills are taught to students (Cuban, 2001) and can therefore play a significant role in how digital technology resources are used by their students (Dolan, 2016).

Attitudes and beliefs. Described by Ertmer (2005) as "the final frontier" (p. 25) in the pursuit of technology integration in K-12 classroom settings, teachers' pedagogical beliefs have been linked to teachers' instructional decision-making and technology integration practices (Ertmer & Ottenbreit-Leftwich, 2010). Hermans and colleagues

(2008) found that teachers' pedagogical beliefs play a deciding role in teachers' computer adoption in classroom practices. An analysis of their survey results (n = 525) revealed that traditional beliefs about teaching and learning (e.g., teacher-centered instruction) had a negative influence on the use of computers while student-centered beliefs and perceptions had a positive impact. Similarly, a multiple case-study examination of twelve K-12 classroom teachers who had received awards for their exemplary use of technology in their instruction, revealed a significant correlation between the teachers' constructivist and student-centered pedagogical beliefs and their instructional practices (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Moreover, five of the study participants identified their own attitudes and beliefs as "one of the most influential factors" that facilitates the integration of technology into their teaching (Ertmer et al., 2012, p. 433). The teachers in this study perceived the more traditional, teacher-centered attitudes and beliefs of other teachers as a significant obstacle to technology integration at their school site.

A hermeneutical phenomenological study of eight exemplary technology-using teachers revealed that teachers' use of digital technology in their instructional practices was directly related to their core belief of utilizing digital technologies to enhance student learning outcomes (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). All eight teachers in this study believed that utilizing digital technologies motivated students and facilitated the development of students' comprehension and higher-order cognitive skills. Further, the teachers believed that digital technologies promoted the development of students' technology skills.

Orientation of teachers' pedagogical beliefs and its relation to technology integration. The orientation of teachers' pedagogical beliefs is one of the personal variables that can promote or hinder technology integration in classroom practices. Research findings show that teachers with more traditional beliefs (e.g., teacher-directed teaching and learning) about education are less likely to implement high-level uses of digital technology in their practice (Ertmer & Ottenbreit-Leftwich, 2010; Judson, 2006). In contrast, teachers who adopt a more student-centered or constructivist approach to teaching and learning are more likely to maximize on the affordances of digital technologies to enhance student outcomes (Judson, 2006). In their multiple case study of 12 award-winning K-12 teachers, Ertmer and colleagues (2012) found a significant correlation between the participants' student-centered beliefs and their practices. Despite the presence of first-order barriers, these participants' student-centered beliefs positively influenced their instructional practices (Ertmer et al., 2012).

Teachers' attitudes and beliefs about the CCSS. Effective implementation of the CCSS is a challenging task for all educators, particularly for K-12 teachers (Porter et al., 2015). While prior studies have examined teachers' views about the CCSS (Porter et al., 2015), few have surveyed Kindergarten – second grade California public school teachers' attitudes about the digital literacy component of these standards.

A comparative case study of two North Carolina public elementary schools revealed that teachers who implemented CCSS in their classrooms faced significant challenges that impacted their personal and professional lives (Porter et al., 2015). The study participants equated the experience to being a 'novice' classroom teacher. They

identified considerable personal investment of time and effort as well as lack of adequate curriculum material and poor communication between administration and teachers as significant hurdles in the effective implementation of CCSS (Porter et al., 2015). These challenges were emotionally taxing on some of the study participants and thus negatively influenced their perceptions of their own professional identity (Porter et al., 2015). According to Richardson (2003), teachers' perceptions are based on their beliefs and play a significant role in teachers' decision-making and instructional practices.

Teachers' attitudes and beliefs about digital literacy. While past studies have focused on teachers' beliefs regarding technology integration (e.g., Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010), scholarship on teachers' beliefs about digital literacy is limited (Ruday et al., 2013) and previous research on digital literacy has focused primarily on older students (e.g., Gormley & McDermott, 2014). Nevertheless, interviews with 26 PreK – grade 7 teachers from Australia show that participants' attitudes and beliefs about digital literacies are highly diverse (McDougall, 2010). This study revealed that in their discourse about digital literacy, study participants undertook one of the following approaches: "traditionalist", "in survival mode", and "futures-oriented" (pp. 683-684). McDougall (2010) concluded that participants with more traditional beliefs about education favored traditional school practices and defined literacy as the basic skills of reading, writing and math; participants "in survival mode" expressed anxiety and concern regarding their lack of confidence; and the "futures-oriented" participants expressed enthusiasm and acknowledged the need to incorporate digital literacies in their practice. Furthermore, these interviews revealed that teachers,

especially those from early elementary grades, expressed concern about the impact of digital literacies on the more traditional literacy skills of reading and writing.

In another study, Ruday and colleagues (2013) examined grades 6-12 English teachers' attitudes and beliefs about digital literacy. They found while study participants acknowledged the importance of teaching digital literacy to their students, they expressed concern regarding their own "lack of agency" (p. 209) about how to effectively incorporate and teach digital literacy skills in their classrooms. An examination of a national survey of 1,441 U.S. literacy teachers further suggests that teachers are not utilizing digital technologies to address 21st Century skills and the emerging new literacies, such as writing blogs and wikis (Hutchison & Reinking, 2011). Many respondents did not view these skills as important components of literacy instruction.

Teacher beliefs across grade levels. Studies of early elementary teachers have revealed a significant relationship between teachers' grade level assignment and their pedagogical beliefs. Buchanan and colleagues (1998) found that teachers of younger children tend to have more child-centered pedagogical beliefs and their practices are more likely to reflect these beliefs. Participants for this study included 277 first to third grade teachers who responded to a questionnaire. Analyses revealed that developmentally-appropriate beliefs and practices were more common among teachers of younger children than those in the older grades (Buchanan, Burts, Bidner, White, & Charlesworth, 1998). Vartuli (1999) found similar results in her study of prekindergarten-third grade teachers but through her classroom observations (using the Early Childhood Survey of Beliefs and Practices and the Teacher Beliefs Scale) found

that participants reported more developmentally–appropriate beliefs and practices than was observed in their actual classroom practice. There is also empirical evidence that links teachers' grade level assignment to their technology integration practices. For example, Gorder (2008) found a significant correlation between grade-level assignment and K-12 teachers' technology use and integration. Specifically, his study revealed that secondary-school teachers are more likely to use and integrate technologies than teachers in middle and elementary schools.

Students' socioeconomic status and teachers' beliefs. Scholars examining the relationship between students' socioeconomic status and the nature of technology use in K-12 classroom settings have discovered a direct correlation between the quality of use and children's socioeconomic status (see Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008; Reinhart et al., 2011; Warschauer, Knobel, & Stone, 2004; Wood & Howley, 2012). In one study, researchers examined the relationship between early childhood educators' beliefs about developmentally appropriate instructional practices, goals for student learning, and position on various educational policies (Stipek & Byler, 1997). The findings revealed that teachers of low-SES students are more 'basic-skills' oriented whereas teachers of students from middle-income families favor more child-centered practices (Stipek & Byler, 1997). This supports findings from literature on the digital literacy divide, which highlights disparities in children's in-school use of digital technologies based on socioeconomic status (see Judge et al., 2004; Warschauer et al., 2004). Several studies (e.g., Reinhart et al., 2011; Warschauer, 2007), for example, have revealed that in low socioeconomic schools, children's use of digital technology consists

primarily of remedial “drill and practice” type activities. These types of activities are correlated with teacher-directed instructional practices that emphasize a basic-skills approach to teaching and learning (Stipek & Byler, 1997).

Importantly, a longitudinal study of 9,840 Kindergarten and first grade public school children, using data from the Early Childhood Longitudinal Study (ECLS-K), revealed that the digital gap broadens as students enter first grade (Judge et al., 2004). Although the findings from this study indicate progress toward achieving digital equity and a general increase in the availability of the number of technological resources in first grade as compared to in Kindergarten, there was a significant decrease in access to both digital hardware, primarily computers, and software-based programs in schools serving low SES students (Judge et al., 2004). The researchers also found that the children's use of technology for instructional purposes differed based on students’ socioeconomic status. Kindergarten and first grade children in high poverty schools generally used computers for more traditional, remedial learning whereas children in more affluent schools used computers in more innovative ways (Judge et al., 2004). According to Warschauer (2007), students’ quality of use of digital technologies is correlated to their socioeconomic status since the basic literacy skills of children from low-income families are often behind those of children from more affluent families. Teachers’ perceptions about children’s language and literacy skills may in turn influence teachers’ beliefs such that they establish lower expectations, which in turn can result in “developmentally inappropriate” practices that emphasize basic skills (Buchanan et al., 1998, p. 478).

Knowledge and skills. Another second-order barrier to technology integration is teachers' lack of knowledge and skills to effectively incorporate and integrate digital technologies in instructional practices (Hew & Brush, 2007). According to research findings, knowledge plays an important role in teachers' decision-making (Ertmer & Ottenbreit-Leftwich, 2010). A two-year case study of three veteran elementary school teachers who were beginners in computer use revealed that the three participants were less likely to integrate computers in their instructional practices if they lacked or had limited basic computer knowledge and skills (Snoeyink & Ertmer, 2001). Additionally, the participants reported that their limited or lack of computer knowledge and skills also contributed to lack of confidence and comfort in computer use (Snoeyink & Ertmer, 2001).

The Technological Pedagogical and Content Knowledge (TPACK) conceptual framework has been developed to describe the depth of knowledge that is required for teachers to effectively integrate technologies in their teaching (Mishra & Koehler, 2006). Since its introduction, TPACK has received considerable attention from the academic realm (Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak, 2013; Harris, Mishra, & Koehler, 2009). This framework is an expansion of a previously-formulated framework, Pedagogical Content Knowledge (Schulman, 1987) which asserts that content knowledge in isolation from knowledge of the pedagogy is insufficient in assuring quality teaching. The intersection of content knowledge and pedagogical knowledge presents what Schulman (1987) described as pedagogical content knowledge. Utilizing this type of

knowledge, teachers are able to make content knowledge accessible for student learning (Mishra & Koehler, 2006).

The TPACK framework, as defined by Mishra and Koehler (2006), provides a description of the knowledge base that is required for effective and successful integration of technology into teaching to enhance students' learning experiences (Voogt et al., 2013). It requires that teachers fully understand the multifaceted relationship between content knowledge, pedagogy, and technology in order to implement relevant instructional approaches (Mishra & Koehler, 2006). TPACK also asserts that the introduction of new technology into an instructional setting, in and of itself, does not ensure effective usage and implementation (Mishra & Koehler, 2006). In addition, knowledge of technology alone does not guarantee effective integration (Mishra & Koehler, 2006).

TPACK advocates for professional development models that are structured based on "integrated and design-based approaches" (Mishra & Koehler, 2006, p. 1045). Effective integration of technology is situational and is reliant on the subject being taught, the age and experience of students, and the types of technology available (Mishra & Koehler, 2006). Traditional models of teacher professional development, such as workshops and classes that emphasize "context-neutral approaches" (p. 1033), do not necessarily lead to an in-depth understanding of effective technology integration in classroom instruction (Mishra & Koehler, 2006). Successful professional development in technology focuses on advancing teachers' TPACK and is "differentiated, personalized, and adaptive" (Harris, 2016, p. 201) and ongoing (Ertmer, 1999; Levin & Schrum, 2013).

Eight general approaches to TPACK development and learning have been identified in literature, which include problem-based and workplace learning, instructional planning, and collaborative instructional design (Harris, 2016, p. 194). A common feature of all eight approaches is their reliance on teacher collaboration, design, problem-solving, and revision of current instructional practices (Harris, 2016). Ongoing professional development experiences allow teachers more time to try out the digital technologies in their classrooms. This incremental application is more likely to yield positive results in terms of building teachers' self-efficacy (Ertmer & Ottenbeit-Leftwich, 2010). Experiencing success with minor changes in teaching practices that involve the use of digital technology can strengthen teachers' confidence and empowers them to implement more significant instructional changes in subsequent trials (Ertmer, 2005).

In their analysis of the TPACK construct, Brantley-Dias and Ertmer (2013) explained that having TPACK does not necessarily translate into implementation. This may be due to teachers' inability and/or unwillingness to use their technological, pedagogical, content knowledge in ways that positively influence students' educational experiences (Brantley-Dias & Ertmer, 2013). Brantley-Dias and Ertmer (2013) concluded that the TPACK framework, with its principal focus on teacher knowledge, does not take into consideration important variables (e.g., teachers' beliefs, school culture) that have been shown to influence teachers' decision-making in relation to technology integration. If the ultimate objective of technology integration in classrooms is to ensure children's 21st Century skills development, then the current TPACK framework may not be adequate in achieving this goal (Brantley-Dias & Ertmer, 2013).

Summary

Effective technology integration in K-12 school settings is a complex process that is influenced by both first-order (organizational) and second-order (personal) barriers (Ertmer, 1999). To better understand the factors that influence digital literacy instruction, it is important to examine the elaborate network of interactions and interrelationships among different variables that influence the integration and use of digital technologies in public school classrooms. To achieve effective technology integration in support of student learning, both first- and second-order barriers must be identified and systematically addressed (Ertmer, 1999). The present study will therefore examine these barriers in the early elementary grades and will identify supports needed to facilitate teaching and learning with digital technologies.

The Conceptual Framework

Drawing on the three sources of knowledge that inform the direction of the present study, the researcher has adopted the conceptual framework depicted in Figure 1. First, literature on barriers to technology integration in K-12 settings is of particular importance. Ertmer's (1999) examination of first- and second-order barriers provides a framework for understanding organizational and personal level factors that may influence teachers' decision-making in integrating technology in their instructional practices.

The second source of knowledge comes from literature on teachers' beliefs. [1] Teacher beliefs are intricate and multifarious (Fives & Buehl, 2012). Previous research

[1] Teacher beliefs have been the subject of scholarly examination and analysis since the 1950's (Fives & Buehl, 2012). While there have been a number of scholars who have defined teacher beliefs (e.g., Hermans et al., 2008; Kagan, 1992; McAlpine, Eriks-Brophy, & Crago, 1996), Pajares (1992), in his seminal review

has demonstrated a correlation between teachers' beliefs and their instructional practices and has shown that personal or contextual limitations may hamper the enactment of these beliefs (Fives & Buehl, 2012). Taking this into consideration, the present study will examine the relationship between early elementary grade teachers' beliefs and attitudes about digital literacy instruction and personal- and school-level variables (e.g., teachers' current grade level teaching assignment).

The third source of knowledge comes from systems thinking (Meadows, 2008). Meadows (2008) defines a system as "a set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviors" (p. 188). The world is composed of many systems. Each system has multiple layers and functions within a complex and interconnected web of other systems (Meadows, 2008). Schools are complex systems, composed of many interconnected parts that are continuously influenced by dynamic and changing internal and external factors (Cuban, 2013). Many of the challenges that educators are confronted with, such as narrowing the achievement gap and increasing student engagement, are ill-structured or ill-defined (Mintrop & Zumpe, 2016), hence, they lack a "convergent solution strategy" (p. 4). These problems cannot be effectively addressed without an in-depth understanding of the intricate and expansive nature of the educational system and the interrelationship and interdependence among its myriad of constituents (Mintrop &

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of literature, described teacher beliefs as a "messy construct" and difficult to study due to "definitional problems, poor conceptualizations, and differing understandings of beliefs and belief structures" (p. 307). Based on his synthesis of research, Pajares (1992) concluded that teacher belief systems consist of networks of interrelated and converging beliefs. He added that a person's beliefs significantly influence one's perception and behaviors. Nevertheless, the present study will evaluate teacher beliefs (broadly defined) given that previous research has demonstrated a clear association between beliefs and practice.

Zumpe, 2016). Focusing on only parts of the system is inadequate in addressing the barriers to technology integration and in bringing about effective and sustainable change (Levin & Schrum, 2013).

Application of the systems thinking framework to technology integration in K-12 educational settings ensures that all components of the system are addressed concurrently, with the knowledge that the introduction of digital technologies not only impacts the classroom system, it inevitably affects the behavior and the interrelationships of other parts of the larger school site and district systems as well (Levin & Schrum, 2013). Furthermore, utilizing the systems thinking approach provides the opportunity to take into consideration multiple perspectives and allows for an analysis of both extrinsic factors or first-order barriers (e.g., lack of or limited access to technology) and intrinsic factors or second-order barriers (e.g., teachers' attitudes and beliefs about technology's utility in instruction) that affect the use of technology in public school classrooms (Ertmer, 1999; Mardis et al., 2008).

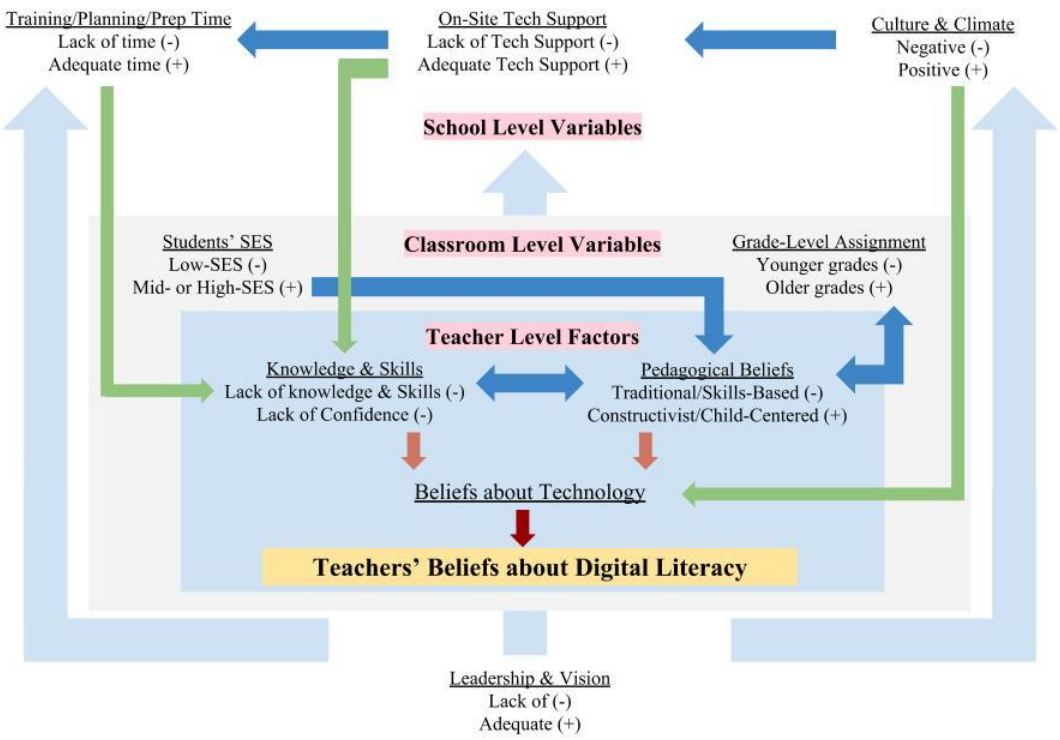

Figure 1. The conceptual framework for the present research which utilizes literature on first- and second-order barriers (Ertmer, 1999), teachers' beliefs, and systems thinking (Meadows, 2008). Note that the framework is organized according to school-, classroom-, and teacher-level variables.

Summary

Successful integration of digital technologies into classrooms in ways that will ultimately support the development of students' 21st Century skills is like building a complex puzzle; all pieces must be in the right place simultaneously for the puzzle to be complete (Levin & Schrum, 2013). As we approach the end of the second decade of the 21st Century, it is critical that digital technologies and the development of digital literacy skills become integrated in our existing teaching ideologies and classroom practices.

The present study will evaluate early elementary grade teachers' beliefs about digital literacy development in the Common Core era. It will also examine the extent that early elementary grade students are provided with opportunities to achieve digital literacy skills, particularly those skills recommended by the CCSS K-12 Technology Skills Scope and Sequence. Findings from this study will then provide valuable information for district- and site-level educational leaders as they attempt to address existing barriers and provide the supports needed to facilitate digital literacy instruction in the early elementary grades.

Chapter 3: Research Design and Methodology

The present study evaluates teachers' attitudes and beliefs about digital literacy development in early elementary school. The study also explores existing barriers and identifies support systems to facilitate digital literacy instruction in Kindergarten-second grade. The following chapter provides a detailed narrative of the study's research design and methodology. The chapter commences with a review of the research questions which is followed by a description of the study site, research subjects, and survey instrument. The latter part of this chapter provides a description of the proposed data analysis methods and a discussion of possible limitations.

Research Questions

The following five research questions guide this investigation:

RQ1: Are early elementary school students provided with ample opportunity to achieve the skills recommended in the CCSS K-12 Technology Skills Scope and Sequence?

Following the review of literature presented in Chapter 2, it is hypothesized that early elementary school students are offered few opportunities to achieve these skills and that this will vary across grade levels (e.g., Kindergarteners will have less exposure and fewer opportunities to learn these skills as compared to first and second graders).

RQ2: What specific school-level supports enhance digital literacy instruction in the early elementary grades and to what extent do these supports influence teaching practices?

Previous research indicates (a) planning time (Ertmer, 1999), (b) on-site tech support (Hernández-Ramos, 2005), (c) differentiated training sessions (based on individual teacher's needs) (Ertmer, 1999; Hew & Brush, 2007), and (d) observations of demo lessons by colleagues or tech coaches (Ertmer, 1999) as possible supports that enhance digital literacy instruction in the early elementary grades. This study explores the extent to which these resources support teaching and whether additional supports are needed.

RQ3: What specific barriers interfere with digital literacy instruction in the early elementary grades and to what extent do these barriers influence teaching practices?

Previous research (e.g., Ertmer, 1999) suggests that: (a) limited time to learn, plan, prepare, and collaborate, (b) lack of on-site support, including adult support, in classrooms, (c) inadequate training, and/or (d) inconsistent vision and leadership are first-order barriers that may interfere with digital literacy instruction. Possible second-order barriers may include: (a) teachers' lack of knowledge and/or confidence, and/or (b) general negative beliefs about digital technology in classrooms. The present study evaluates the relative influence of each of these barriers on instruction and pedagogy.

RQ4: What is the relationship between early elementary school teachers' current teaching assignment and their beliefs about digital literacy development?

For this analysis, teacher's 2017-2018 grade-level assignment serves as the independent variable and the dependent variable is teacher's beliefs about

digital literacy development. It is hypothesized that teachers' grade level assignment influences their beliefs about when and whether to introduce various digital literacy skills.

RQ5: What is the relationship between students' socioeconomic status and early elementary school teachers' beliefs about digital literacy development? For this analysis, the independent variable is the school's Title I status and the dependent variable is teacher's beliefs about digital literacy development. Following previous reports (e.g., Judge et al., 2004), it is hypothesized that teachers of low SES students are more likely to focus on developing children's core academic skills of reading, writing, and arithmetic rather than developing children's digital literacy skills.

Site Description

This study surveyed early elementary school teachers from a district in Northern California. According to the 2016-2017 California Department of Education enrollment data, this school district serves a population of approximately 10,000 students in grades TK through 8. Approximately 48.1% of these students are Hispanic or Latino, 19.9% are Asian, 17.9% are White, 5.5% are bi- or multiracial, 4% are Filipino, 3.6% are African American, 0.8% are Native Hawaiian/Pacific Islander, and 0.3% are American Indian/Native Alaskan. About 40.4% of the students enrolled in grades TK-8 receive free or reduced-price meals – a program offered to children from low-income families. Three of the 16 elementary schools in this district receive Title I funding – a form of financial aid allocated through the U.S. Elementary and Secondary Education Act to public schools

where a significant portion of the student population is from low-income families (U.S. Department of Education, n.d.).

This particular school district was selected for this study for several reasons. First, in recent years the school district has attempted to minimize the barriers to technology integration associated with a lack of resources - particularly issues related to the lack of access to technology, technical support, and training which have been shown to significantly obstruct the path to successful technology integration in schools (Ertmer, 1999; Ertmer & Otternbreit-Leftwich, 2010). The district has carried out a phased plan, beginning in 2013 and ending in 2017, to provide Chromebooks for use in Transitional Kindergarten through eighth grade throughout the district as part of their technology plan. As a result, all students enrolled in this school district have access to Chromebooks and an individualized Gmail account. The school district also provides a stipend for at least one Tech Mentor (a staff member who provides on-site tech support) at every school in the district. In addition to the tech support provided by on-site Tech Mentors, all teachers have access to individualized trainings and/or in-class demonstrations (e.g., how to use and incorporate Google Docs in instruction) provided by district-level EdTech coaches.

Second, the school district has aimed to address the barriers associated with lack of vision and leadership for technology integration by explicitly detailing the use of digital technologies for enhancement of student-learning outcomes, particularly in relation to the development of 21st Century skills, in the district's Local Control Accountability Plan (LCAP). The district has also adopted and adapted the CCSS K-12 Technology Skills Scope and Sequence document for use in Transitional Kindergarten through eighth grade.

Furthermore, as of Fall 2016, a new article has been added to the teachers' contract requiring the school district to provide training opportunities for any technology that teachers are required to use.

These purposeful efforts to reduce first-order barriers through increased access to digital technology resources (e.g., Chromebooks), the availability of district-level tech coaches and site-level tech mentors, and a consistent vision and leadership for technology integration, make this particular district an ideal research site. Furthermore, by surveying participants from this particular district, the researcher can evaluate whether early elementary school teachers continue to encounter barriers in digital literacy instruction despite the availability of tech resources and the support systems in place.

Research Participants

There are approximately 140 early elementary grade general education teachers employed in the district (e.g., Kindergarten, first, and second grade teachers as well as teachers with combination-grade teaching assignments such as Kindergarten/first grade combination classrooms). The district includes three Title I schools and 13 non-Title I schools. All eligible teachers in the district were invited to participate.

Data Collection Method

Data was collected using an online survey that was accessible over a span of three weeks. The initial email invitation was followed by two reminders. The survey instrument was designed to address the study's primary research questions by offering an efficient method to collect data from a large number of participants and allowing for quantitative data analysis, which is essential in establishing statistically significant

relationships between variables. The online survey also has the added benefit of maintaining participants' anonymity, such that they may be more likely to respond honestly (Dillman, Smyth, & Christian, 2014).

Scholarship on teachers' beliefs and attitudes about technology and the barriers to technology integration (e.g., Ertmer, 1999) was consulted to generate a list of items for the survey instrument. Survey questions asking about the respondents' grade-level teaching assignment (Question 1), years of teaching experience (Question 2), and their beliefs about when it is appropriate to introduce various elements of digital literacy (Questions 11-20) were adapted from Blackwell et al.'s (2015) survey instrument which was used in a study of 945 early childhood educators. Questions about when and how to introduce various elements of digital literacy (Questions 11-20) and students' use or anticipated use of digital technology devices (Questions 47-54) incorporate language from the CCSS K-12 Technology Skills Scope and Sequence document (LBUSD, n.d.). Survey questions asking whether and how certain factors interfere with or enhance teachers' abilities to support digital literacy skills (Questions 21-38) were modeled off of the Technology Skills, Beliefs, and Barriers Scale (Brush et al., 2008), which was previously used in a study of preservice teachers.

Prior to implementation, a paper copy version of the survey instrument was piloted to determine comprehensibility, coherence, and the amount of time required to complete the survey. All necessary adjustments (e.g., wording of survey questions to ensure clarity) were made accordingly. After the piloting phase, the online survey was developed using

Qualtrics and submitted for IRB review. Upon approval, the researcher emailed the consent form and survey to all eligible participants.

Proposed Analysis Method

The survey instrument contained primarily closed-ended and multiple-choice questions in addition to five open-ended questions (see Appendix B). Most survey items followed a 5-point Likert Scale format ranging from 1 (e.g., "strongly disagree") to 5 (e.g., "strongly agree"). Survey Questions 47-54 (students' frequency of use or anticipated use of digital technology devices to engage in a variety of activities) provided data to answer RQ1 which asks how often children are provided with opportunities to practice the digital literacy skills that are recommended by the CCSS K-12 Technology Skills Scope and Sequence. The factors that interfere with digital literacy instruction in the early elementary grades (RQ3) were explored using data collected from survey Questions 7-10 (which assessed participants' familiarity with 21st Century skills, digital literacy, and technology standards) as well as Questions 28-43 (which assessed whether certain factors interfere with or enhance their ability to teach digital literacy skills). Questions 1 (current grade-level teaching assignment), 11-20 (participants' beliefs on the earliest introduction of various elements of digital literacy), 21-27 (an evaluation of participants' pedagogical values) and 28-43 (an evaluation of whether and how certain factors interfere with or enhance their teaching) provided data to answer RQ4 which evaluates the relationship between early elementary grade teachers' beliefs about digital literacy development and their current grade-level teaching assignment. Survey Question 6 (the school's socioeconomic status) provided data to answer RQ5 concerning the

relationship between early elementary grade teachers' beliefs about digital literacy development and their students' socioeconomic status.

Relationships and correlations amongst and across survey questions were explored. Specifically, the researcher compared responses to questions asking about teachers' beliefs about digital literacy development across grade levels in order to address RQ4. Additionally, responses to questions asking about potential barriers and enhancers were compared across grade levels in order to address RQ2 and RQ3. Responses to the open-ended questions were coded for further analysis using in vivo and provisional coding methods (Miles, Huberman, & Saldaña, 2014) primarily based on Ertmer's (1999) first- and second-order barriers.

Possible Limitations

There are several limitations to this study that should be considered. First, the survey instrument (Appendix B) was the primary method of data collection utilized in this research. Although the survey instrument offers an efficient method to collect data from a large number of participants while ensuring participants' anonymity, this methodology relies on self-reported quantitative data which may not provide the depth of information often rendered through interviews or classroom observations. Second, while every effort was made to solicit participation, less than 30% of the eligible participants returned a complete survey (see Chapter 4), which may affect the generalizability of the research findings. Third, whereas there are advantages to using closed-ended questions (e.g., efficient method of data collection), there are also some drawbacks in that participants may interpret the survey questions differently or may choose not to respond to certain

questions which can then lead to inconsistencies in the data (Krosnick & Presser, 2010). Lastly, there may be other variables (e.g., students' race), not examined in this study, that may influence early elementary grade teachers' beliefs about digital literacy development.

Researcher Positionality

This study is of particular interest to the researcher. As a first-grade teacher at one of the schools in the district since 2004, the researcher has personal experience with the changes that the new technology mandates have introduced with regard to teaching and learning expectations and has a first-hand account of the challenges and barriers that teachers face when integrating digital technologies in classroom instruction. Furthermore, the researcher is in a unique position to enhance programming at the research site.

However, it should be noted that the researcher has close working relationships with several of the study's participants, which may have influenced their willingness to participate and/or provide specific responses according to what they believed the researcher would like to see. To address this concern, all potential participants were informed that all personally identifying information would be removed to maintain confidentiality and anonymity.

Chapter 4: Results and Findings

This chapter explores the results and findings of the study. The first section of this chapter will review participant demographics. This will be followed by an examination of the data pertaining to each of the five research questions. The last section of this chapter will recap the study's key results and findings.

Participant Demographics

Thirty-seven early elementary grade teachers participated in this study, including 24% Kindergarten teachers (n = 9), 43% first grade teachers (n = 16), and 32% second grade teachers (n = 12). Participants who taught a first/second grade combination class (n = 5) were classified as first grade teachers and participants who taught a second/third grade combination class (n = 5) were classified as second grade teachers. Participants' teaching experience varied from 1 to 31 years (M = 16.2 years) while their teaching experience in their 2017-2018 grade-level assignment ranged from 1 to 24 years (M = 7.2 years). Participants across the three early elementary grade levels had similar levels of teaching experience (mean years of experience = 17.7 for Kindergarten teachers, 14.9 years for first grade teachers, and 14.9 years for second grade teachers). Overall, the Kindergaten teachers were more experienced in teaching their current grade-level assignment (M = 12.1 years). First and second grade teachers had fewer years of teaching experience in their 2017-2018 grade-level assignments (M = 6.5 and M = 4.8, respectively). Of the 37 teachers who participated in this study, 24% (n = 9) were employed at Title I schools. Participants from both Title I and non-Title I schools had similar teaching backgrounds (M = 16.0 and M = 16.3 years of teaching experience, and

M = 7.4, *M* = 7.2, years of experience in their 2017-2018 grade level assignment, respectively).

Opportunities to Practice Digital Literacy Skills

To address the first research question regarding students' frequency of use, or anticipated use, of digital technology devices to practice the skills recommended in the CCSS K-12 Technology Skills Scope and Sequence, the researcher evaluated participants' responses to survey questions #47-54. For these questions, participants were asked to rate, on a scale from 1 (Never) to 5 (Always – several times a week), students' frequency of use, or anticipated use, of digital technology devices to engage in a variety of activities that promote the development of digital literacy skills. Results show that students across the three early elementary grade levels learn basic computer operations skills (e.g., turn on a computer), access age-appropriate software and online websites, and engage in online structured learning activities (e.g., complete lessons online), several times a week (*M* = 4.5, *M* = 4.6, and *M* = 4.6, respectively). In response to the open-ended questions, one participant mentioned that, "We are on the Chromebooks weekly for i-Ready lessons." Another participant noted, "New teachers especially only really hear that students should be doing 45 minutes per week of i-Ready." Overall, results indicate that students are provided with opportunities to develop basic computer literacy skills (e.g., basic operations skills) (Hignite et al., 2009), but they seldom engage in activities that promote the development of information literacy skills (e.g., locate/collect information online) which focus on the students' ability to gather,

analyze, and effectively apply information acquired through digital sources (Hignite et al., 2009) (see Figure 2).

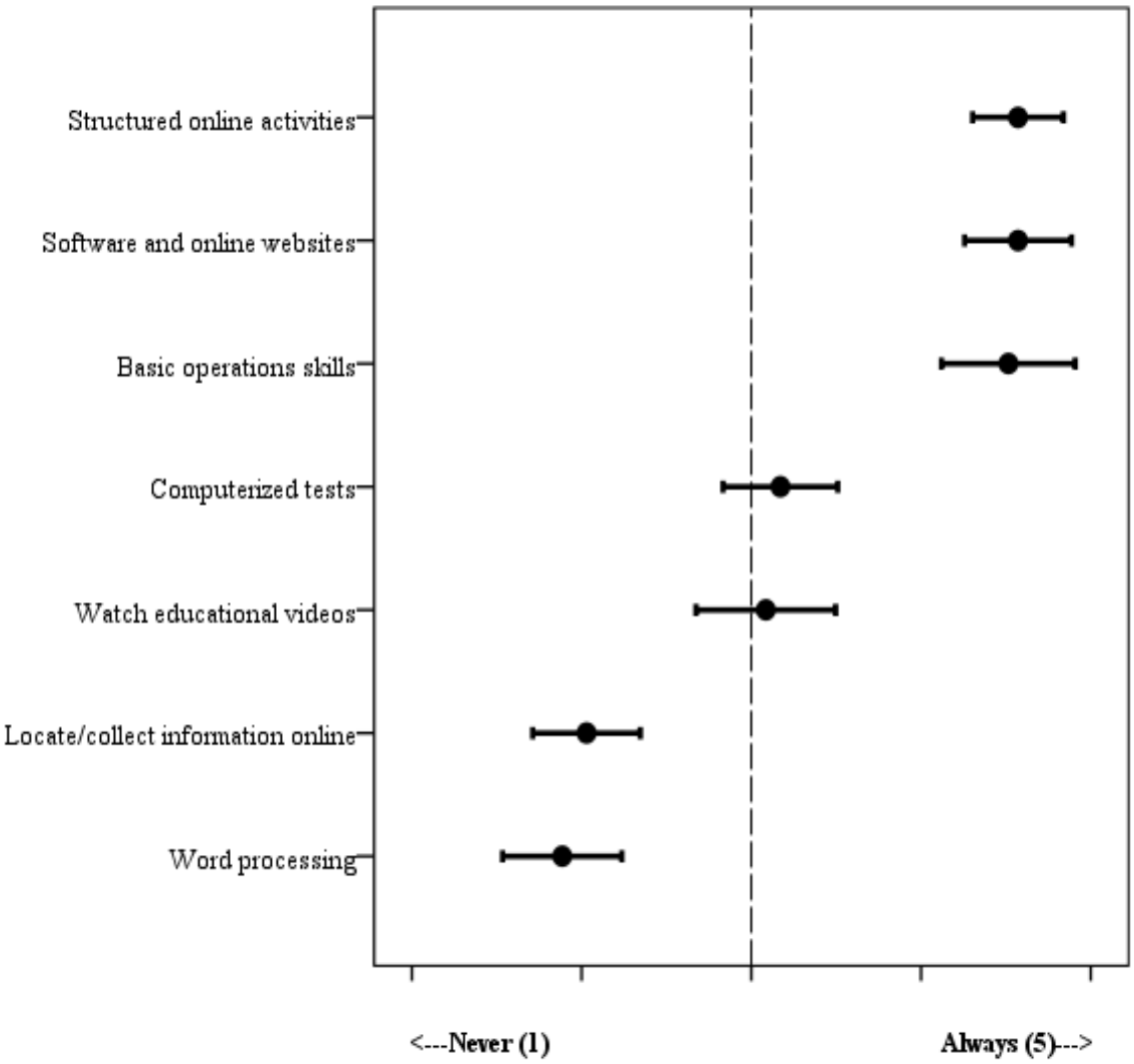

Figure 2. Students' frequency of use of digital technology devices to engage in a variety of activities. Circles represent the mean response, error bars represent +/- 2 SE.

Overall, second grade students engage in activities that promote the development of digital literacy skills more frequently than students do in first grade and Kindergarten (see Figure 3). However, it appears that first grade students do not take computerized assessments (M = 2.8) nor engage in structured learning activities (e.g., complete lessons

online) (M = 4.5) as frequently as students do in Kindergarten and second grade. In fact, a One-Way ANOVA revealed a significant difference in the frequency by which students locate and collect information from online sources across grade levels, $F(2, 35) = 9.733$, $p < .001$. More specifically, second grade students (M = 2.7) use digital technology devices to locate and collect information from online sources significantly more often than first grade (M = 2.0) and Kindergarten students (M = 1.2). Students across the three grade levels, however, are provided with ample opportunities (at least 3 to 6 times a month) to learn basic computer skills, access age-appropriate software and online websites, and engage in structured online learning activities (e.g., completing lessons online) (See Figure 3).

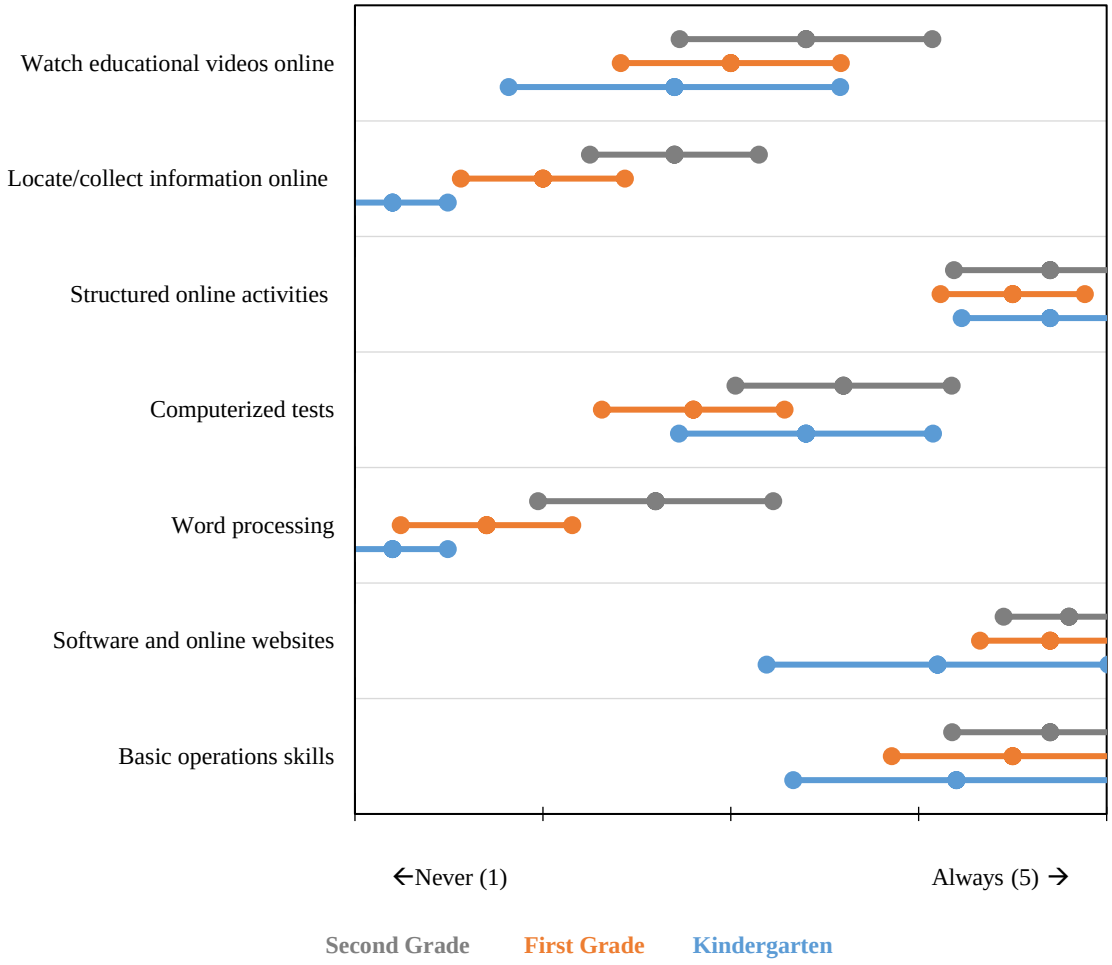

Figure 3. Students' use of digital technology devices to engage in a variety of activities across the three early elementary grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

Importantly, students across the three grade levels seldom access a word processing application to write, edit, print, and save simple assignments. A One-Way ANOVA revealed a significant difference in the frequency of students' use of word processing applications according to grade level, $F(2, 35) = 6.592$, $p = .004$. Second grade teachers offer support with accessing word processing applications notably more often ($M = 2.6$) than first grade ($M = 1.7$) and Kindergarten teachers ($M = 1.2$) (See Figure 4). A

majority of the Kindergarten teachers (77.8%), 46.7% of the first grade teachers, and 8.3% of the second grade teachers reported that their students never access a word processing application during the course of the school year. One Kindergarten teacher noted, "If I can get to word processing (typing 1 sentence or even 1 word) that would be amazing, but not possible at my grade level." Fifty percent of second grade teachers, 40% of first grade teachers, and 22.2% of Kindergarten teachers indicated that their students rarely (less than once a month) access a word processing application to write, edit, print, and save simple assignments.

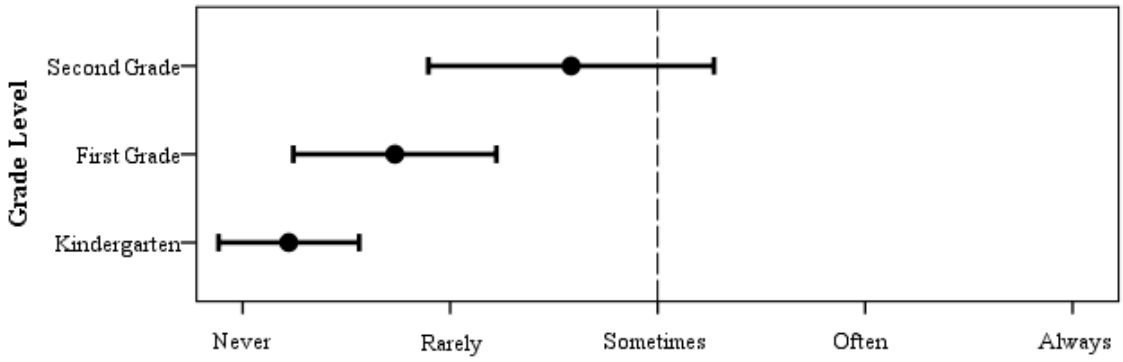

Figure 4. Students' use of digital technology devices to access a word processing application such as Google Docs, to write, edit, print, and save simple assignment across the three early elementary grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

School Level Supports and Barriers

Participants' responses to survey questions #28-43 were evaluated to address the second and third research questions about school-level supports and barriers that influence digital literacy instruction in the early elementary grades. For these questions, participants were asked to identify the extent to which certain factors interfere or enhance their ability to teach digital literacy skills on a scale from 1 (significantly interferes with

teaching) to 4 (significantly enhances teaching). Participants also had the option to mark "Not Applicable/Not Available at My Site." Participants' responses to survey questions #7-10, which asked participants to rate their familiarity with 21st Century skills and digital literacy, as well as the district's and the grade-level specific technology standards on a scale from 1 (strongly disagree) to 5 (strongly agree) were also included in these analyses. Finally, analyses explored participants' written responses to survey question #44 and #45, which asked about additional supports that schools can provide to enhance teachers' ability to teach digital literacy skills and to describe any other factors that interferes with digital literacy instruction.

Teachers' knowledge. A Repeated Measures ANOVA revealed a significant difference with regards to participants' knowledge of 21st Century skills, digital literacy, and technology standards, $F(3,36) = 37.58$, $p < .001$. Overall, participants perceived themselves to be more knowledgeable about 21st Century skills ($M = 4.2$) and the definition of digital literacy ($M = 3.9$). They were less knowledgeable about the technology standards that the school district has adopted ($M = 3.0$). Participants were least familiar with their grade-level specific technology standards ($M = 2.8$) (see Figure 5).

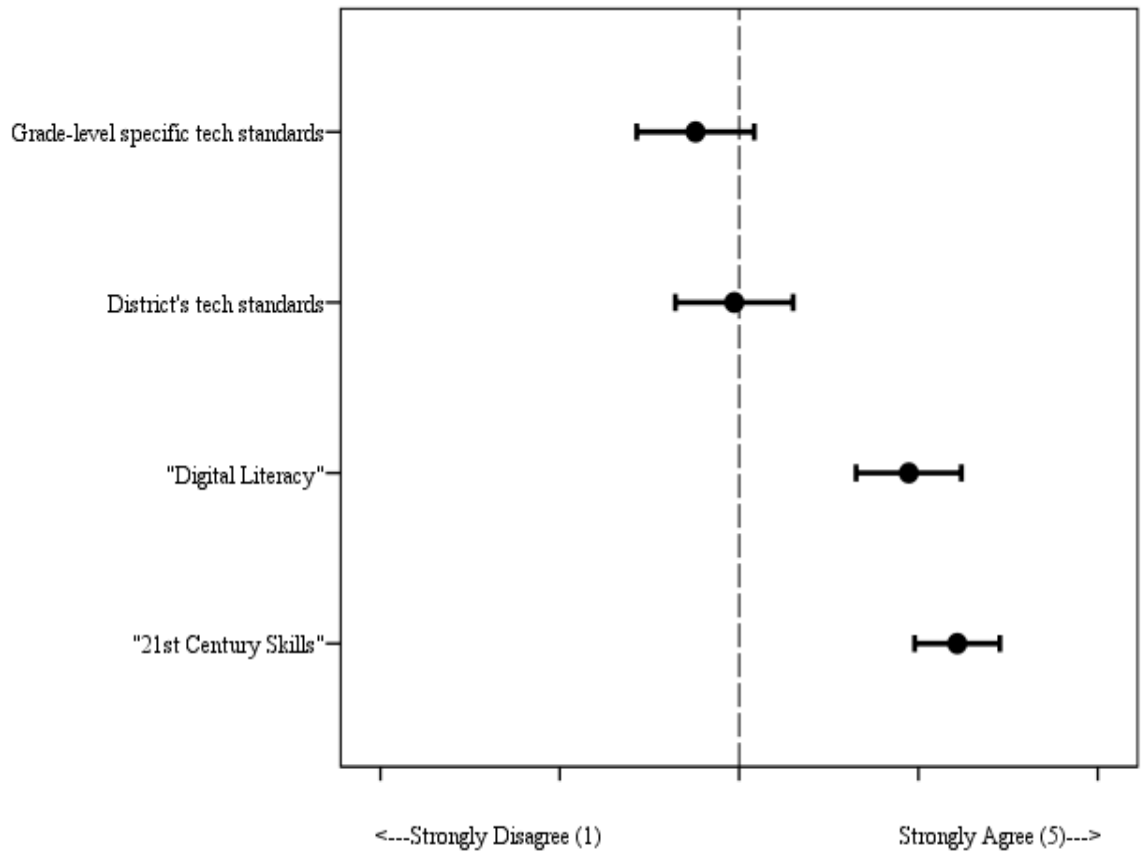

Figure 5. Participants' familiarity with digital literacy terminology and standards. Circles represent the mean response, error bars represent +/- 2 SE.

Barriers and supports. Overall, participants identified first-order (Ertmer, 1999) or organizational-level obstacles as barriers to digital literacy instruction in the early elementary grades (see Figure 6). According to 94% of participants, the students-to-teacher ratio is the most impactful barrier to teaching digital literacy skills in the early elementary grades (M = 1.6). One participant stated:

> The biggest issue that I have is that it is difficult for me to instruct and monitor 23+ students on computers when there is only one me. They have a difficult time following directions with a computer in front of them. Another person in the room would help immensely.

Other participants suggested providing “an actual computer teacher” and “an aid in the computer lab.”

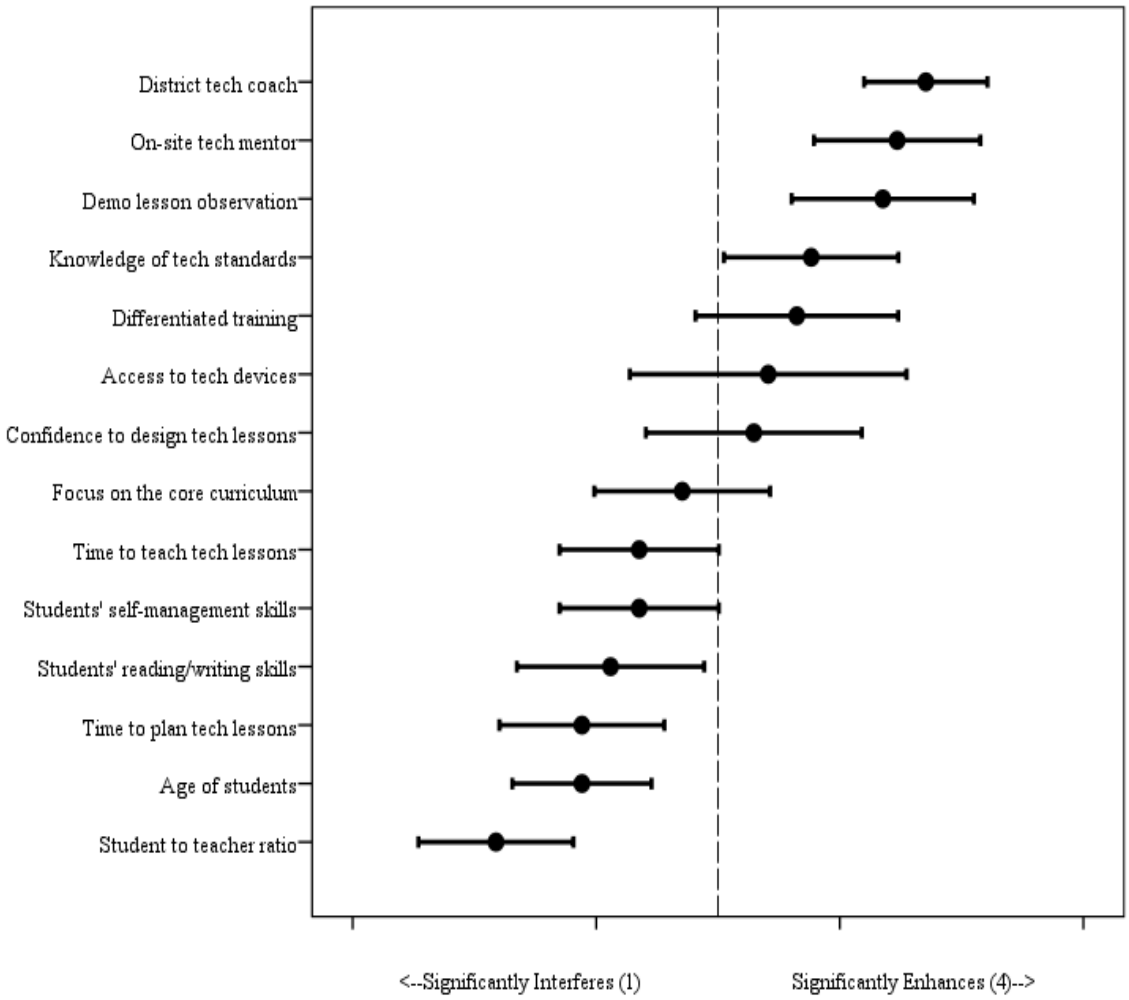

Figure 6. Factors that interfere with or enhance the participants’ ability to teach digital literacy skills. Circles represent the mean response, error bars represent +/- 2 SE.

The lack of time to plan technology lessons (*M* = 1.8) and the lack of time during the school day to teach these technology lessons (*M* = 1.9) are also significant barriers to teaching digital literacy skills in the early elementary grades. There is “not enough time in the day” as one participant pointed out. Although there is no statistically significant difference among grade levels ($p > .05$), the lack of time to plan and to teach technology

lessons appears to be a more considerable hurdle for participants who teach second grade than it is for participants who teach first grade and Kindergarten (see Figure 7). The expectation to focus on the core curriculum, especially reading, writing, and math (*M* = 2.4) was also identified as a barrier to digital literacy instruction across all of the early elementary grades. One first grade teacher noted, "Priority goes to teaching my students how to read, write, and become math-literate," while another pointed out, "I don't have time to implement because of demands of SEAL and core programs." Similarly, a second grade teacher commented that having "too many other things to do" interferes with digital literacy instruction in the classroom. While there is no statistically significant difference across grade levels, the expectation to focus on core curriculum instruction appears to negatively impact second grade teachers (*M* = 2.2) slightly more so than Kindergarten (*M* = 2.3) and first grade teachers (*M* = 2.5) (Figure 7).

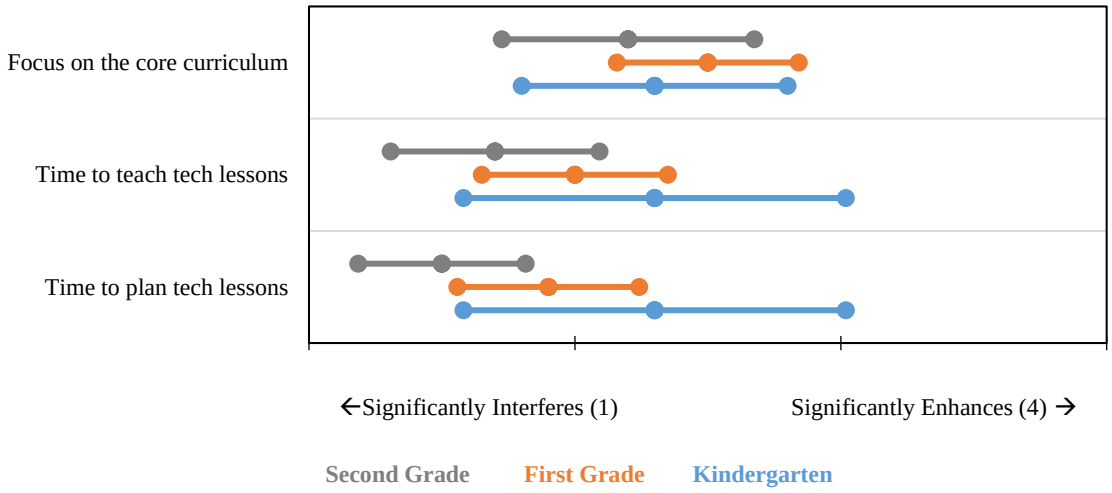

Figure 7. Participants' perceptions about the impact of time and the core curriculum mandates on digital literacy instruction. Circles represent the mean response, error bars represent +/- 2 SE.

Other barriers include students' age (M = 2.1), students' basic reading and writing skills (M = 2.1), and students' self-management skills and independence (M = 2.2) (see Figure 8). According to one teacher, "It is difficult to maintain all students' attention when demonstrating how to do certain things on the computer when they each have a computer in front of them." Children's age, self-management, and academic skills appear to present a greater challenge for participants who teach the earlier grade levels. For example, one participant noted, "Mainly their age and independent level interferes with digital literacy instruction. In Kindergarten, they all need one on one support which is not possible in a classroom setting." Another participant who taught Kindergarten observed, "Technology should wait until later in the year."

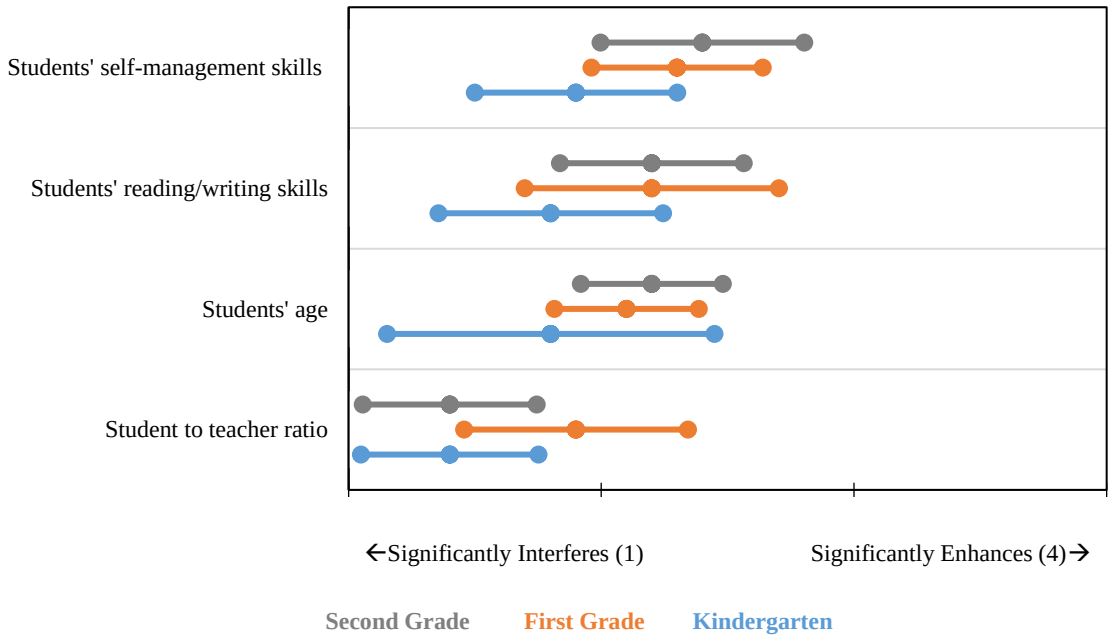

Figure 8. Student-related factors that interfere with or enhance the participants' ability to teach digital literacy skills across grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

Limited access to Chromebooks and technical glitches (e.g., “internet slow/crashing”) were also cited as barriers to digital literacy instruction in the early elementary grades (see Figure 9). Regular access to digital technology devices appears to be more impactful in Kindergarten (M = 3.1) than in first and second grade (M = 2.9 and M = 2.3 respectively). One participant noted that there are “not enough Chromebooks for my class. I need to borrow every day,” while another pointed out that, “Often I don’t have access to enough devices.” One participant suggested that, “Better quality headphones (sturdy materials for younger students) are much needed.” Overall, these responses indicate that frequent access to robust and dependable digital technologies exerts a positive influence on digital literacy instruction. In fact, according to 61% of participants, access to digital technology devices such as Chromebooks enhances digital literacy instruction in the early elementary grades.

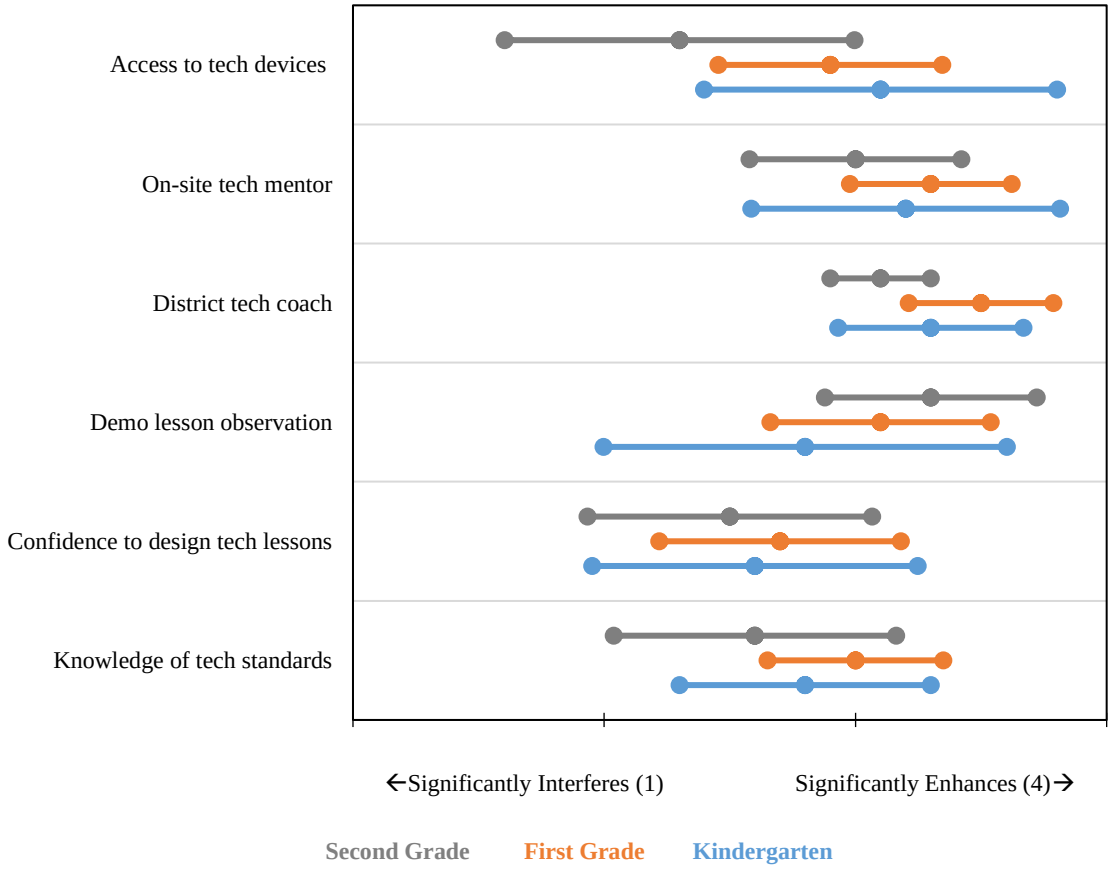

Figure 9. Factors that interfere with or enhance the participants' ability to teach digital literacy skills across grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

Participants' views about second-order barriers (Ertmer, 1999) were mixed. While 55% of participants viewed their confidence in their own skills and knowledge to design age-appropriate technology lessons as supporting their ability to teach digital literacy skills, 46% of respondents identified it as a barrier. Data on participants' confidence in their own knowledge of grade-level technology standards yielded similar results. Whereas 70% of participants viewed their confidence in their own skills and knowledge of grade-level technology standards as a factor that enhances their ability to teach digital

literacy, 30% identified it as a barrier. Although a statistically significant difference across grade levels does not exist, participants who taught first grade seemed to be more confident in their own skills and knowledge of grade level technology standards (*M* = 3.0) as compared to Kindergarten (*M* = 2.8) and second grade teachers (*M* = 2.6).

The most impactful support that enhances digital literacy instruction in the early elementary grades appears to be teachers' access to a district tech coach (*M* = 3.3) (Figure 9). In response to a question asking about other supports needed to enhance digital literacy instruction, one participant stated:

> More time with tech coaches on a regular basis - we schedule appointments with our tech coaches and seek them out as needed. Often I get too busy and forget. If ongoing coaching was a part of our planning, then there would be much more forward movement.

Observations of demo lessons by colleagues or tech coaches (*M* = 3.1) and availability of on-site tech mentors (*M* = 3.2) also support digital literacy instruction; however, observations of demo lessons by colleagues or tech coaches are more impactful for participants who teach second grade (*M* = 3.3) than for those who teach first grade (*M* = 3.1) and Kindergarten (*M* = 2.8) (Figure 9).

Data on the administrator's impact on the participants' ability to teach digital literacy was inconclusive. In fact, more than half of the participants (53%) indicated that the administrator's evaluation of their ability to teach digital literacy is not applicable or not available at their school site. Similarly, over 39% of participants indicated that expectations to teach digital literacy skills from the site administrator are either "not applicable" or "not available". Participants' responses to the open-ended questions highlight a potential gap between teachers' views about digital literacy instruction and the

district's expectations related to technology use in the early elementary grades. One participant stated that, "I wish our district had a greater focus on technology, not just iReady testing." This sentiment was shared by another participant who pointed out that the district should "make good digital literacy a priority; iReady is not good digital literacy."

Participants had mixed views about the impact of differentiated training sessions that address teachers' specific learning needs related to digital literacy instruction. While 40% of participants indicated that differentiated training sessions enhance their ability to teach digital literacy skills, 26% identified this factor as a barrier and 34% indicated that it is not applicable or not available at their school site. Grade level analysis of data also produced mixed results. Participants who taught first grade viewed differentiated training sessions more positively (M = 2.9) than participants who taught Kindergarten (M = 2.4) and second grade (M = 2.4).

Grade-Level Teaching Assignment

To address the fourth research question about the relationship between early elementary school teachers' current teaching assignment and their beliefs about digital literacy development, the researcher grouped survey responses into three categories: Kindergarten, first, and second grade. Participants' responses to survey questions #7-10 (participants' familiarity with 21st Century skills, digital literacy, and technology standards), #11-20 (participants' beliefs on the earliest introduction of various elements of digital literacy), and #21-27 (participants' pedagogical values) were examined.

Teachers' knowledge. Overall, participants across all three early elementary grade-levels were more knowledgeable about 21st Century skills and the definition of digital literacy as compared to their knowledge of the technology standards that the school district has adopted (including their grade-level specific technology standards). An analysis of the responses to survey question #46, which asked participants to define digital literacy at their current grade-level assignment, revealed that the majority of participants across all three grade-levels define digital literacy in terms of computer literacy skills (e.g., the ability to perform basic computer operations like operating a mouse and touch screen, Hignite et al., 2009). A few of the participants who taught first and second grade defined digital literacy in terms of both basic operations skills as well as information literacy skills which center on the children's capability to collect, assess, and effectively utilize information obtained from digital sources (Hignite et al., 2009). One participant pointed out:

> Digital literacy in second grade looks like understanding the usefulness of the internet as a tool for learning as well as a place where we must be careful. My students are already on YouTube, so they have some interaction with the internet. They need instruction on how to be safe and kind on the internet and what to do if they see or experience cyberbullying. They also should know how to search for information and how to type up their ideas.

A participant who taught first grade added, "Students should be able to log on, maneuver through Google Classroom, conduct searches, identify sources, begin keyboarding, and communicate and collaborate with others in safe and respectful ways."

The participants across all three early elementary grade-levels were least knowleageable about the specific technology standards that the school district has adopted for each of their grade-levels. In particular, second grade teachers were least

knowleageable about the specific grade-level technology standards that the district has adopted. The perceived lack of knowledge may be due to the fact that 58% of second grade teachers have 1 to 5 years of teaching experience in their current grade-level assignment (a result that will be revisited in detail in Chapter 5). According to one participant who taught second grade, "the district's technology expectations need to be made more clear and we need additional training on how to meet those expectations." Another participant stated, "when I met with the Tech Coach, he mentioned all these standards per grade level that I wasn't aware of."

Views on the earliest introduction of various elements of digital literacy. Participants across all three grade levels were in favor of introducing students to digital technology devices and teaching them the basic operations and responsible use and handling prior to first grade (see Figure 10). Participants indicated that keyboarding and typing skills should be introducted in first grade and that word processing skills should be introduced in second grade. A participant who taught first grade added, "I think explicitly teaching surveys, Google slides, Google docs, keyboarding, and Google classroom should all begin in third grade." Overall, participants who taught Kindergarten were more in favor of introducing information literacy skills (e.g., use a variety of digital resources such as presentation software to communicate and exchange ideas) in second grade and beyond (see Figure 11).

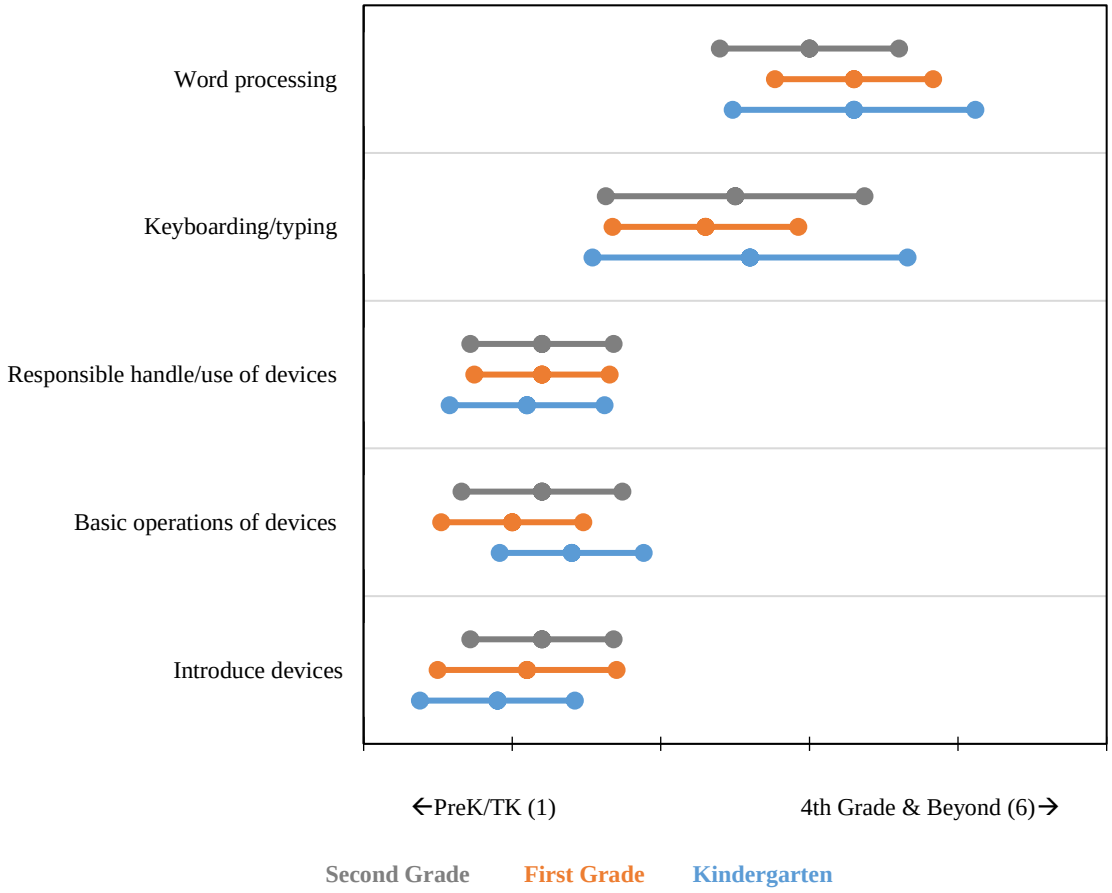

Figure 10. Participants' beliefs on the earliest introduction of basic computer literacy skills across grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

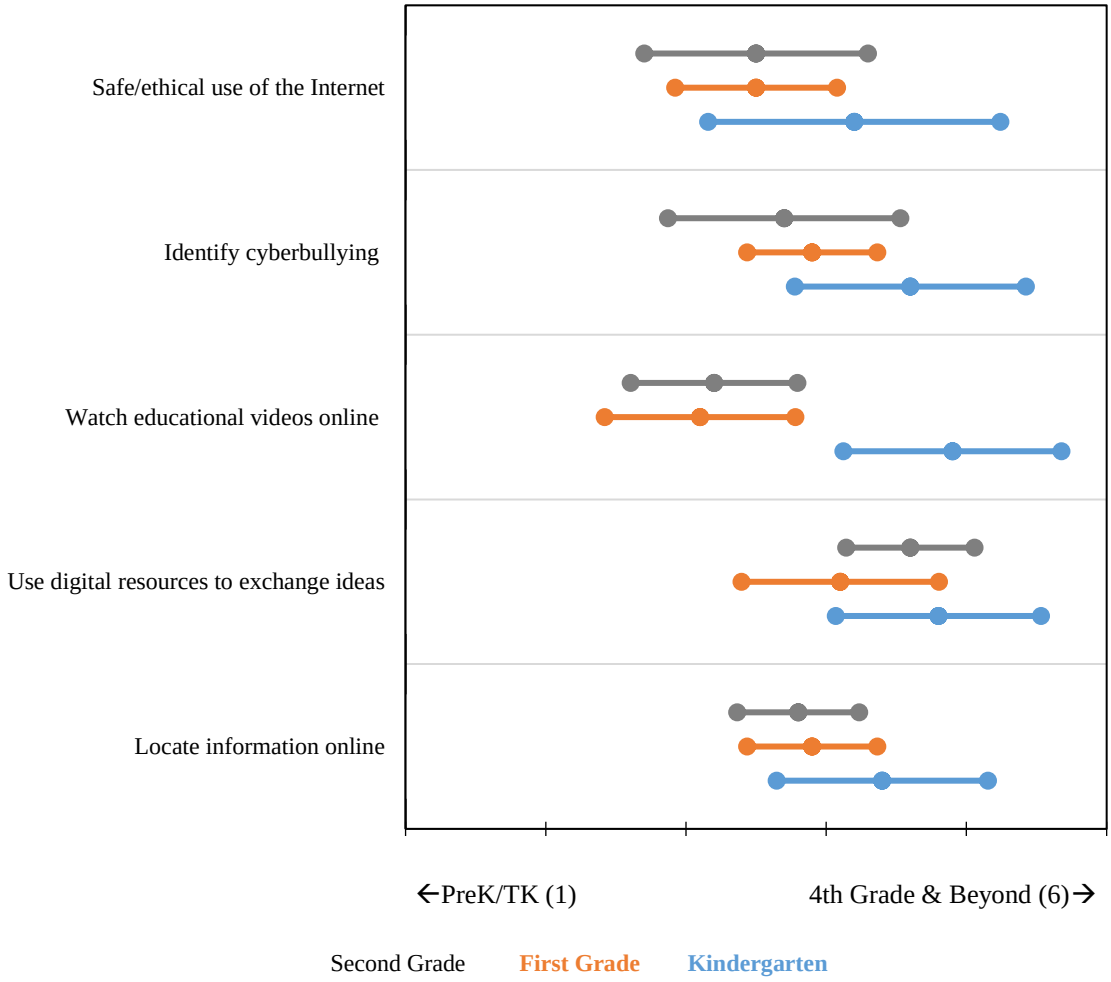

Figure 11. Participants' beliefs on the earliest introduction of information literacy skills and digital citizenship across grade levels. Circles represent the mean response, error bars represent +/- 2 SE.

A One-Way ANOVA revealed a significant difference across grade levels with regards to their opinion on when children should be introduced to online videos, $F(2, 36) = 7.021$, $p = .003$. While Kindergarten teachers were far more likely to be in favor of introducing children to this element of digital literacy toward the latter part of second grade, first and second grade teachers indicated that this activity should be introduced in early first grade (see Figure 12).

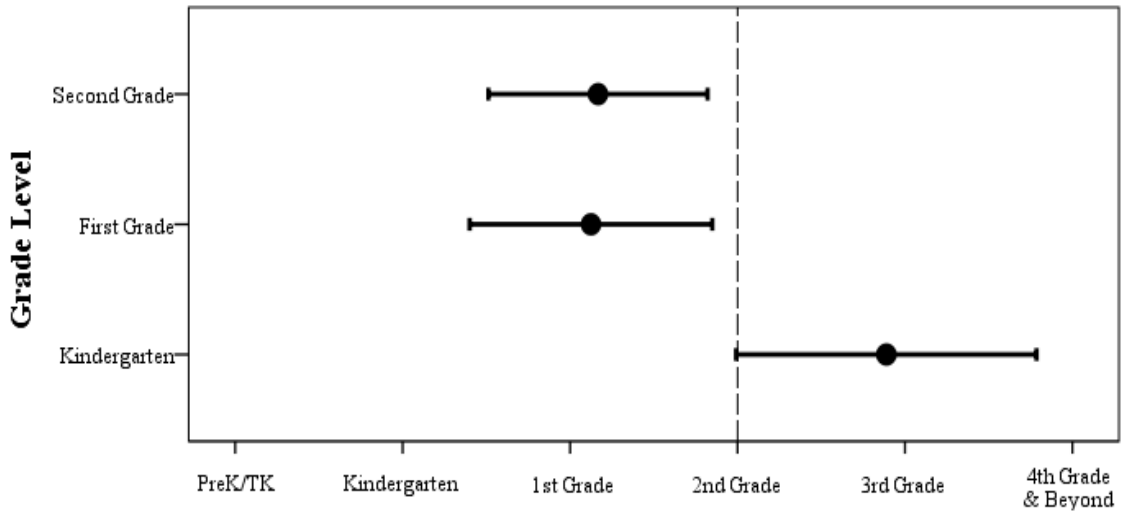

Figure 12. Participants' beliefs on the earliest introduction of students to watching online videos and using the play, pause, rewind, and forward buttons on the digital devices (e.g., Chromebooks) across grade levels. While first and second grade teachers are more in favor of introducing this skill prior to second grade, Kindergarten teachers think it should be debuted in the latter part of second grade. Circles represent the mean response, error bars represent +/- 2 SE.

Teachers' pedagogical views. Analyses by grade level revealed that participants who taught second grade perceived their students to be more technologically savvy – they do not require as much explicit instruction to learn basic technology skills. They also expressed a greater need for their students to learn about digital citizenship (see Figure 13). Although there is no statistically significant difference across grade levels, Kindergarten teachers were more likely to indicate that developing their students' basic literacy skills and core content knowledge is their main focus as teachers and that addressing their students' other needs (e.g., reading and writing skills) takes precedence over developing students' digital literacy. Furthermore, Kindergarten teachers were less likely to consider digital literacy as a core component of their instructional practice and to

view digital technology devices as essential learning tools for student use in comparison to first and second grade teachers.

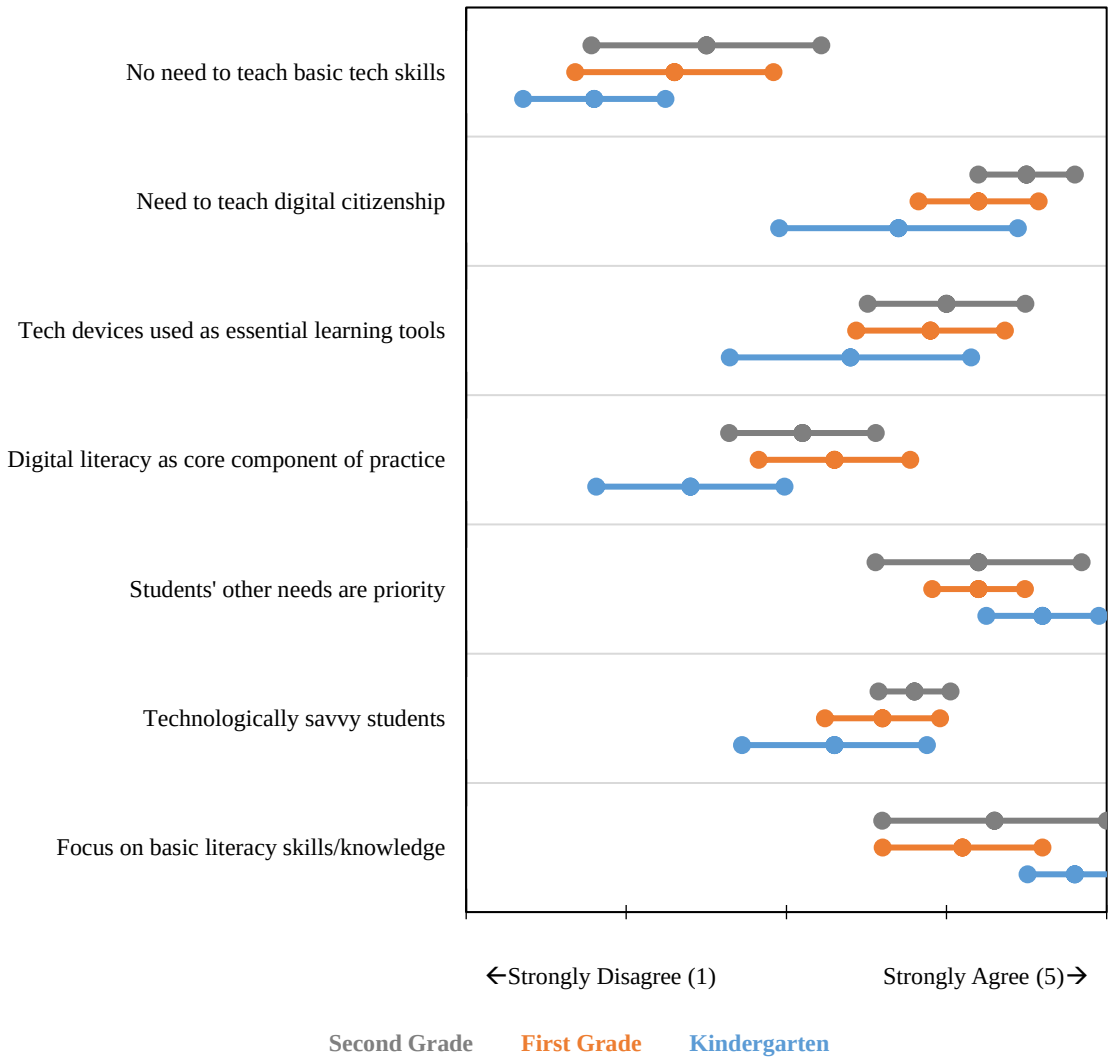

Figure 13. Participants' views and perceptions regarding different elements of digital literacy instruction. Circles represent the mean response, error bars represent +/- 2 SE.

Students' Socioeconomic Status

To address the fifth research question, "What is the relationship between students' socioeconomic status and early elementary school teachers' beliefs about digital literacy

development?" the researcher grouped survey responses into two categories: non-Title I schools (n = 28) and Title I schools (n = 9). As a reminder, Title I funding is a form of financial aid allocated through the U.S. Elementary and Secondary Education Act to public schools where a significant portion of the student population is from low-income families (U.S. Department of Education, n.d.). Participants' responses to survey questions #7-10 (participants' familiarity with 21st Century skills, digital literacy, and technology standards), #11-20 (participants' beliefs on the earliest introduction of various elements of digital literacy), #21-27 (participants' pedagogical values), #28-43 (barriers and supports), and #47-54 (students' frequency of use or anticipated use of digital technology devices to engage in a variety of activities) were examined.

Teachers' knowledge. Although there is not a statistically significant difference between groups, participants who taught at non-Title I schools were more knowledgeable about 21st Century skills (M = 4.3) and the definition of digital literacy (M = 4.0) as compared to teachers from Title I schools (M = 3.9, M = 3.7 respectively). They were also slightly more familiar with the district (M = 3.0) and grade-level specific (M = 2.8) technology standards than participants who taught at Title I schools (M = 2.9, M = 2.7 respectively) (see Figure 14).

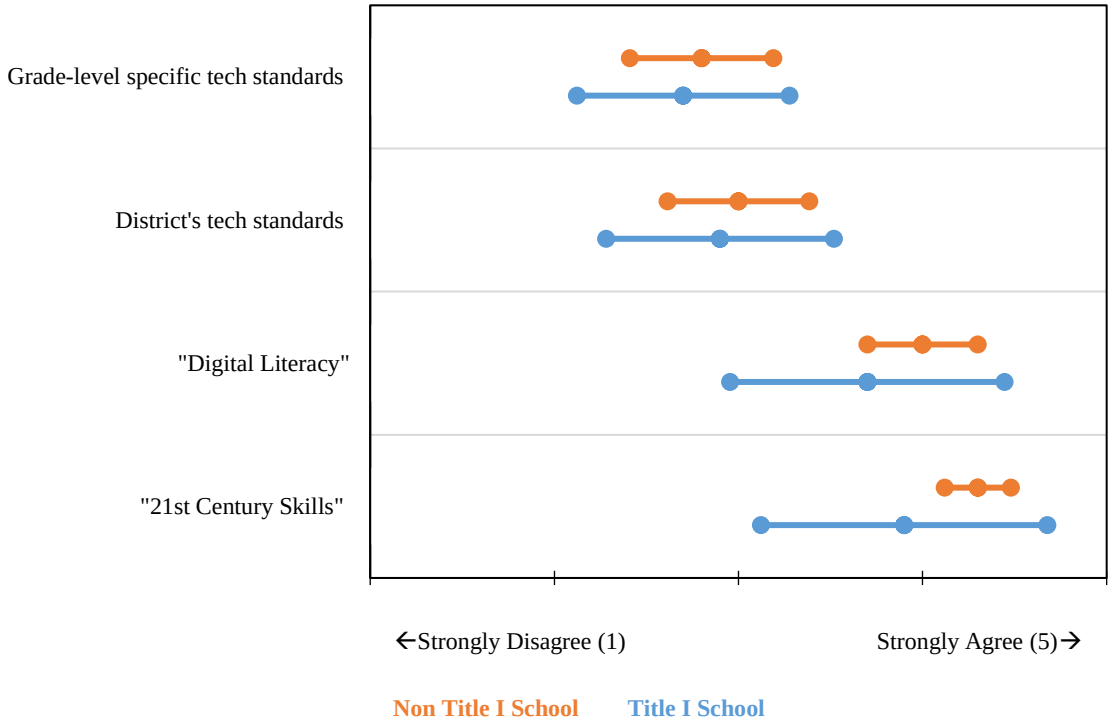

Figure 14. Participants' familiarity with digital literacy terminology and standards based on school type. Circles represent the mean response, error bars represent +/- 2 SE.

Views on the earliest introduction of various elements of digital literacy. Overall, participants who taught at Title I schools were more in favor of introducing the various elements of digital literacy in earlier grade levels. Participants from non-Title I schools consistently preferred later grade-levels (see Figure 15).

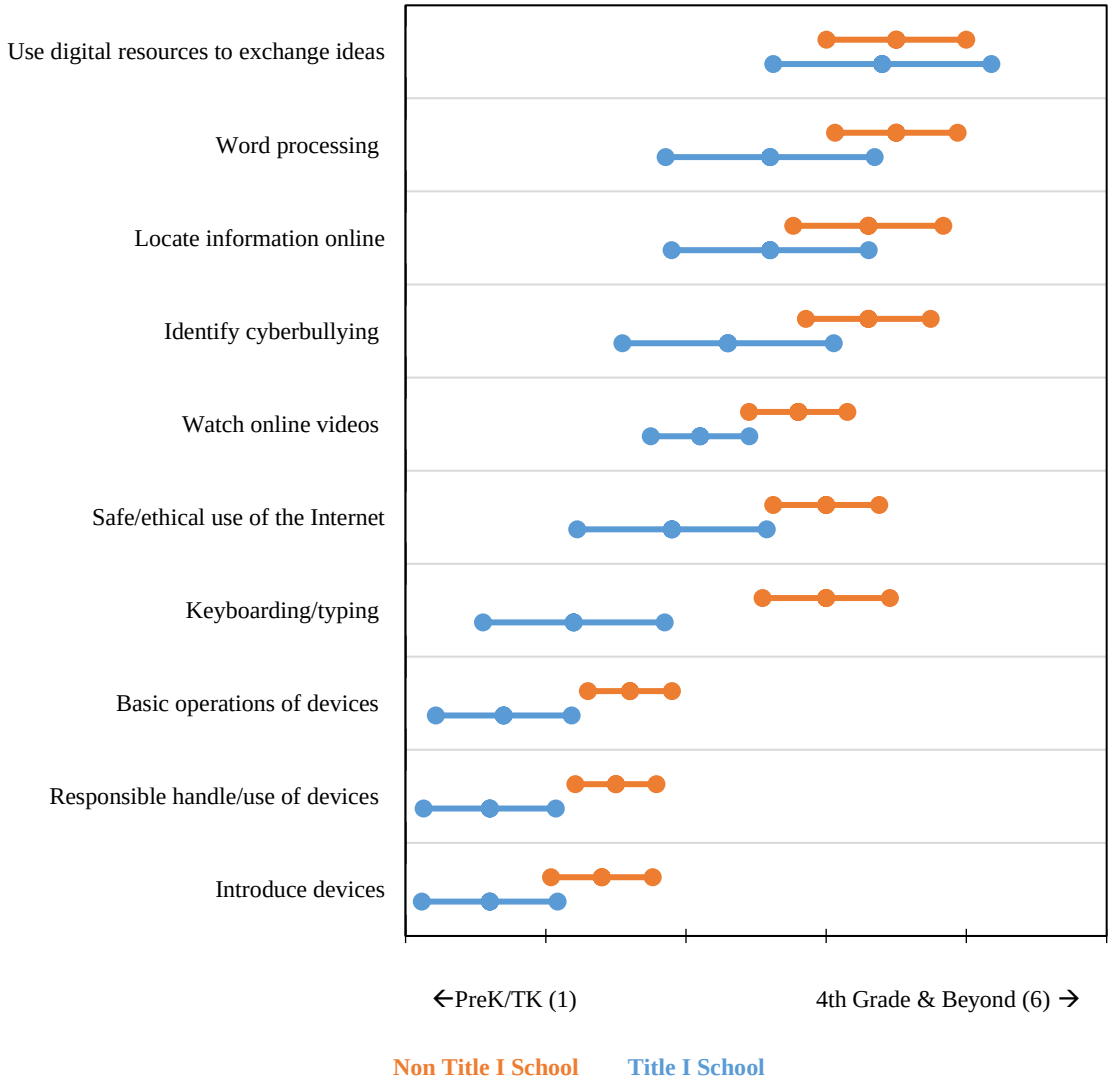

Figure 15. Participants' views on the earliest introduction of various elements of digital literacy according to school type. Circles represent the mean response, error bars represent +/- 2 SE.

More specifically, participants from Title I schools were more likely to be in favor of introducing children to computer literacy skills (e.g., basic operations of digital technology devices, keyboarding/typing) earlier than participants who taught at non-Title I schools (see Figure 16).

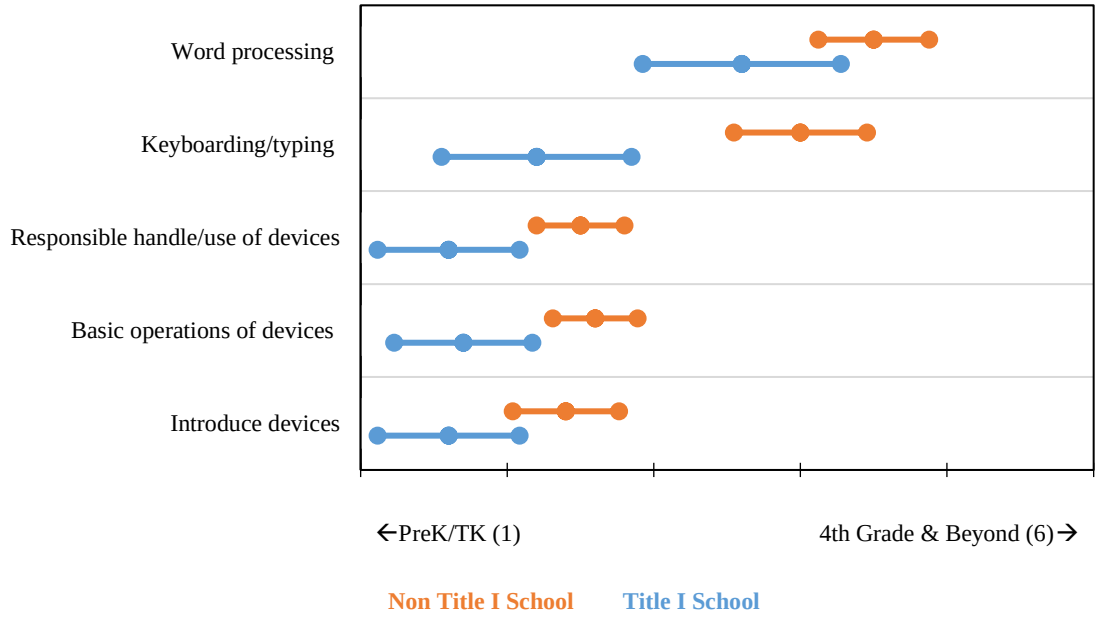

Figure 16. Participants' views on the earliest introduction of computer literacy skills according to school type. Circles represent the mean response, error bars represent +/- 2 SE.

Teachers' pedagogical views. There were no statistically significant differences in regards to participants' pedagogical views based on their school's Title I status. However, participants who taught in non-Title I schools perceived their students to be more technologically savvy and less likely to require explicit instruction to learn basic technology skills. They were also more likely to indicate that developing their students' basic literacy skills and core content knowledge is their main focus as teachers (see Figure 17).

Participants who taught at Title I schools expressed a greater need for their students to learn about digital citizenship. They were also more likely to consider digital literacy as a core component of their teaching pracitce and to view digital technology devices as essential learning tools for student use. Participants from both Title I and non-Title I

schools indicated that addressing their students' other needs (e.g., reading and writing skills) takes precedence over developing students' digital literacy skills.

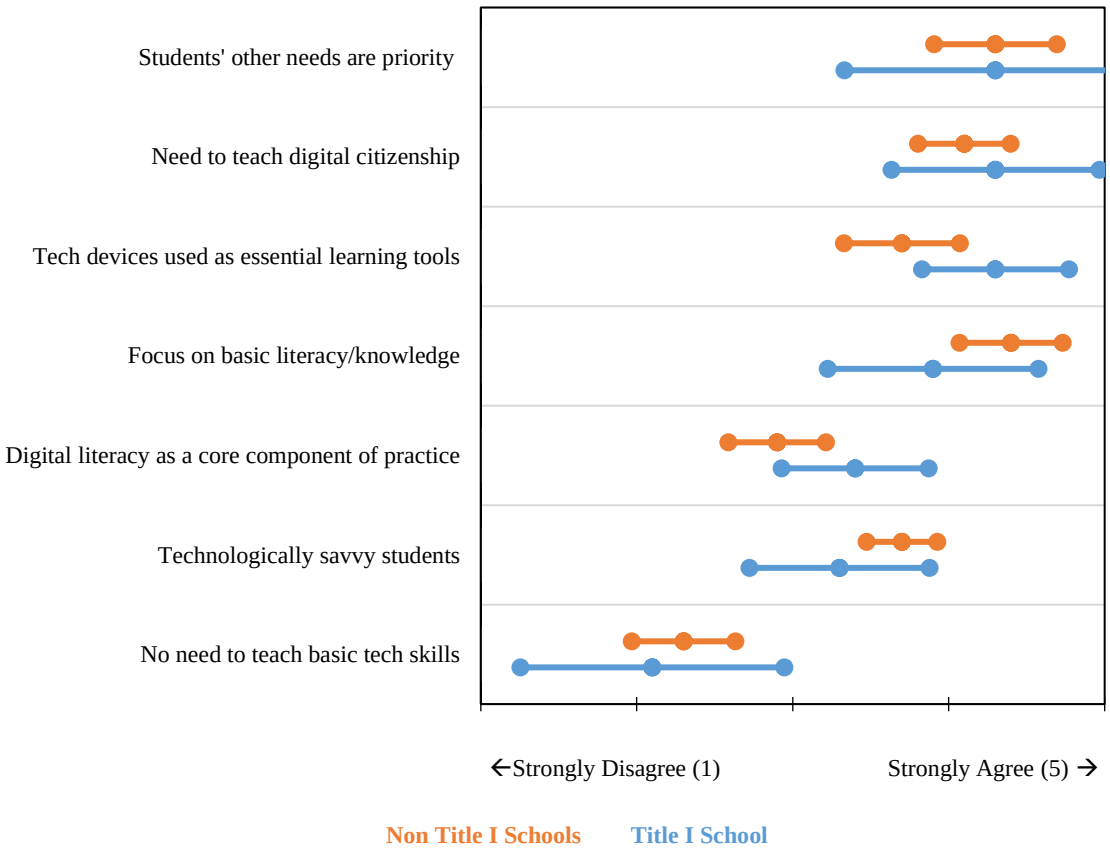

Figure 17. Participants' views and perceptions regarding different elements of digital literacy instruction. Circles represent the mean response, error bars represent +/- 2 SE.

Barriers and supports. While there were no statistically significant differences in regards to participants' perceptions of barriers and supports according to their school's Title I status, participants from Title I schools were more likely to perceive the number of students to teacher ratio as a barrier to digital literacy instruction. On the other hand, participants from non-Title I schools were more likely to indicate that the age and self-management skills of their students along with their students basic reading and writing skills presented a challenge in teaching digital literacy skills (see Figure 18).

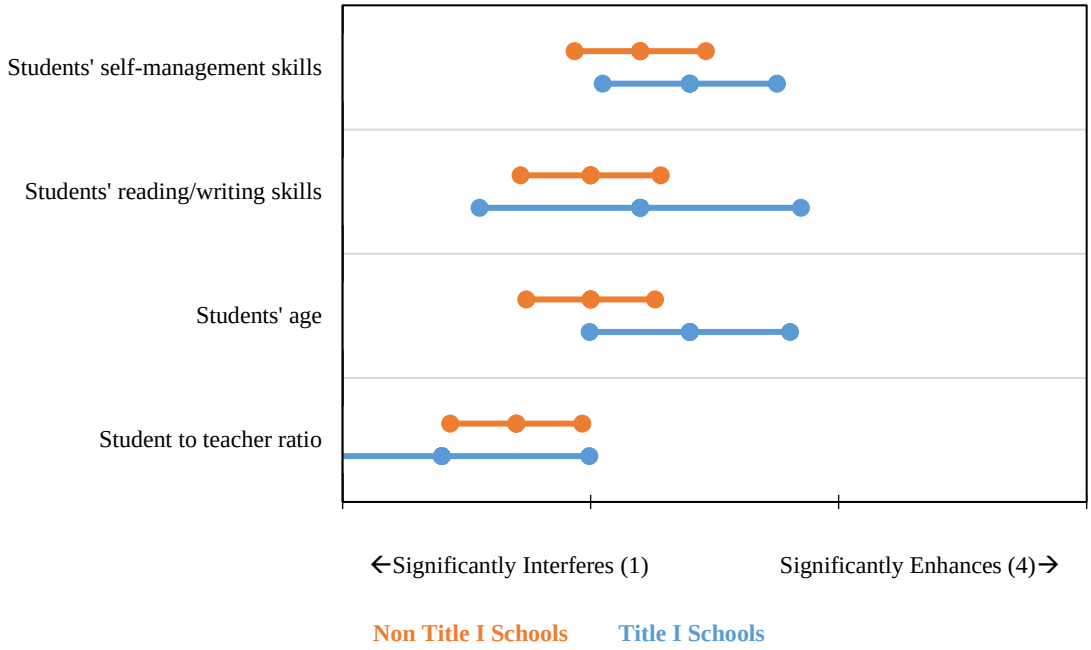

Figure 18. Student-related factors that interfere with or enhance the participants' ability to teach digital literacy skills across Title I and non-Title I schools. Circles represent the mean response, error bars represent +/- 2 SE.

A perceived lack of time to plan and teach technology lessons was seen as greater obstacles by participants who taught at non-Title I schools. These participants also indicated that expectations to focus on the core curriculum had a more negative impact on their ability to teach digital literacy skills (see Figure 19).

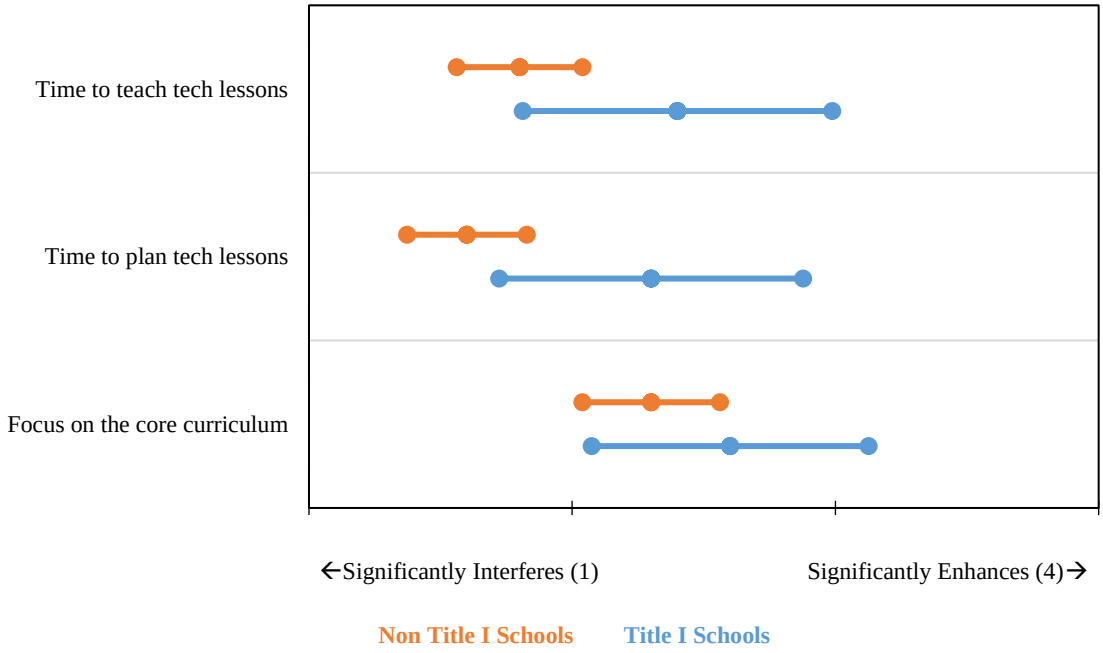

Figure 19. Views about the influence of time and the core curriculum mandates on digital literacy instruction based on school's Title I status. Circles represent the mean response, error bars represent +/- 2 SE.

Title I teachers'confidence in their own knowledge of grade-level technology standards and their ability to design age-appropriate technology lessons was higher than teachers from non-Title I schools. These teachers also had a more positive outlook on their access to on-site tech mentors/district coaches and opportunities to observe demo technology lessons (see Figure 20).

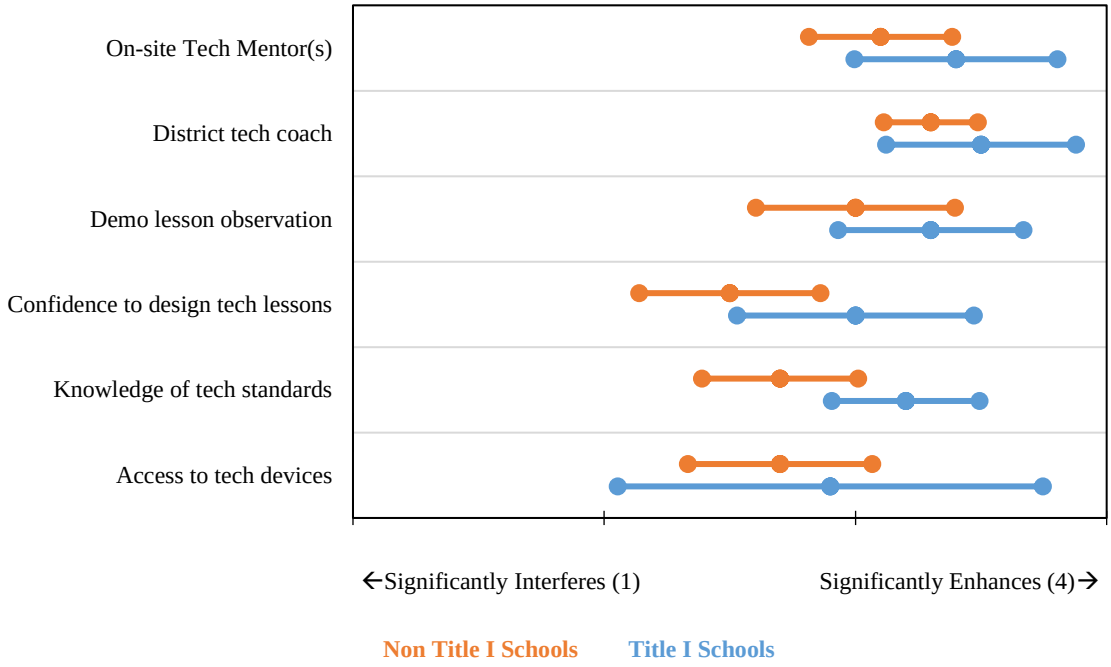

Figure 20. Other factors that influence digital literacy skills across Title I and non-Title I schools. Circles represent the mean response, error bars represent +/- 2 SE.

Data on differentiated training sessions and the site administrator's impact on digital literacy instruction was inconclusive due to a low response rate from participants. For example, approximately 29% of teachers at non-Title I schools and 44% of teachers at Title I schools indicated that differentiated training sessions that address teachers' specific learning needs related to digital literacy instruction are not applicable or not available at their school site. Similarly, 32% of teachers at non-Title I schools and 44% of teacher at Title I schools stated that the expectation to teach digital literacy skills from the site administrator is not applicable or not available at their school site. Data on the impact of site administrator's evaluation of participants' ability to teach digital literacy yielded similar results with 43% of teachers from non-Title I schools and 67% of teachers

from Title I schools indicating that this factor is not applicable or not available at their school site.

Opportunities to practice digital literacy skills. Although differences across Title I and non-Title I schools are not statistically significant ($p > .05$), it appears that, overall, students in Title I schools are provided with more opportunities to practice digital literacy skills than students in non-Title I schools (see Figure 21). Opportunities to use digital technology devices for accessing a word processing application are scarce in both Title I and non-Title I schools ($M = 1.9$). Students in non-Title I schools use digital technology devices to locate and collect information from online sources slightly more frequently ($M = 2.1$) than students in Title I schools ($M = 1.9$).

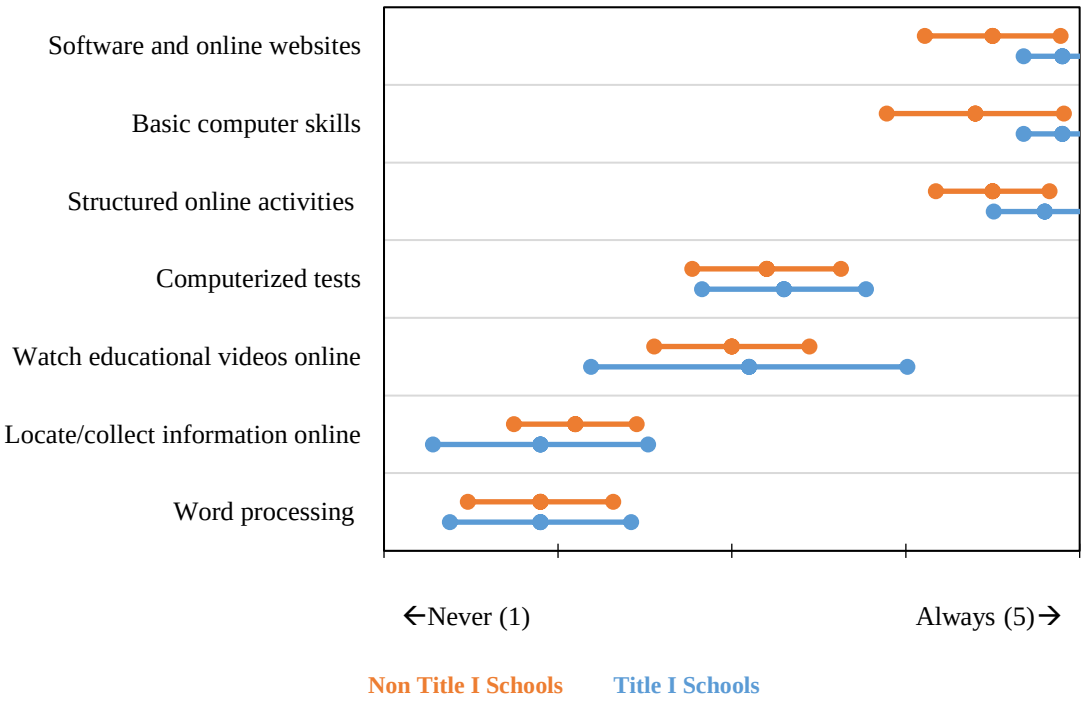

Figure 21. Students' frequency of use or anticipated use of digital technology devices to engage in a variety of activities across Title I and non-Title I schools. Circles represent the mean response, error bars represent +/- 2 SE.

Summary

The analyses above show that early elementary school students are provided with more opportunities to practice basic computer literacy skills than information literacy skills, which focus on the students' ability to collect, evaluate, and successfully utilize information attained from digital sources (Hignite et al., 2009). Overall, students in second grade have more exposure and opportunities to participate in activities that promote the development of digital literacy skills than students in first grade and Kindergarten.

Participants identified (a) access to a district tech coach, (b) on-site tech support, (c) observations of demo lessons by colleagues or tech coaches, and (d) confidence in their knowledge of grade-level technology standards as the most impactful factors that support digital literacy instruction in the early elementary grades. Participants also expressed a need for more time to plan and teach technology lessons.

The most significant hurdles to digital literacy instruction in the early elementary grades were identified as: (a) number of students to teacher ratio, (b) limited time to plan, prepare, and teach technology lessons, and (c) students' self-management skills/independence (e.g., problem solving). Students' age and basic academic skills were also cited as barriers. These factors posed a more significant challenge for participants who taught younger students.

Participants' grade-level assignment influenced their views about when and whether to introduce various digital literacy skills. Overall, participants who taught Kindergarten were more in favor of introducing students to information literacy skills (e.g., use a

variety of digital resources such as presentation software to communicate and exchange ideas) in second grade and beyond. School's Title I status also had an impact on the participants' views. Participants who taught at Title I schools were considerably more in favor of teaching computer literacy skills in earlier grade levels.

Chapter 5: Discussion and Conclusions

This study explores early elementary grade teachers' views and attitudes about digital literacy instruction in a Northern California public school district. Existing barriers to digital literacy instruction were examined and support systems needed to facilitate instruction were identified. Implications for practice, which are structured around the research questions guiding this study, are discussed in this chapter. Also included in this chapter are considerations for future research. The chapter ends with this study's conclusion, which recaps the study's main findings.

Digital Literacy Development in the Early Elementary Grades

The study's findings show that, in general, Kindergarten through second grade students in this school district access age-appropriate software/online websites and engage in structured online activities (e.g., complete lessons online) more often than they practice the higher order skills associated with digital literacy (e.g., locate and collect information from online sources). Overall, children in second grade are provided with more opportunities to develop digital literacy skills as compared to Kindergarten and first grade students.

Grade-level teaching assignment. Participants' beliefs about digital literacy development across their 2017-2018 grade-level assignment suggest that, overall, Kindergarten teachers were supportive of presenting information literacy skills (e.g., use a variety of digital resources such as presentation software to communicate and exchange ideas) in second grade and beyond. Furthermore, participants' responses to the open-ended survey questions show that, in general, Kindergarten teachers appear to take

developmental appropriateness into consideration regarding digital literacy instruction in their classrooms. This finding aligns with previous reports (e.g., Buchanan et al., 1998) that suggest that developmentally appropriate beliefs and practices are more prevalent among educators of younger children.

Participants in this study cited their students' "maturity, age, attention span, fine motor skills, and independence level" as potential barriers to digital literacy instruction. According to one Kindergarten teacher:

> Technology is a wonderful tool for older children 7, 8, 9+ years. My personal opinion is that when technology is over-used, it "wires" children wrong. At 4, 5, and 6, their eyes do not function completely and sitting at a computer is not good for eye or social development. Technology needs to be used as a very small piece of their learning.

Results from this study also indicate that teachers across all three early elementary grades were not very familiar with the technology standards that the school district has adopted – this is particularly true of second grade teachers. One possible explanation for this phenomenon may be that more than half of second grade teachers who participated in this study had only 1 to 5 years of teaching experience in their current grade-level assignment. This finding suggests that providing clear expectations regarding digital literacy instruction in the early elementary grades is imperative and the school district would likely benefit from providing continuous and integrated professional development opportunities that promote teachers' development of TPACK (Mishra & Koehler, 2006). In fact, previous research findings indicate that this lack of knowledge significantly interferes with technology integration (Hew & Brush, 2007). Studies have also demonstrated that teacher knowledge influences the teachers' instructional decision-

making (Ertmer & Ottenbreit-Leftwich, 2010). Teachers are less likely to utilize digital technologies in their teaching if they do not have adequate knowledge and skills about computers (Snoeyink & Ertmer, 2001). This is particularly problematic because students will not have the opportunity to engage in activities that promote the development of digital literacy skills.

Title I status. For this analysis, the school's Title I status and the participants' views and beliefs about digital literacy development were examined. The findings indicate that teachers from Title I schools favored earlier introduction of various elements of digital literacy in comparison to teachers from non-Title I schools. Moreover, teachers from Title I schools were more likely to consider digital literacy as a core component of their teaching practice than teachers from non-Title I schools. It also appears that in Title I schools, children access age-appropriate software/online website and engage in structured learning activities (e.g., complete online lessons) more frequently than students in non-Title I schools. This outcome is in concert with findings from previous studies (e.g., Reinhart et al., 2011; Warschauer, 2007), which found that children attending low socioeconomic schools use digital technologies mainly to engage in teacher-directed remedial activities. This inconsistency in the quality of digital technology use in classrooms further magnifies the already existing educational inequities in public schools.

Enhancing School Level Supports and Addressing Barriers

While this Northern California school district has made efforts to reduce the barriers to technology integration (e.g., improving accessibility to digital resources), there are still obstacles that must be overcome. One way to ensure the success of a systemic change

effort (e.g., technology integration in classroom instruction) is to remove potential obstacles (Kotter, 1995), in this case, addressing the barriers to technology integration that have been identified in literature (e.g., Dolan, 2016; Ertmer, 1999; Ertmer, 2005; Ertmer & Otternbreit-Leftwich, 2010; Hew & Brush, 2007) and were presented in Chapter 2.

Resources. This study's findings are consistent with prior research, which has demonstrated that limited or lack of resources (e.g., time to plan, access to technology) can have a considerable impact on the quality of technology integration in classroom instruction (e.g., Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010). In fact, participants in this study identified the lack of time to plan and to teach technology lessons as one of the most significant obstacles to digital literacy instruction. To address the limited or lack of time to plan, prepare, and teach technology lessons, the school district should consider providing more structured planning time on a regular basis so that teachers can incorporate digital literacy instruction into their lesson planning agenda. School leaders should therefore provide teachers with time for collaboration and teamwork by implementing creative ways of addressing staffing or scheduling constraints (Ertmer, 1999). For example, principals can seek out qualified community members or student teachers from local universities to volunteer their time at school sites while teachers work in teams to plan and develop technology-enhanced curricular material and new lessons (Ertmer, 1999).

Knowledge and skills. Teachers across the three grade-levels seemed to be far more knowledgeable about 21st Century skills and the definition of digital literacy than the

technology standards that their school district has adopted. As mentioned above, participants were least familiar with their corresponding grade-level technology standards, but more than half of all participants identified their confidence in their own skills and knowledge of grade-level technology standards and their ability to design age-appropriate technology lessons as factors that can potentially boost their capacity to engage in digital literacy instruction. Previous scholarship (discussed in Chapter 2) has demonstrated that knowledge and skills can have a significant influence on how or whether digital technologies are integrated in teaching and learning. Ertmer (2005), for example, has identified three conditions that exert a positive influence on teachers' attitudes and pedagogical beliefs regarding the use of technology in classrooms: (a) experiencing personal success with technology, (b) observing exemplary models or expert teachers demonstrate best practices using technology, and (c) engaging in collaboration and teamwork with peers who use technology in their classrooms.

An essential step, therefore, would be for the school district to address the professional development needs of teachers to ensure that all early elementary educators are knowledgeable about district- and specific grade-level technology standards and feel confident to design age-appropriate technology lessons that address the various elements of digital literacy for their grade-level. Site administrators can also incorporate designated collaboration time for teachers during grade-level professional learning community (PLC) meetings such that teachers can design technology lessons and share instructional practices that promote young children's digital literacy development. Administrators and teachers can also participate in instructional rounds (City, 2011)

whereby they can observe and reflect on current classroom practices so as to identify areas of need and determine appropriate measure to address these needs (City, 2011). Engaging in instructional rounds also enables educators to establish a collective insight into effective instructional practices and take ownership of their learning (City, 2011).

Training and professional development. Successful technology professional development can equip teachers with the essential knowledge and skills for technology integration and may also positively affect teachers' views and attitudes about technology (Hew & Brush, 2007). School districts' technology professional development plans should therefore incorporate trainings that focus on developing teachers' management skills to direct and guide "technology-rich classrooms" (Ertmer & Ottenbreit-Leftwich, 2010, p. 273). Addressing classroom management skills may then alleviate the challenges associated with the student to teacher ratio, students' age, and their development of self-management skills and academic capabilities – all of which are barriers to digital literacy instruction that participants identified in Chapter 4. Effectual classroom management methods and techniques may also enable teachers to tackle some of the obstacles to technology integration (e.g., student to teacher ratio) (Ertmer, 1999). Morrison and colleagues (as cited in Ertmer, 1999) suggest teacher modeling and guidance, as well as showing students how to provide peer support. Establishing specific rules around technology use is also important (Ertmer, 1999). Teachers and students in the early elementary grades can create explicit classroom rules and procedures (e.g., what to do when children experience a technical difficulty, the proper use and maintenance of digital technology devices in the classroom). If possible, parent volunteers can also be

recruited to support the children when they are using digital technology devices in classrooms.

While training and ongoing teacher development are essential in building individual capacity, these efforts must be integrated with collaboration, teamwork, modeling, and coaching practices to strengthen the collective capacity of educators in schools (Fullan, 2010). Previous research findings show that participation in collaborative professional communities enhances teachers' technology use (Anthony, 2011). Teachers should also have the opportunity to collaborate with peers, reflect on and revise current teaching practices, and observe classrooms of expert technology-using colleagues (Ertmer & Ottenbeit-Leftwich, 2010).

Since the number of district tech coaches is relatively limited (n = 3) in this school district, it is important to utilize the expertise of teacher leaders at every school site. Teacher leaders in schools can act as mentors and coaches, provide valuable feedback, and support their colleagues in their efforts to utilize digital technologies in their instructional practices (Kopcha, 2010). They can be powerful change agents (Kirtman & Fullan, 2010) who can influence other teachers' beliefs and attitudes about technology through mentorship and modeling of best practices using technology (Ertmer, 2005). Drawing upon the expertise of teacher leaders can also significantly alleviate the cost of hiring outside experts (Kopcha, 2010).

Institution: Leadership and vision. Past studies (Chandra, 2016; Levin & Schrum, 2013; Porras-Hernández & Salinas-Amescua, 2013) have highlighted the importance of the site administrator’s leadership in relation to setting high expectations and developing

a clear technology integration plan at the school site. Constructing a well-articulated shared vision about the significance of technology use in teaching and learning as well as a coherent strategy for integration of digital technologies in instructional practices are among the primary duties of administrators and trademarks of effective systemic change efforts (Ertmer & Ottenbreit-Leftwich, 2010; Levin & Schrum, 2013). Research findings indicate that a school leader's unyielding commitment to the vision has a positive impact on how teachers in that school culture view digital technologies (Levin & Schrum, 2013). For teachers to leverage digital technology so as to elevate and enhance instructional practices, the school environment must be both "a catalyst and conductive to facilitate the design, development, and delivery of appropriate classroom activities" (Chandra, 2016, p. 235). Therefore, constructing a shared vision that emphasizes the importance of digital technologies in improving instructional practices is essential in successful technology integration in classroom practices (Ertmer, 1999). To empower teachers, it is important to include them in the design, planning, and implementation of the school district's technology plan (Cuban, 2001).

Findings from this study related to the principal's influence on digital literacy instruction in classrooms yielded inconclusive outcomes. Many participants pointed out that the expectations to teach digital literacy skills from their principal or his/her evaluation of their ability to teach digital literacy is "not applicable or not available" at their school site. As a way to investigate this issue, the educational leaders at this school district can begin by utilizing the TPACK Leadership Diagnostic Tool (Herring et al., 2015). By applying the diagnostic tool, the executive team can assess the quality of

current systems and make adjustments as needed to ensure that site-level administrators have the knowledge, skills, and resources available to lead digital literacy instruction efforts at their school sites.

As an example, several participants in this study pointed out that teachers are strongly encouraged to allocate time daily for students to complete online i-Ready lessons in English language arts and in math. This suggests that the school district would also benefit from expanding its technology integration plan to ensure that students are provided with a well-balanced student-centered digital literacy curriculum across the early elementary grade levels instead of focusing predominantly on children's use of a single or limited number of software or online programs such as i-Ready. In fact, the higher-order cognitive and metacognitive skills most commonly associated with the CCSS and the 21st Century skills (e.g., collaboration, critical thinking) are hallmarks of student-centered practices. In student-centered classrooms, students are no longer mere consumers of digital technology; they utilize digital technology resources to produce and generate new knowledge and express their thought processes in innovative ways (Dolan, 2016). In order to develop an instructional program that promotes student-centered teaching and learning, it is imperative to supply students with multiple methods to acquire information and demonstrate learning (Wolfe, Steinberg, & Hoffman, 2013).

Considerations for Future Research

Centered on the findings and the limitations of the present study, the following considerations for future research are suggested. First of all, the present study focused on classroom teachers' perceptions about digital literacy instruction in the early elementary

grades. However, classrooms and the teachers and students who occupy them do not exist in a vacuum (Cuban, 2001). Future research should therefore survey elementary school principals and district-level administrators to evaluate their views about existing barriers and supports related to digital literacy instruction. Utilizing the systems thinking approach can then provide educational leaders with the opportunity to take into consideration multiple perspectives and allow for an analysis of both extrinsic (e.g., education policy) and intrinsic (e.g., school culture) factors that impact the use of technology in public school classrooms (Mardis et al., 2008).

To examine the scope of the digital literacy divide (Watkins, 2012) in California public elementary schools, subsequent research should expand the pool of participants to include early elementary grade teachers from various public school districts across the state to examine teachers' views, perspectives, and practices related to digital literacy development on a more extensive scale. Future investigators may also explore other student-level factors that were not considered in the present study, such as students' race and ethnicity, to find out if these factors influence the quality of digital literacy instruction in the early elementary grades.

The number of teachers from Title I schools who participated in this study was relatively small ($n = 9$). Utilizing a larger sample, future investigators may explore the relationship between school's Title I status and the teachers' perceptions of barriers and supports examined in the present study. Additionally, the researchers may examine Title I teachers' views and beliefs about the earliest introduction of various elements of digital

literacy skills so as to hone in on the teachers' responses and determine whether results are comparable to the findings in this study.

Finally, the primary method of data collection in this study was an online survey. Future studies may conduct in-person interviews and classroom observations to gain a deeper understanding of digital literacy instructional practices that take place in the early elementary grade public school classrooms. While face-to-face interviews allow the researchers to obtain a more intimate insight into participants' views and perspectives, observations are especially useful in providing direct encounters with the topic of study (e.g., digital literacy instruction) in its everyday environment (e.g., classrooms) (Merriam & Tisdell, 2016).

Conclusion

The present study provides insight about digital literacy development in the early elementary grades. Teacher responses indicate that while children in this California public school district are provided with opportunities to develop digital literacy skills, the quality and frequency of use remain inconsistent across the three early elementary grades. Moreover, while early elementary grade teachers appear more confident in their knowledge of 21st Century skills and digital literacy, they are less informed about technology standards. In concert with previous scholarship (e.g., Buchanan et al., 1998; Reinhart et al., 2011), findings from the present study also demonstrate that teachers' grade-level assignment and/or the school's Title I status influence teachers' views and perceptions about digital literacy instruction in the early elementary grades.

While the school district in the present study has made strides in addressing first order barriers related to lack of adequate resources (e.g., access to Chromebooks), more work is needed to ensure that digital technologies are utilized in a student-centered fashion. To address the areas of need (e.g., providing early elementary grade students in both Title I and non-Title I schools with adequate opportunities to develop and practice grade-level digital literacy skills), the school district would benefit from adopting a systemic approach which in turn requires effective communication among key stakeholders including educational policymakers, district leaders, school site administrators, teacher leaders, classroom teachers, and even students (Li, 2007). In so doing, school leaders can establish successful technology enhanced student-centered learning environments (Hannafin & Land, 1997; Pendersen & Liu, 2003) which will result in student-centered school cultures where computers serve as a "catalyst for supporting 21st Century skills" (Levin & Schrum, 2013, p. 43). It is essential that both human and fiscal resources are appropriately distributed to support the school district's' core values and vision for teaching and learning with technology (Fullan, 2010). Furthermore, the collective capacity of the whole motivates and inspires individuals and drives the school toward achievement and success – it is only through collective action that problems of practice in education can be effectively addressed to yield successful outcomes (Fullan, 2010).

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Appendix A

Participant Consent Form

REQUEST FOR YOUR PARTICIPATION IN SAN JOSÉ STATE UNIVERSITY RESEARCH

Digital Literacy in Early Elementary School
Delnaz Hosseini, Doctoral Student
Dr. Emily Slusser, Ph.D., San José State University Faculty Advisor

PURPOSE
The purpose of this study is to understand K-2nd grade teachers' views about digital literacy development, identify existing obstacles, and determine the support systems needed to facilitate digital literacy instruction in the early elementary grades.

PROCEDURES
In this voluntary survey, you will be asked to share your views about digital literacy development in the primary grades. We anticipate that the survey will take no longer than 15 minutes to complete.

POTENTIAL RISKS
Potential risks are no greater than those normally encountered in daily life. Survey responses will remain confidential.

POTENTIAL BENEFITS
While there are no foreseeable benefits to individual participants, we anticipate that the findings will help to inform best practices in technology integration in the primary grades.

COMPENSATION
No compensation will be given for participating in this study.

CONFIDENTIALITY
Survey responses will remain confidential. No identifying information will be collected or used in the final report. When necessary, ID numbers and pseudonyms will be used in the analysis and dissemination of the results in our final report.

PARTICIPANT RIGHTS
Your participation in this study is voluntary. You may refuse to participate in the entire study or any part of the study without any negative effects on your relationship with San José State University. You also have the right to skip any question you do not wish to answer. This is a written explanation of what will happen during the study if you decide to participate. You will not waive any rights if you choose not to participate, and there is no penalty for stopping your participation in the study.

QUESTIONS OR PROBLEMS
You are encouraged to ask questions at any time during this study.

- For further information about this study, please contact Delnaz Hosseini at 408-914-8770 or delnaz.hosseini@sjsu.edu.

- Complaints about the research may be directed to Dr. Arnold Danzig, Ph.D., Professor, Educational Leadership & Education Policy (Director, Ed.D. Leadership Program, San José State University, 408-924-3722.
- For questions about participant rights or if you feel you have been harmed in any way by your participation in this study, please contact Dr. Pamela Stacks, Associate Vice President of the Office of Research, San José State University, at 408-924-2479.

SIGNATURES

Your participation consent below indicates that you voluntarily agree to be a part of this study, that the details of the study have been explained to you, that you have been given time to read this document, and that your questions have been answered. You will receive a copy of this consent form upon request.

____ I agree to participate in this survey. (Participants skip to Question #1).

____ I do not agree to participate in this survey. (Participants skip to the "Thank you." page and exit).

Appendix B

Survey Instrument

Q1 What grade levels are you teaching this year? (Check all that apply).

- ○ Kindergarten
- ○ First Grade
- ○ Second Grade
- ○ Other (please specify) _____

Q2 How many years have you been a teacher (including the current 2017-2018 school year)?
_____

Q3 How many years have you taught in your current grade-level assignment (including the 2017-2018 school year)? If you teach a combo class this year, how many years have you taught this particular combo?
_____

Q4 Over the course of your entire teaching career, which grade-levels have you taught? (Check all that apply).

- ○ Preschool (Pre-K)
- ○ Transitional Kindergarten (TK)
- ○ Kindergarten
- ○ First Grade
- ○ Second Grade
- ○ Third Grade
- ○ Fourth Grade
- ○ Fifth Grade
- ○ Sixth Grade
- ○ Other (please specify) _____

Q5 The general economic-level of the students in your class this year can be described as (please answer to the best of your ability):

- ○ Low-income
- ○ Middle-income
- ○ Upper-income

Q6 Is the school you teach at this year identified as a Title I school (receives Title I funding)?

- ○ Yes
- ○ No
- ○ I don't know.

Q7-10 Thinking about the grade-level you are teaching in the current (2017-2018) school year, identify the extent to which you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I know what "21st Century skills" are.	○	○	○	○	○
I know what "Digital Literacy" means.	○	○	○	○	○
I know the technology standards that my school district has adopted.	○	○	○	○	○
I know the specific technology standards that my school district has adopted for my grade-level.	○	○	○	○	○

Q11-20 Identify the earliest grade-level that you think it is appropriate for teachers to do the following:

	Preschool	Transitional Kindergarten	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade and Beyond
Introduce children to computers, tablets, Chromebooks, i-Pads, or other digital technology devices	○	○	○	○	○	○	○
Teach children about the basic operations of the devices above (e.g., turn on a digital device and log in)	○	○	○	○	○	○	○
Teach children how to handle/use digital devices responsibly	○	○	○	○	○	○	○
Teach children keyboarding/typing skills	○	○	○	○	○	○	○
Teach children word processing skills (e.g., Google Docs or Google Slides, Microsoft Word)	○	○	○	○	○	○	○
Teach children how to perform basic searches on the Internet to locate information (e.g., Google search for images and answers)	○	○	○	○	○	○	○
Teach children how to use a variety of digital resources (e.g., drawing programs, presentation software) to communicate and exchange ideas	○	○	○	○	○	○	○

Teach children how to watch online videos and to use the play, pause, rewind, and forward buttons on the digital devices (e.g., Chromebooks)	○	○	○	○	○	○	○
Teach children how to identify cyberbullying and strategies to deal with such situations	○	○	○	○	○	○	○
Teach children about the safe and ethical use of the Internet, including social interactions online or through networked devices such as Google Classrooms	○	○	○	○	○	○	○

Q21-27 Thinking about the grade-level you teach in the current (2017-2018) school year, identify the extent to which you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My main focus as a teacher is to develop my students' basic literacy skills (reading and writing) and core content knowledge.	○	○	○	○	○
My students are technologically savvy.	○	○	○	○	○
Addressing my students other needs (e.g., reading and writing skills) is a priority.	○	○	○	○	○
Digital literacy is a core component of my teaching practice.	○	○	○	○	○
My students use digital technology devices (e.g., Chromebooks, i-pads, tablets) as essential learning tools.	○	○	○	○	○
My students need explicit teaching about digital citizenship (the safe, ethical, and responsible use of the Internet).	○	○	○	○	○
My students do not require explicit instruction to learn basic technology skills.	○	○	○	○	○

Q28-43 Thinking about the grade-level you teach in the current (2017-2018) school year, identify the extent to which the following factors interfere with or enhance your ability to teach digital literacy skills:

	Significantly Interferes	Interferes	Enhances	Significantly Enhances	Not Applicable/ Not Available at My School
Number of students to teacher ratio	○	○	○	○	○
Age of my students	○	○	○	○	○
My students' basic reading and writing skills	○	○	○	○	○
My students' self-management skills (e.g., problem solving, independence)	○	○	○	○	○
Expectation to focus on the core curriculum, especially reading, writing, and math	○	○	○	○	○
Access to digital technology devices such as Chromebooks	○	○	○	○	○
Confidence in my own skills and knowledge of grade level technology standards	○	○	○	○	○
Confidence in my own skills and knowledge to design age-appropriate technology lessons	○	○	○	○	○
Time to plan tech lessons	○	○	○	○	○

Time during the school day to teach these lessons	○	○	○	○	○
Expectations to teach digital literacy skills from the site administrator	○	○	○	○	○
Site administrator's evaluation of my own ability to teach digital literacy	○	○	○	○	○
Observations of demo lessons by colleagues or tech coaches	○	○	○	○	○
Access to a district tech coach	○	○	○	○	○
Availability of on-site Tech Mentor(s)	○	○	○	○	○
Differentiated training sessions that address teachers' specific learning needs related to digital literacy instruction	○	○	○	○	○

Q44 Is there anything else that your school can provide or do to enhance your ability to teach digital literacy skills to your students?

_____

Q45 Is there anything in particular that interferes with digital literacy instruction in your class?

_____

Q46 How would you define digital literacy at the grade level that you teach? What does it mean to be "digitally literate" in the grade-level that you currently teach?

_____

Q47-54 Thinking about the grade-level you are currently teaching (2017-2018) school year, how often do you anticipate that your students will use digital technology devices (e.g., Chromebooks, tablets, i-Pads) to engage in the following activities?

	Never	Rarely (less than once a month)	Sometimes (1-2 times a month)	Often (3-6 times a month)	Always (several times a week)
Learn basic computer operations skills (e.g., turning on a computer)	○	○	○	○	○
Access age-appropriate software/online websites	○	○	○	○	○
Access a word processing application, such as Google Docs, to write, edit, print and save simple assignments	○	○	○	○	○
Take computerized assessments	○	○	○	○	○
Engage in structured learning activities, where students only do a specific activity such as completing lessons online	○	○	○	○	○
Locate and collect information from online sources	○	○	○	○	○
Engage in online activities such as learning addition math facts	○	○	○	○	○
Watch educational videos online	○	○	○	○	○

Q55 Is there anything else you would like to add?

_____